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TEXAS
ELEMENTARY LITERACY PROGRAM

ENGLISH

Grade 4

Unit 2 | Teacher Guide

Eureka! The Art of Invention

Grade 4 | Unit 2

Eureka!
The Art of Invention

Teacher Guide

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Introduction

EUREKA! THE ART OF INVENTION

Introduction

"Have a great idea. Have a lot of them."—Thomas Edison

Eureka! The Art of Invention is a 10-day ELA Quest. Quests are narrative-driven units that immerse students in close reading adventures. Through them, students read complex literary and informational texts and consistently demonstrate their ability to find evidence and use it appropriately. Over the course of the Quest, students write routinely in opinion, informational, and narrative modes, adjusting style for the task and audience indicated. Beyond this, Quests are deliberately varied. Each aims to immerse students in a new world, with new content and challenges. Quests are also more flexible than other units. We have provided suggestions for how to customize the Quest throughout and encourage you to make your own variations to suit your students' needs.

As they go through *Eureka! The Art of Invention*, students read a range of informational texts about inventors, inventions, and the process of creation. In addition to close readings, students analyze objects and situations in the world around them, identify problems, create evidence-based solutions, and ultimately become inventors themselves. By routinely writing informational and opinion pieces, students practice research, observation, communication, and persuasion. They also engage in a range of collaborative discussions, sharing ideas and working in teams with defined roles and agreed-upon rules.

In *Eureka! The Art of Invention*, students are contestants on the bizarre and exciting reality TV game show of the same name—a show in danger of cancellation because of a few . . . unfortunate incidents last season. Students are divided into teams (labs) and participate in activities and challenges both in groups and individually. Guided by inventor-judges Jacques Cousteau, Hedy Lamarr, Thomas Edison, and George Washington Carver, as well as a host—you, the teacher—contestants learn about the process of invention through examples and experiments. Throughout the Quest, the judges will "interact" with students through videos and notes. Your role as host is the key to creating and maintaining the game-show "world." We have provided host scripts throughout the unit and hope you will add in your own elements.

Eureka! The Art of Invention also provides opportunities for students to build content knowledge and draw connections to social studies and science subject areas but does not explicitly teach the Texas Essential Knowledge and Skills standards for Social Studies and Science. At times throughout the unit, you may wish to build on class discussions to support students in making cross-curricular connections to the strands of science, technology, and society and social studies skills from the social studies discipline, and scientific investigation and reasoning from the science discipline.

OVERVIEW

Each lesson in the Quest is a 90-minute "episode" with a variety of activities. These tasks incorporate reading, writing, and speaking and listening skills, which are explained in each Episode chapter.

READING

During the Quest, students read informational texts, pulling evidence and details to support arguments. Reading activities are concentrated in the first half of this unit; however, students will continue to refer back to the material in the *Eureka! Files* reader throughout the Quest. Students will read biographical articles about eight inventors, detailed histories of important inventions, and scientific explanations of simple machines. Some of the content of the Quest will be familiar to students: the microscope, George Washington Carver, Thomas Edison, and the Wright Brothers all appear in earlier units.

Note on Text Complexity and Support

Eureka! Student Inventor has a fairly high level of text complexity, both owing to the scientific nature of the material and the character voices of the featured inventors. To help support students with the reading, we have flagged the most challenging vocabulary in each lesson overview, as well as in the text and glossary, that you may wish to introduce before you begin the readings or outside of the Quest. Some text may be best taught as a teacher Read-Aloud or a class read-together, with frequent pauses to summarize the meaning and check for comprehension.

In circumstances where Read-Alouds are impractical, such as when each lab is tasked with a different reading, we either include headers that map to the activity questions and help break the reading down into sections, or we keep the articles short. If there is great range of reading ability within your class, you may wish to keep these lab-based reading activities in mind when creating labs, to promote peer support.

SPEAKING AND LISTENING

Comprehension and collaboration skills are developed throughout, as students establish rules for group work and work together over an extended period in their labs on building, reading, and presentations. Students make oral presentations about their inventions and demonstrate how and what they have learned from their peers' presentations. Audio and video components, as well as teacher-read texts, give students opportunities to practice active listening.

WRITING

Throughout the Quest, students consistently practice informative and opinion writing. In addition to working on developing arguments and using support, the writing challenges lend themselves to adaptation and addition. You can focus on additional language standards by adding requirements to the challenge. If you have extra time, you can also take advantage of the emphasis on building collaboration skills and introduce a round of peer editing to one or more of the writing challenges.

THE STRUCTURE OF EUREKA!

This Quest is divided into two "rounds." Round 1 consists of seven episodes, in which contestants earn points by understanding six key skills: collaboration, research, pitching, knowledge, documentation, and failure. After learning and practicing each skill, students face a "wedge challenge" (usually a short individual writing assignment). Once all members of the lab successfully complete the challenge, the lab earns the wedge, representing mastery of that skill, to add to their "Wheel of Invention." In Lessons 1, 6, and 7, the focus is a building challenge in which students follow criteria established by the judges to build a new invention and write about it.

Round 2 (three episodes) offers students more creative freedom as they design their own inventions. The last two episodes of the Quest are especially flexible. Depending on your time, resources, and your students' interests and abilities, the final project may involve building working inventions, nonworking invention models, and/or detailed diagrams. You may choose to have students work independently, with partners, or as full labs. (We recommend that they continue to compete for their lab for scoring purposes.) Final presentations may be made orally to the entire class, in a "science fair" style with museum displays, on paper, or using any combination of these approaches. These options are set out in detail in the Advanced Planning section of Episode 8.

Round 1: The Wheel of Invention

Episode 1: Collaboration

Contestants embark on the Quest and meet the eccentric judges. They review best practices for group work, embark on collaborating with a whimsical building challenge, and write their first opinion piece about collaboration.

Episode 2: Research

Contestants open the *Eureka! Files* to read biographies of the judges. They use their research to complete inventor cards, until the episode is interrupted by a cranky Thomas Edison.

Episode 3: Research/Introduction to Pitching

Contestants delve further into the *Eureka! Files* to research the light bulb and write a persuasive piece for Thomas Edison. Next, they use their research skills to gather evidence on other important inventions. The host previews pitching, the next skill they'll need to share that research.

Episode 4: Pitching

Contestants use their research to write and present pitches about the great inventions.

Episode 5: Knowledge

Contestants learn about simple machines and translate their understanding into physical movements during a "Simple Machine Dance Party." Next, they use their understanding of simple machines and knowledge of great inventions to write a creative solution to a technical challenge.

Episode 6: Documentation

Contestants are given another building assignment and challenged to create a record of their work, including diagrams and written directions.

Episode 7: Failure

Contestants explore the importance of failure in the inventing process. They revisit their invention from Episode 6 in order to improve its functionality, and write a persuasive piece about the value of learning from failure.

Round 2: Final Inventions

Episode 8: Why We Invent

Students make up any unfinished wedge-challenge writing and complete the Wheel of Invention. After listening to the judges explain what brought them to inventing, students explore problems that can be addressed by inventing, conduct peer-to-peer interviews to research problems, then select a problem their final inventions will address.

Episode 9: Invent!

Students complete their final inventions, give and receive feedback from their labs for improvements, and prepare their final presentations.

Episode 10: The Finale

Students present their final inventions to the class, and the winner is declared.

Recurring Activities

While episode activities vary, there are some types that recur:

- the TV show's opening audio clip
- a recap of the previous episode ("Last Time on *Eureka!*"), provided by a student
- the distribution of wedges earned from the previous episode
- an accounting for bonus points and the distribution of the leader marker, the "Light Bulb of Glory," to the top lab to display for the day
- the return of workbooks (*Inventor's Notebooks*) and the collection of any homework

- Most episodes conclude with "Introspective Inventors," a reality show-style confessional that asks contestants to share what they've learned and questions brought up that day. (You may opt to do "Introspective Inventors" more or less frequently than indicated in the script.)
- videos of judges, teaching students the ways of inventors
- Judges' Notes also occur throughout the Quest. We provide these as audio recordings, or you can choose to read the transcriptions aloud.
- Inventor Cards: Students are asked to read inventor cards (similar in format to baseball cards), either in class or as homework.
    - Optional Challenge: Students can complete additional inventor cards for bonus points using articles about inventors that they themselves locate or that you provide for them.

FLUENCY SUPPLEMENT

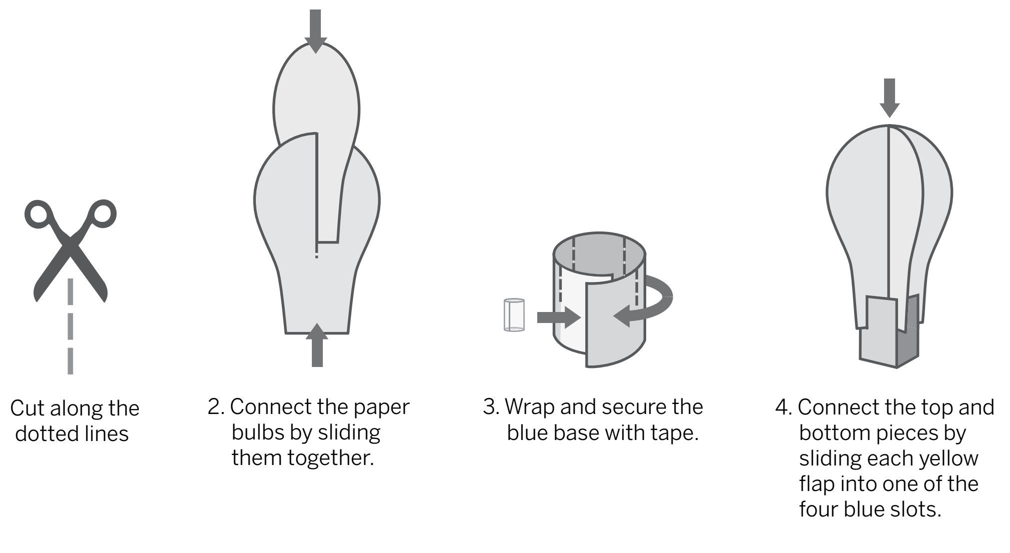
A separate component, the Fluency Supplement, is available on the program's digital components site. This component was created to accompany materials for Grades 4 and 5. It consists of selections from a variety of genres, including poetry, folklore, fables, and other selections. These selections provide additional opportunities for students to practice reading with fluency and expression (prosody). There are sufficient selections so you may, if desired, use one selection per week. For more information on implementation, please consult the supplement.

TEACHER RESOURCES

This Quest includes:

- **Teacher Guide**
  The Teacher Guide provides detailed descriptions of the lessons in this Quest, learning objectives, assessment opportunities, supports for universal access, copies of student reading and workbook pages, and answer keys. All resources that need to be copied—Find Your Lab clues, Simple Machine Lightning Round, blank inventor cards, the final pitch rubric—are found in the Teacher Guide at the point of use and online in the program materials. More information on using the Teacher Guide is found at the end of this section.

- ***Eureka! Files* (Student Reader)**
  Eureka! Files is the student Reader accompanying this Quest. Each copy of the *Eureka! Files* includes all of the readings students will complete over the course of the Quest. Because different labs are assigned to different topics, students will have more reading in their copy than they need to complete. Students will need articles from the *Eureka! Files* to complete the inventor cards assigned as homework in Episodes 2, 4, 5, and 6. If you prefer students not take the *Eureka! Files* home, you can make copies of these articles.
- ***Inventor's Notebook* (Student Activity Book)**
  The *Inventor's Notebook* includes all of the worksheets and prompts needed to complete the Quest's activities. You will need to collect it regularly to review student work, including the wedge-writing challenges. At the end of the *Inventor's Notebook* is a blank inventor card for student use in Episode 10.
- **Wheels of Invention and Wedges**
  There are six Wheels of Invention—one for each lab—and six wedges to every wheel. Display the Wheels of Invention prominently during the Quest, and watch them fill with wedges! You may wish to get a set of 36 Velcro dots so students can attach each wedge to the wedge spot on the wheel.
- **Light Bulb of Glory**
  Like the yellow jersey in the Tour de France or the Stanley Cup in hockey, the Light Bulb of Glory is a traveling trophy. The lab with the most points at the top of an episode is awarded the Light Bulb of Glory to display.



- **Stickers**
  The stickers come in six varieties, and each design indicates a lab. Use them to mark *Inventor's Notebooks* for easier scoring of wedge challenges, to label the Wheels of Invention, and to create lab namecards.
- **Inventor Cards**
  There are two different perforated sheets of inventor cards for each student. The first sheet includes all four judges and can be distributed to students on Episode 2 to tear apart. The second sheet includes cards used at different points in the Quest, so you may prefer to tear them out and distribute them on an as-needed basis so students don't lose them. There are also two blank inventor cards: one at the end of the *Inventor's Notebook*, and one at the end of the introduction to this Teacher Guide. This template can be copied so that students can make supplemental inventor cards for bonus points.
- **Invention Cards**
  These cards are used primarily for the Timeline of Invention in Episode 5. They can also be used during the Invention Pitch Lightning Round in Episode 4 and can be posted as decorations around the classroom.

Digital Components

Digital Components of the Quest are available on the program's digital components site.

- **Audio Recordings and Audio Scripts**
  Audio recordings are indicated by the speaker icon in the Teacher Guide. Audio recordings are fully transcribed. They include an audio opening sequence (i.e., a voiceover that introduces the start of each episode) and the Judges' Notes. Jacques Cousteau and Hedy Lamarr have accents, so if you have students who will have difficulty understanding the audio files, you may prefer to read them aloud.
- **Video Recordings and Video Scripts**
  These are indicated by a video-camera icon in the Teacher Guide. Scripts for all the Judges' Notes and videos are available as PDFs, if you wish to print copies for students.

- **Scoreboard Poster**
  This is available as a PDF to print, display in your classroom, and use to keep track of lab points. It is also available in this Teacher Guide at the end of the Introduction.
- ***Eureka!* Image of the Day**
  This is a digital image available to project in your classroom to create atmosphere and excitement. It can also be a fun backdrop for "Introspective Inventors."
  Note: This image is not integrated into the lesson.
- **Digital versions of the print components.**
- **Quiet and Applause signs**
- **Winner's Certificate**

SUPPLIES TO GATHER

These materials are not provided but are necessary or desirable to run the Quest. We have tried to make them simple and accessible.

- Materials follow for the building challenges in Episodes 1, 6, and 7, and in Round 2, should you choose to include building. In testing, we used the following materials—you can adjust the list as appropriate for your circumstances.

  1. table tennis balls (required)
  2. rubber bands (required)
  3. tissues (required)
  4. pencils (required)
  5. cardboard

6. scissors
7. tape
8. popsicle sticks
9. toilet-paper rolls
10. shoeboxes
11. markers
12. hole punchers
13. string
14. poster board

- Materials such as cardboard and markers are ideal to make lab namecards, as they are sturdy enough to fold and display in the labs' workspace. These namecards can stay in the labs' workspace throughout the Quest. (Episode 1)
- music for the Simple Machine Dance Party Challenge (optional, Episode 5)
- books and articles about additional inventors (optional, for bonus inventor cards)

GRADING AND SCORING

All scoring is done on a lab basis. Students earn points for their labs, even if they are doing individual work.

The bulk of scoring comes from completing each round. The Wheel of Invention earns labs 20 points, and a trip to Round 2.

> **Note:** If your students are having trouble completing the wheel and you want to move them along, you may alternately choose to award three points along with each wedge as you go, instead of making it all or nothing. (Completing the wheel then earns a two-point bonus, to add up to twenty points.)

The scoring of Round 2 is left to you. We have provided a possible 20-point rubric for individual presentations, to be averaged across each lab.

Contestants can earn additional points throughout the Quest by winning games, successfully completing small challenges, and creating bonus inventor cards. While we have indicated some places to award bonus points, we encourage you to customize opportunities to your classroom environment—use them to motivate good behavior, to reward excellent individual work or teamwork, and/or for extra-credit research assignments.

Keep track of points on the scoreboard. At the end of the Quest, tally the points to determine the winner.

The script is set up so that you can review wedge-challenge writing in the *Inventor's Notebooks* after class, provide feedback, and award wedges the next day. These challenges provide frequent formative assessment opportunities. The Quest does not require that these challenges be formally graded, so how you evaluate them is up to you.

We build in 15 minutes in Episode 8 to make up incomplete assignments, but as you go you might want to require students to revise writing as homework in order to earn their wedges. Another option, particularly if your grading time is tight, is to require labs to submit only one wedge-challenge letter per skill.

The Light Bulb of Glory can go on the table of the lab currently in the lead each day.

MAKE GOOD TELEVISION (AND HAVE FUN!)

A great deal of the fun and excitement of this Quest lies in keeping the spirit of the reality game-show running throughout.

As the teacher-host, you are the link between the unpredictable real-life action of the Quest and the scripted animated videos. We've provided scripts within the Teacher Guide to help you create and stay in character, but this is only a guide. You may wish to go off script and create your own host character, maybe even give yourself a character name, or don a wild game-show jacket. Please have fun with it! We do recommend that you read the script carefully to review your lines before going "on"—the Quest is complicated, and there are some twists that it would be good to anticipate.

Things to know about the show's "backstory":

- The Judges are unpredictable and crazy, but they really, really care about invention and the students' success as well.
- The network is mentioned often. When we mention the network, we are referring to the big, bad executives downtown just waiting for an excuse to cancel *Eureka!*.
- Last season was a disaster. No one watched, no one learned to invent, and some of the challenges were fiascos. We don't know a lot about those challenges, but one involved a run-in with some jellyfish, and another involved a lot of pudding.

- Both the Judges and the network regularly contact the host during episodes. These "calls" might be through an imaginary phone, an invisible earpiece, or some other method that speaks to your character.
- In addition to the elements in the script, we encourage you to find other ways to incorporate game-show-style flourishes throughout this Quest as seems appropriate.
- To get students excited and engaged, treat them as a studio audience, as well as contestants. Ask for a drumroll or a musical flourish before big announcements. Have them shout out the name of the program at the opening and closing of each episode.
- Use the applause sign to encourage students to support one another, and the quiet sign for "look at me" and focus moments.
- Pick a spot for the "camera" or the "producers" that you can reference throughout the episode.
- If you have access to a video recorder, you can record "Introspective Inventors" and the Pitches (Episode 4 and 10), and show clips as a retrospective in Episode 10.
- When you check in with students throughout the lessons, remind them of the "viewers at home" who might have questions.
- When reviewing students' written work, make your comments "from the judges."
- Use music of your choice, or have students make music, to signal the beginning and ending of writing time and other activities.

USING THE TEACHER GUIDE

Each episode/chapter in the Teacher Guide begins with an overview.

This includes:

- Primary Focus objectives and Formative Assessments for each lesson
- Lesson at a Glance, which breaks lessons down into sections, with associated materials and time estimates
- Advance Preparation, which is divided into Read (reading, previewing Quest content and student work), Customize (any decisions, choices, or rules teachers must establish for their class), Prop Master (gathering and assembling materials), and preparation for Universal Access supports.
- vocabulary from in-class and homework reading (does not appear every day)

Other Components:

- Check for Understanding
    - Each lesson provides several spots in which you can informally check that students understand the ideas and skills in focus.
- Pages from the *Eureka! Files* and the *Inventor's Notebook* as well as inventor cards are reproduced as screenshots in the Teacher Guide, so you will see what students see.
- We include answer keys for activities where appropriate. In cases where students are responding to different readings, all versions of the activity answer key are included.

Homework

Homework is listed at the end of the episode.

After Class

Student work that needs to be reviewed by you is listed at the end of the episode as well as in the "Advance Preparation" section of the next episode.

This icon indicates lines for the teacher in the role of "host."

This icon indicates an audio recording, available on the program's digital components site.

This icon indicates a video recording, available on the program's digital components site.

This icon indicates that material should be written on the board.

This icon indicates material that you will need to prepare to distribute to students.

EUREKA! STUDENT INVENTOR SCOREBOARD

 AIRPLANE	
 ALARM CLOCK	
 MICROSCOPE	
 PAPER	
 RADIO	
 TELEPHONE	

Inventor Card

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

EPISODE

1

Welcome to *Eureka!*—Collaboration

PRIMARY FOCUS OF LESSON

Speaking and Listening

Students will be able to discuss and practice collaboration, following agreed-upon rules and maintaining assigned roles. TEKS 4.1.A; TEKS 4.1.D

Reading

Students will integrate ideas from two texts and speak knowledgeably on the best practices of collaboration. TEKS 4.6.G; TEKS 4.6.H

Writing

Students will write clearly about their own collaboration experience, supporting their opinions with facts and details. TEKS 4.12.D

FORMATIVE ASSESSMENT

Activity 1.2	**Collaboration Building Challenge** Observe small group conversations and ensure that all students are contributing and maintaining agreed-upon roles. TEKS 4.1.A; TEKS 4.1.D
Activity 1.4	**Letter to Jacques** Review students' writing, checking for coherence and use of details and facts to support each response. TEKS 4.12.D

TEKS 4.1.A Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities; **TEKS 4.6.G** Evaluate details read to determine key ideas; **TEKS 4.6.H** Synthesize information to create new understanding; **TEKS 4.12.D** Compose correspondence that requests information.

LESSON AT A GLANCE

	Time	Materials
Episode 1 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Judges' Note 1A, 1B, 1C (Digital Components) ❏ Video: Welcome to *Eureka!* (Digital Components) ❏ Wheels of Invention ❏ Find Your Lab Clues (Digital Components) ❏ materials to make lab namecards ❏ lab stickers ❏ *Eureka! Files* ❏ six sets of building materials (table tennis balls, pencils, tissues, rubber bands)
Find Your Lab Matching Game	10 min.	
Define *Invention*	10 min.	
Learn from Last Season: Bad Collaboration	10 min.	
Collaboration Building Challenge	40 min.	
Collaboration Wedge Challenge: Letter to Jacques	10 min.	
Closing: "Introspective Inventors"	5 min.	

EPISODE OVERVIEW

Contestants embark on the Quest and meet the eccentric judges. The class defines *invention* and determines good practices for group work. It then applies those practices as it tackles a whimsical building challenge.

ADVANCE PREPARATION

Read

- Review unit overview.
- Review video or video scripts available online.
- Review "Learn from Last Season" in *Eureka! Files*.

Customize

- In the Find Your Lab Matching Game, students will divide into the groups ("labs") that they will work in throughout the Quest by matching clues about famous inventions. If you don't want to leave those groups to chance, select them and assign clues to individual students.

Prop Master

- Attach Velcro dots to Wheels of Invention and wedges.
- Add a lab-identifying sticker to each wedge.
- Gather building materials for building challenge:
    - six table tennis balls
    - twelve pencils
    - tissues
    - rubber bands
- Divide building materials into six sets (one per lab).
- Print and post scoreboard (available on the program's digital components site) in your classroom.
- Prepare to distribute a Find Your Lab Clue to each student.
- Test audio and video resources.
- If you wish to have students read the Judges' Notes, print the PDFs.
- Prepare to project the Eureka! "Image of the Day" if desired.
- Prepare sentence frames as supports for writing Activity 4.1.

- When collaborating, it is important to ___.
- I helped my group when I ___.
- I saw ___ help our group today when they ___.

• Prepare expanded prompts for writing Activity 4.1.

- In your opinion what is the most important rule of collaboration? If people ignore this rule, what can go wrong?
- Give one example of how you followed this rule in today's activity.
- Give one example of when you observed someone else in your group following this rule.

ACADEMIC VOCABULARY

Students will encounter the following word in their reading in today's episode. Vocabulary words are listed before each lesson for your reference, bolded in the student reading at their first occurrence, and compiled in the glossary of the *Eureka! Files*.

producers, n. people who supervise a television production

Start Lesson

Episode 1: Welcome to Eureka!

Collaboration

90M

Primary Focus: Students will be able to discuss and practice collaboration, following agreed-upon rules and maintaining assigned roles. **TEKS 4.1.A; TEKS 4.1.D**

Students will integrate ideas from two texts and speak knowledgeably on the best practices of collaboration. **TEKS 4.6.G; TEKS 4.6.H**

Students will write clearly about their own collaboration experience, supporting their opinions with facts and details. **TEKS 4.12.D**

TEKS 4.1.A Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities; **TEKS 4.6.G** Evaluate details read to determine key ideas; **TEKS 4.6.H** Synthesize information to create new understanding; **TEKS 4.12.D** Compose correspondence that requests information.

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has ten episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better —as inventors. This is the world of the reality game show Eureka! Student Inventor*—where puppets pull the strings and "making it work" is only the beginning.*

Inform class of its selection for the show.

Welcome to *Eureka! Student Inventor*. I'm your host, ________.

As you know, we scoured the country looking for the right mix of hard workers with creativity, ingenuity, and resilience—contestants who wouldn't be fazed by a little mess or a little yelling—students we could gather up and mold into the next great *Eureka!* inventors. And when the producers found your class—well, we cried, "Eureka!" which, in addition to being the title of our show, is also an expression we get from the ancient Greek inventor Archimedes that means "I have found it!"

But before we get started with the work of invention training, allow me to introduce you to our judges. I should warn you—they may be brilliant, but they're also . . . eccentric.

Play video: Welcome to *Eureka!*

Describe the Wheel of Invention and challenges.

Now you know what I have to deal with offscreen, day after day. They're geniuses, but not the easiest people in the world. But they really do want you to become great, well-prepared inventors yourselves. Every episode will focus on one or two of the six skills that will make you consummate inventors. You'll be working in groups to complete challenges related to these skills.

After you've learned about a skill and practiced applying it, you'll be assigned a wedge challenge—by completing it, your group can earn one of six wedges that together form the Wheel of Invention. This is fitting, since the wheel and the wedge are two of the greatest inventions ever!

Completing this wheel will earn you rewards, including twenty points and a trip to Round 2! There are also opportunities for bonus points, and all these points will help determine the winner . . . but let's not get ahead of ourselves.

Play audio, read aloud, or invite student to read Judges' Note 1A.

Judges' Note 1A

A Note from Thomas Edison:

Welcome, widgets. As your judge, and as the owner of 1,093 patents (by far the most of any of these clowns), I have the awesome responsibility of giving you your first challenge. How, you might ask, did I, one man with only twelve weeks of formal schooling, achieve so much? Hard work, hard work, and more hard work. And not just my own hard work: I started the first industrial lab in Menlo Park, New Jersey, hiring scientists, technicians, and mathematicians to carry out research and development to further my ideas. Honestly, I am not a huge fan of working with people, and I don't know that my employees were so thrilled to work with me, but we put up with it because we knew that many minds lead to excellent innovation! So you will also be working in lab groups. Go find them.

Sincerely,

Thomas Edison

FIND YOUR LAB MATCHING GAME (10 MIN.)

List the activity steps on the board

1. Read your clue and circle any words that provide details about your invention.
2. Find your group by discussing your clues with your classmates, and listening for other clues that match yours.
3. Sit together and raise your hands so the host can confirm you are correct.
4. Create a name card for your lab and write an invention slogan.

- Each lab will have four to five students. Sentences describe the airplane, the microscope, paper, the clock, the radio, and the telephone.

Explain the lab matching game

OK, contestants, it's time to find your lab. You will each receive a sentence/clue that relates to one of six famous and important inventions. First read your sentence and circle any words that might give you a hint about which invention you have. Then walk around and discuss it with your fellow contestants. In your discussions, share the details you circled and listen for hints that might go with yours. Find those contestants whose sentences relate to the same invention yours does, and you'll find your lab.

Once you find your lab mates, sit down together and raise your hands. I will come check on you. You can also begin working on creating a name card for your lab and a slogan for your invention. A slogan is a catchy phrase, such as you might see in advertising. A slogan for the light bulb, for example, might be "Light bulbs illuminate." A slogan for the refrigerator might be "Keeping it cool. Brrrrr!"

On *Eureka!*, in addition to wedges, you can also earn bonus points for your lab by completing certain tasks or winning games. Write a good slogan—something catchy that describes your invention—and your lab will earn its first bonus point!

Begin Lab Matching Game

Note: You may want to prearrange the distribution of slips in order to ensure that the labs include a good mix of students with complementary skills.

- To make this activity easier and quicker, you can provide students with the lab invention names before they try to match up. Do this by placing simple prewritten namecards for the labs around the room, or by listing the names of the labs on the board.
- The radio and clock groups both include an extra clue, for students 25 and 26. If your class has more than twenty-six students, two students can share a clue. If your class has fewer than twenty-five students, give a few students two clues.
- Once a lab is complete, confirm that the students have found the correct group. Have them create their lab name card, and give each member of the lab a sticker for their *Inventor's Notebook*, plus one for the name card.
- Award one bonus point to each lab with a catchy and informative slogan. Record bonus points on the scoreboard.

Check for Understanding

Circulate to each group and confirm that students have found the correct inventions for their clues. If students have not correctly identified their inventions, point out key details in the clues and ask them to consider which other inventions these could be describing.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Exchanging Information/ideas

Beginning
Suggest conversation prompts for students, such as "Which invention do you think you have?" They should tell partners,

"I think my clue may refer to the ___.

Intermediate
Suggest conversation prompts for students, such as: "I think my invention might be ___. Do you think we have the same invention? How do you know?"

Advanced/ Advanced High
Share the important details of your sentences and discuss which inventions your clues could be describing.

ELPS 1.B; ELPS 1.E; ELPS 2.C; ELPS 3.D

Orville and Wilbur Wright practiced flying and steering gliders for two years before building the *Flyer*.

The Wright Brothers succeeded in keeping the *Flyer* airborne at Kitty Hawk, North Carolina, in 1903 because they had installed innovative controls to keep it balanced and stable.

The Wright Brothers continued experimenting for two more years, eventually building the *Flyer III* which had separate levers for turning it left or right, lifting its nose or tail, and tilting it from side to side.

These additions, known as three-axis controls, were the secret to the Wright Brothers' success. Three-axis controls are still used today.

Find Your Lab Clues: Microscope

In the 1650s a young Dutchman named Antonie van Leeuwenhoek began experimenting with glass lenses.

Van Leeuwenhoek manufactured a tiny lens that he then attached to a brass plate.

By 1676 Van Leeuwenhoek had improved his invention to the point where he was even able to see single-celled organisms, like protozoa.

Thanks to Van Leeuwenhoek's invention, nineteenth-century scientists like Robert Koch and Louis Pasteur were able to identify the bacteria that cause deadly diseases like cholera and tuberculosis.

In ancient China people wrote on silk, which was very expensive, or on scrolls of bamboo, which were very heavy and difficult to manufacture.

Around the year 105 CE, a record-keeper named Cai Lun decided he would come up with a better option—a writing surface that was light, cheap, and easy to make.

Cai Lun succeeded, and his invention made his job of writing down, transporting, and storing records much easier.

Cai Lun's invention also enabled people to spread knowledge over great distances by carrying lightweight documents with them wherever they traveled.

Find Your Lab Clues: Clock

As people started interacting with one another in more complicated ways, time became important.

People divided the day into twenty-four hours and needed to keep track of those hours accurately.

People began measuring small units of time with sundials, determining the passage of daylight hours by observing the direction and size of shadows cast by the sun.

The next great innovation in timekeeping was a simple bowl with holes carved in it: if you knew how long it took for all the water to flow out of a full bowl, you could measure the passage of time by checking the water level.

As the centuries marched on, timekeeping inventions became more accurate as water power was replaced by springs and pendulums.

In 1894 a young man in Italy, Guglielmo Marconi, read a book that explained how to produce electromagnetic waves—electricity that travels through the air.

Marconi began working on his invention in his attic, building a wireless transmitter (to send messages) and a wireless receiver (to receive messages).

Soon scientists and businesspeople realized that the future of Marconi's technology was in sending sound directly to receivers in people's homes.

The first commercial stations began broadcasting in 1920, and by 1930, programs were being heard in twelve million American homes.

Stations broadcast news, music, comedies, adventure shows, game shows, soap operas, talent contests—almost everything you see on TV today.

Find Your Lab Clues: Telephone

Alexander Graham Bell aimed to send the human voice across a wire by turning it into electrical signals.

Bell worked on improving the invention, and in 1876 he and his assistant had a conversation over a distance of two miles. The first words spoken were, "Mr. Watson, come here. I want to see you."

Businesses saved money, as meetings that had once required long-distance travel could now be held using his invention.

People living in isolated areas were now able to call for help in an emergency.

DEFINE "INVENTION" (10 MIN.)

Describe the importance of a common understanding of *invention*

You know, while you were working on your lab slogans, I was thinking—so much confusion in the world, and on television, would be avoided if everyone were to define their terms carefully. Last season we didn't define our terms. It was, like so much of last season, bad news. Combine a lab that thinks an invention must include electricity (not true!), a lab that thinks anything you can throw is an invention (not true—and where did they get that idea?), and a boatload of jellyfish and pudding—the results weren't pretty.

So the network has imposed a new rule for *Eureka!* You can't be an inventor if you can't explain what an invention is. What are some of the things that come to mind when I say *invention*?

Write "*invention*" on the board and facilitate a discussion about the definition.

- Answers will vary, but some ideas to encourage are: something new, something that does something, something you build, something that can help humans improve their lives.
- Once you have taken some ideas of what inventions can be generally, ask for more specific suggestions.
  - Make sure to clarify that things found in nature are not inventions. You may also want to discuss whether or not art is an invention.

Write: "An invention is an object or process that someone MAKES that is NEW and DIFFERENT and was created to DO SOMETHING."

- Agree upon the definition on the board.
- Ask students for examples of inventions.
  - Examples could include wheel, pencil, television.
- Clarify the difference between inventions and objects found in nature.
  - Things in nature are not inventions because we didn't make them, and they were never new or different.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Exchanging Information/Ideas

Beginning
Ask: Is the chair an invention? Is the pencil an invention? Is a rock an invention? Why is the rock not an invention? (Things found in nature are not inventions. We didn't make them. They were never new or different.)

Intermediate
Ask: Can you tell me one of your favorite inventions? What was it created to do?

Advanced/ Advanced High
Ask: What is the difference between an invention and things found in nature?

ELPS 1.A; ELPS 1.F; ELPS 3.D

Wrap-up discussion

> There. We have a fantastic definition of *invention* and you can use it—we're already ahead of last season.

LEARN FROM LAST SEASON: BAD COLLABORATION (10 MIN.)

Introduce skill: collaboration

> And now, time to start work on the first wedge in the Wheel of Invention! Let's practice . . . COLLABORATION!

- Ask students what they think the word *collaboration* means. Answers will vary but might include: working together, everyone contributing, sharing ideas, helping teammates.

Jacques is passionate about collaboration.

> Judge Jacques Cousteau is particularly maniacal about collaboration, so if you don't want to end up on his bad side, you'll take this skill seriously.

Support

Share the following sample sentence to help students figure out the definition of *collaboration*: My brother and I learned that our chores go more quickly when we practice collaboration.

Play audio, read aloud, or invite student to read Judges' Note 1B.

Judges' Note 1B

A Note from Jacques Cousteau:

Bonjour, tadpoles! Inventing—it is like a boat trip. Lab mates are at once alone and together amid the hostile seas. (Alas, this season they will not let me put you on a boat amid hostile seas to demonstrate this. I swear to you, the thing with the jellyfish was not something we could have prevented! And no one, including the jellyfish, suffered any permanent damage! The network, it spoils all my fun.)

But I digress. Here is the thing: you must work together in this Quest. You must listen to one another. You must let everyone have a turn. You do not know—ze quiet one in ze corner could save your life. I mean . . . fix your invention. Oui!

It is not the easiest thing, collaboration. So today, we practice! You see the collaboration wedge? I am not giving that away for freebies!

Sincerely,

Jacques Cousteau

Challenge

Remind students that Jacques Cousteau was a famous oceanographer, and ask them how the language in his note reflects this.

Write students' ideas about collaboration on the board.

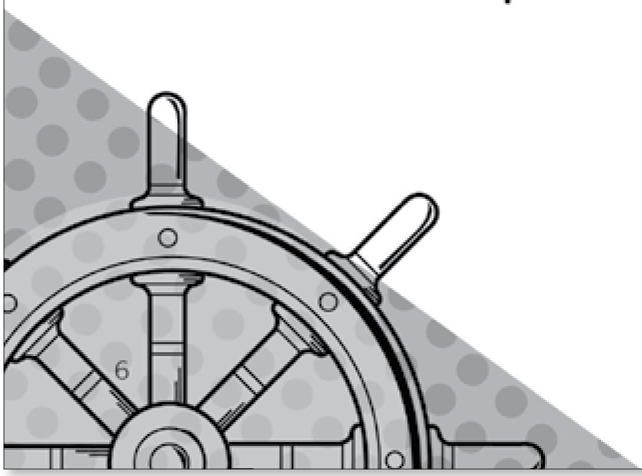
- Begin by asking students what they think are good rules for collaboration. Make two columns on the board: "Things TO do when collaborating" and "Things NOT to do when collaborating."
- Once students have shared their ideas for two to three minutes, have them take out their *Inventor's Notebooks*, open to Activity Page 1.1, and go over Jacques's Rules for Collaboration.
- If contestants came up with any great additions (or you have any that make your classroom run smoothly), then add them to the list!

Activity Page 1.1

1.1

JACQUES'S RULES FOR COLLABORATION

- ☐ Take turns talking and listening.
- ☐ Stay on task.
- ☐ Ask good questions.
- ☐ Make suggestions in a positive, constructive way.
- ☐ Consider everyone's ideas.
- ☐ Everyone contributes. Help others and ask for help when you need it.



Reading last year's transcripts

Using what we've already talked about, let's take a look at some contestants from last season and see how they adhered to Jacques's rules. Unfortunately, many of the recordings of episodes from last season have been confiscated. But we have the transcripts here in the semi-classified *Eureka! Files*, so we can re-create them together! As you read along closely on pages 3–5, please underline all examples of someone saying or doing something that violates Jacques's rules.

Check for Understanding

Check on whether students have underlined examples of poor collaboration. You may stop after page 3 to ensure that all students are reading closely and noting examples. If necessary, point out an example of poor collaboration on page 3 and guide students to underline this.

- Select students to read the transcript of some of last season's disastrous group work, found in the *Eureka! Files*.

Eureka! Files

CAST LIST

Contestants:

Sam
Laura
Tyler
Maria
Alex

Other Characters:

Narrator
Host

Learn From Last Season: Bad Collaboration

Narrator: We are about to watch one of last season's building activities. Here students attempt to dip a paintbrush in a cup of red paint and then paint a red *X* on a piece of paper without any person touching the paintbrush directly. The contestants have just begun …

Sam: OK, OK, OK, I have such a good idea. We're gonna get everyone to stand in a line and I'm gonna tie a string around my wrist and attach the paintbrush to the string and then we're gonna tie everyone's wrists together, and—

Laura: Wait, I don't understand how that's gonna—

Sam: And then everyone will stand close together and there will be, like, a countdown and when we all swing our arms we'll launch the paintbrush into the paint—

Tyler: Oh, I have an idea! Let's just all make a pyramid with the paintbrush at the top—

Maria: You guys are being stupid.

Eureka! Files | Transcript 3

Laura:	I didn't even say anything!
Maria:	This is stupid. I say we forget the paintbrush and just put the paint in our mouths and then spit it onto the paper—
Alex:	Oh! That reminds me of this really funny thing that happened at lunch yesterday! I was opening my milk, and I squeezed the box as I was opening it and there was this spurt of milk in my eye, but it was really funny. What's for lunch today?
Laura:	I think it might be pizza day. Because it's Tuesday.
Maria:	No, no, pizza is Friday. Tuesday is tacos.
Sam:	We're gonna tie our wrists together!
Tyler:	I don't think putting paint in our mouths is a good idea. Did anyone hear me about the pyramid?
Maria:	I'm putting the paint in my mouth right now. Ew—gross, it tastes foul.
Narrator:	Maria starts to cough and can't stop coughing.
Host:	What's going on over here??
Narrator:	The host listens in [their] earpiece.

Host: OK, I'm being told . . . the **producers** are saying that you cannot ingest the paint. That was not a good idea. It's toxic. It's poisonous.

Narrator: Everyone looks at Maria. She is turning blue.

Host: We have to get her to the doctor, right now.

Laura: Does that mean we lose?

ENGLISH LANGUAGE LEARNERS

Reading
Supporting Opinions

Beginning
On page 4, when Alex asked, "What's for lunch?" was this a good question? Why or why not?

Intermediate
On page 3, what is happening in the conversation involving Sam, Laura, and Tyler? Which of Jacques's rules are they not following?

Advanced/ Advanced High
On page 4, can you find an example of a person's NOT following the rules of collaboration?

ELPS 4.G;
ELPS 4.K

If you haven't already, list Jacques's Rules for Collaboration on the board.

- Compare the behavior of last season's contestants to the rules—where did they fail to follow the rules? How could they have done better?

COLLABORATION BUILDING CHALLENGE (40 MIN.)

Introduction

Jacques's Challenge

> Now that you've shown you've learned his rules, Jacques has a new challenge for you!

Play audio, read aloud, or invite student to read Judges' Note 1C.

Judge's Note 1C

A Note from Jacques Cousteau:

It is all well and good to talk the collaboration talk, but what about when you must walk the collaboration walk, to put these rules into practice yourself? This is the big one, my wiggly fishies. If you succeed in this challenge—and by succeed, I mean work together thoughtfully and well, and then write about how you did it—you will earn your first wedge to get your Wheel of Invention rolling.

Sincerely,

Jacques Cousteau

Read "Jacques's Collaboration Building Challenge" in *Inventor's Notebook*.

So here we are—the first wedge challenge. Let's see what we have.

Open your *Inventor's Notebooks* to "Jacques's Collaboration Building Challenge" (Activity 1.2).

Activity Page 1.2

- Have students read the challenge aloud.

Clarify challenge constraints

Before we go on, does anyone have any questions about the inventing challenge?

Whatever you invent must allow you, without touching the table tennis ball, to:

1. Pick up the unaltered table tennis ball from the table.
2. Pass it around among the members of your group so that each member is in control of the ball for three seconds.
3. Deposit it into the basket.

Clarify building-manager role and wedge challenge

Does anyone have any questions about the role of building manager, or anything else about collaboration? I'll be assigning building managers for this challenge in a minute—this is a role that I will assign every episode, so if you aren't building manager today, you'll have a chance on another episode.

As Jacques told us, completing this challenge is required for your collaboration wedge. I'll give you five minutes to brainstorm alone, and then it's lab-work time. Later you'll be writing about how your lab worked together, so pay attention to the good work of your lab mates as you build! The most important part of this challenge is how you work together. BUT! If you succeed in making a working invention, you will also earn a bonus point.

ACTIVITY 1.2

Name: ______________________

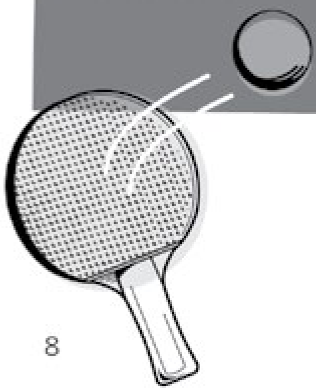
Date: ______________________

JACQUES'S COLLABORATION BUILDING CHALLENGE

Devise a way to pick up a standard table tennis ball from the table, pass it around among the group (each lab member must be in control of it for three seconds), and then put it in the basket.

- Do not touch it with your hands. That includes covering your hands with any kind of glove-like item!
- Do not drop it.
- You may use up to two pencils, ten pieces of tissue, and a box of rubber bands.

You may use trial and error and test your experiment or components of your experiment as you build. Keep your table tennis ball under control at all times!!



Notes on group work:

You will work in your lab to complete this building challenge. In order to be successful, you will need to work together! Ensure that all lab members are given an opportunity to express their opinion and that everyone is contributing to the process. Listen carefully to what the other members of your group have to say. Their ideas may help you come up with a new idea of your own.

For this challenge, one team member will be assigned the role of building manager.

The building manager leads the decision-making process. This does not mean that the building manager has to do all of the work, or that the group uses all of the building manager's ideas! But sometimes, when a group has many ideas, it can be hard to decide which one to try first. The building manager should listen to the lab and help make that decision. They can call for a vote, or, if there's a tie, break the tie. If there are several tasks to be accomplished at the same time, the building manager can assign them. If you don't know what you should be doing to help, ask the building manager.

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Activity Page 1.3

Brainstorm

- Give students five minutes to brainstorm individually using the "Invention Brainstorming!" page in the *Inventor's Notebook* (Activity 1.3). Note that this page recurs, so ensure students are on the right episode.
- As they are brainstorming, circulate and assign building managers.

ACTIVITY 1.3

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ______________________ Date: ____________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

10

Draw your invention here:

11

Build

Building manager leads planning

OK, contestants, it's time to get into groups and build! Share your brainstorming, and let the building manager lead a conversation about which design or combination of designs you'll use. While you do that, I'll distribute the building materials. As soon as you've decided on your design, you can start building. Remember, the design you decide on can be revised as you build, but you have only about ten minutes to build, so budget your time wisely.

- Depending on how quickly students select a design, allow groups to talk, build, and experiment for fifteen minutes, give or take.

Check for Understanding

Circulate and observe the small group conversations, ensuring that the building manager is taking on their responsibilities, and that all students are contributing to the discussion. If necessary, remind students about the rules of collaboration and suggest adjustments to enhance collaboration.

Demonstrations and Debriefing

- Groups demonstrate their inventions. If they succeed, they receive a bonus point.
- If any groups don't succeed, remind students that failure is so important to invention that it is the final wedge they will earn in Episode 7.
- If the inventions vary in design, observe how there are many ways to solve a problem, something you'll talk about more in Episode 5.
- Ask students to share "with the audience at home".

1. What went well?
2. What was the most enjoyable part of the activity?
3. What are you most proud of? What was hardest?

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Exchanging Information/Ideas

Beginning
Prompt student conversation: Whose turn is it to talk? What is your idea? Does anyone have a question for ___? Can someone offer a constructive suggestion?

Intermediate
Prompt student conversation: Has everyone shared their ideas? What questions do we have? Which idea are we going to try?

Advanced/ Advanced High
Ensure all students are participating: Who has not had a chance to speak? ___, can you share your idea with the group? ___, do you have any suggestions for ___?

ELPS 2.C; ELPS 3.B; ELPS 3.E

COLLABORATION WEDGE CHALLENGE (10 MIN.)

- Have students open their *Inventor's Notebooks* to "Collaboration Wedge Challenge: Letter to Jacques" (Activity 1.4).
- Have students read the challenge and answer the questions.
- Have students write individually for five to seven minutes.
- Have students share some of their writing responses.

Activity Page 1.4

ENGLISH LANGUAGE LEARNERS

Writing

Beginning
Offer these closed sentences: When collaborating, it is important to ___. I helped my group when I ___. I saw ___ help our group today when they ___.

Intermediate
Ask students to give details to answer these questions: In your opinion what is the most important rule of collaboration? If people ignore this rule, what can go wrong?

Advanced/ Advanced High
Encourage students to write longer answers by prompting for more details or more personalized opinions.

ELPS 1.B; ELPS 1.C; ELPS 1.F; ELPS 3.G; ELPS 4.C; ELPS 4.G; ELPS 5.B; ELPS 5.F

ACTIVITY 1.4

Name: ______________________________

Date: ______________________________

COLLABORATION WEDGE CHALLENGE: LETTER TO JACQUES

Think back on the group work rules that Jacques introduced and that we addressed as a class in the "Learn from Last Season" transcript and the building prompt.

Prove to Jacques that you were paying attention. Pick one rule and write him a letter explaining how you used that rule during the building activity.

Dear Jacques,

I believe the most important rule for collaboration is:

If you ignore this rule:

15

I used this rule during the building activity when:

Another one of my lab mates used this rule when:

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Sincerely,

Eureka! | Inventor's Notebook 17

CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Contestant interviews/"Introspective Inventors"

Thank you very much—I know that Jacques loves getting mail, so he'll be thrilled with all these letters! If all goes well, there will be wedges tomorrow!

Here on *Eureka!* we like to close the program with a segment we call "Introspective Inventors." (*Introspective* means "looking within yourself.") The viewers at home like to know what's going on inside our contestants' minds, so I'll invite one or two contestants up each episode for a little interview about what they did and what they learned.

- Invite a student to come to the front of the room and "face the camera, for the audience at home."
- Ask two or three questions, which might include:

  1. Can you think of anything particularly clever or helpful that a lab mate did during the episode?
  2. What was a challenging moment, and how did you address it?
  3. What are you looking forward to?
  4. What is a lesson you'll take away from today and apply to the rest of the Quest?

- Collect *Inventor's Notebooks.*

Sign-off

> Please join us next time for another action-packed episode of *Eureka!* Until then, remember Mr. Edison's words of wisdom: "Have a great idea. Have a lot of them."

After Class

- Review Collaboration Wedge Challenge letters. Check for coherence and use of details and facts to support each response. Identify unanswered prompts and provide guiding questions to gain more detail where necessary.

EPISODE

2

Those Fascinating Judges—Research

PRIMARY FOCUS OF LESSON

Reading

Students will complete close reads of several inventor biographies and will be able to summarize key ideas and key details and answer questions about the inventors, using text evidence to support their responses.

TEKS 4.6.G; TEKS 4.7.C; TEKS 4.7.D

Writing

Students will draw evidence from inventor biographies to support their own research. TEKS 4.7.E; TEKS 4.13.A; TEKS 4.13.C

FORMATIVE ASSESSMENT

Inventor Cards	**Research Wedge Challenge 1 of 2** The Judges collect and review students' inventor cards, checking for complete answers. TEKS 4.7.E; TEKS 4.13.C

TEKS 4.6.G Evaluate details read to determine key ideas; **TEKS 4.7.C** Use text evidence to support an appropriate response; **TEKS 4.7.D** Retell, paraphrase or summarize texts in ways that maintain meaning and logical order; **TEKS 4.7.E** Interact with sources in meaningful ways such as notetaking, annotating, freewriting, or illustrating; **TEKS 4.13.A** Generate and clarify questions on a topic for formal and informal inquiry; **TEKS 4.13.C** Identify and gather relevant information from a variety of sources.

LESSON AT A GLANCE

	Time	Materials
Episode 2 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Wheels of Invention ❏ Collaboration Wedges ❏ Light Bulb of Glory ❏ Judges' Note 2A, 2B (Digital Components) ❏ *Eureka! Files* ❏ Edison, Cousteau, Carver, Lamarr Inventor Cards ❏ Ruth Wakefield Inventor Card ❏ Video: Irate Thomas Edison (Digital Components)
Introduction to Research: Thomas Edison	10 min.	
Complete Inventor Card: Thomas Edison	20 min.	
Inventor Cards Research Wedge Challenge	25 min.	
Know Your Judges Challenge	15 min.	
Ruth Wakefield Inventor Card	10 min.	
Closing: "Introspective Inventors"	5 min.	

EPISODE OVERVIEW

Contestants open the *Eureka! Files* to read biographies of the judges. They do research to complete inventor cards, until the episode is interrupted by a cranky judge.

ADVANCE PREPARATION

Read

- Read and evaluate students' "Collaboration Wedge Challenge" writing (Letters to Jacques) from Episode 1 in student *Inventor's Notebooks*.
- Determine which labs have earned the collaboration wedge.
- Review lesson script in Teacher Guide and Edison, Cousteau, Carver, Lamarr, and Wakefield bios in *Eureka! Files*.

Customize

- Establish a make-up process for labs that did not earn their collaboration wedge. (Examples: rewrite letter to Jacques for homework; write an extra paragraph about another example of collaboration; quiz on Jacques's Rules of Collaboration)
- Choose a set of rules for the "Know Your Judges Challenge" described in Episode 2.

Prop Master

- Test audio and video resources.
- Assemble the Light Bulb of Glory.
- Locate inventor card sheets with Edison, Cousteau, Carver, and Lamarr to distribute to students. Separate Wakefield inventor cards from second sheet for distribution to students.
- Prepare a stash of blank inventor cards for students who request them.
- If you don't want students to take the *Eureka! Files* home, prepare copies of the Ruth Wakefield article for the homework.

Universal Access

- Prepare sentence frames for Edison's inventor card.
    - Make a list of seven of Edison's inventions, mentioned in the biography.
    - Complete these sentences: A challenge Edison faced was having a ___ family and having to go to work when he was ___ years old.
    - One fact I found interesting about Thomas Edison is that he ___.

ACADEMIC VOCABULARY

Students will encounter the following words across their reading and/or homework in today's episode. They are listed here for your reference, bolded in the student reading at their first occurrence, and compiled in the glossary of the *Eureka! Files*.

agricultural, adj. relating to farming

aquatic, adj. relating to water

arguably, adv. able to be supported by a reasonable argument

avid, adj. eager or excited

botanist, n. a scientist who studies plants

botany, n. the scientific study of plants

crop rotation, n. yearly switching of which crops are grown on a piece of land

deliberately, adv. on purpose

deter, v. discourage

fertile, adj. capable of producing healthy plants

financiers, n. people who give inventors money to develop and sell their products, in return for a portion of the profits

frequency, n. the rate at which radio signals are transmitted

greasy spoons, n. slang for cheap and unsanitary restaurants

humble, adj. not significant; modest

indifference, n. lack of interest

inventory, n. a complete list

irk, v. bother, irritate

irritation, n. the state of being annoyed

malfunctioning, adj. not working properly

marketing, n. activities involved in advertising and selling a product

optimistic, adj. expecting a favorable outcome

patent, v. get a government license giving an inventor the right to be the only one to manufacture and sell their invention for a certain period of time

phonograph, n. a machine that reproduces sound by means of a needle in contact with a grooved rotating disk

player piano, n. a piano fitted with an apparatus enabling it to be played automatically

prestigious, adj. highly respected

producers, n. people who supervise a television production

profit, n. (often financial) gain

rehabilitation, v. recovery

self-sufficient, adj. able to take care of oneself

sharecroppers, n. farmers who had to give part of their crop away as rent

spearhead, v. lead

synchronized, adj. occurring at the same time

take root, v. begin

telegraph, n. a machine that transmitted and received messages across great distances using electrical signals and wires. Messages were transmitted in codes that had to be received and translated by specially trained operators

Start Lesson

Episode 2: Those Fascinating Judges

Research

90M

Primary Focus: Students will complete close reads of several inventor biographies and will be able to summarize key ideas and key details and answer questions about the inventors, using text evidence to support their responses. **TEKS 4.6.G; TEKS 4.7.C; TEKS 4.7.D**

Students will draw evidence from inventor biographies to support their own research. **TEKS 4.7.E; TEKS 4.13.A; TEKS 4.13.C**

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has ten episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor—where puppets pull the strings and "making it work" is only the beginning.

"Last Time, on *Eureka!*"

Note: For this class, the host models "Last Time, on *Eureka!*" In the future, students can be selected to offer the recap.

Recap last episode

Last time, on "*Eureka! Student Inventor*," contestants worked together on the infamous table tennis challenge. (Review two or three memorable moments from the Episode 1 class.) Through a careful study of collaboration, they hoped to avoid the disaster of last season.

TEKS 4.6.G Evaluate details read to determine key ideas; **TEKS 4.7.C** Use text evidence to support an appropriate response; **TEKS 4.7.D** Retell, paraphrase or summarize texts in ways that maintain meaning and logical order; **TEKS 4.7.E** Interact with sources in meaningful ways such as notetaking, annotating, freewriting, or illustrating; **TEKS 4.13.A** Generate and clarify questions on a topic for formal and informal inquiry; **TEKS 4.13.C** Identify and gather relevant information from a variety of sources.

Housekeeping

- Return *Inventor's Notebooks.* For those students who did not successfully complete the wedge writing, explain the process for making it up so that they, too, can earn their wedge.
- Assign a building manager for each lab for the episode.
- Award the Light Bulb of Glory to the leading lab.

Award collaboration wedge and introduce research wedge **TEKS 4.13.A**

Your first triumph as new inventors—wedge 1 of 6—the collaboration wedge!!!

Attach the wedge to your scorecard and bask in the glory!

All right, that's enough glory—you have much more work to do. What lies in store on today's episode of *Eureka!*? Let's watch as contestants embark on the RESEARCH challenge.

(Turn head dramatically, as if looking to another camera.)

RESEARCH. An underrated superpower. Know where to look or whom to ask and you can save yourself time, or even prevent a disaster before it happens. The more research you do on famous inventors, the better for your inventions!

TEKS 4.13.A Generate and clarify questions on a topic for formal and informal inquiry.

INTRODUCTION TO RESEARCH: THOMAS EDISON (10 MIN.)

Play audio, read aloud, or invite student to read Judges' Note 2A

Judges' Note 2A

A Note from George Washington Carver:

Welcome, seedlings! There are many ways to conduct research—for instance, in the field, in the lab, and in the library! In this Quest you will learn from some of the greatest inventors in all of history! That is the beauty of having a television show! These inventors like being mentioned on TV, so they will offer their advice for free, which is good since the producers slashed our budget this year. These inventors come from many different backgrounds and work in many different ways, but they all have very specific things to teach us about invention. Look to them for inspiration and practical suggestions when inventing on your own.

We don't want to be conceited, but perhaps your judges are a good place to begin learning about great inventors?

Sincerely,

George Washington Carver

ENGLISH LANGUAGE LEARNERS

Reading
Listening Actively

Beginning
Is Thomas Edison an important American inventor? What does it mean that he came from "humble" beginnings? What was his first invention and how many inventions had he found before he died?

Intermediate
When Thomas Edison saved a child from the path of a moving train, how did this event help him become an inventor?

Advanced/ Advanced High
Do you agree that Thomas Edison should be considered the most successful American inventor of all time?

ELPS 2.F; ELPS 3.J; ELPS 4.G

Introduce inventor card activity

As you research great inventors, in order to help remember the lessons of their lives and careers, you'll create and collect inventor cards.

Today we'll start by making an inventor card for each of the judges. This is the first half of the Research Wedge Challenge; your lab must complete one card per judge. We'll do Thomas Edison together—he gets touchy, we don't want to offend him. Then you can split off into your labs and decide which of you will do each of the other judges. All of the inventor biographies can be found in the *Eureka! Files*.

Read: Thomas Edison Biography

- Before reading aloud, review the bold vocabulary words of this biography. Explain to students that definitions for bolded vocabulary can be found in the glossary of their reader. Ask students to look up definitions for the three vocabulary words on page 7 of their reader (patented, humble, deterred).
- As a class, read the biography of Thomas Edison.
- Before reading page 8, ask students to look up definitions for the three vocabulary words on this page.

Thomas Edison

Grouchy inventor Thomas Edison returns to anchor the panel of judges on *Eureka! Student Inventor*

Producers are relieved to have Thomas Edison back on the judging panel this season on *Eureka!* Without a big name like his, they were concerned that even fewer people would tune in. For everyone's sake, the producers hope that this season's contestants pay Edison the respect he feels he deserves.

After all, many claim that Thomas Alva Edison is the most successful American inventor of all time. He **patented** over a thousand inventions in the United States. He had **humble** beginnings, however. Born on February 11, 1847, in Milan, Ohio, he was the last of seven children. His family was poor and his education consisted mainly of being homeschooled and reading his father's books. He got his first job when he was twelve years old, selling newspapers on the Grand Trunk Railroad. In his time off, he read in the public library and conducted chemistry experiments in the baggage cars. One of his experiments set the train on fire, but Edison wasn't **deterred**. Even then, he knew that you often have to figure out the wrong way to do something before you can find the right way.

One day he rescued a child from the path of a moving train, and the boy's father, who was trained to operate a **telegraph**, offerred him lessons in telegraphy. He soon became a telegraph operator and before long was inventing remarkable improvements to the telegraph that got the attention of **financiers**. With their support, he opened a laboratory in Menlo Park, New Jersey.

His lab was the first of its kind. It was a busy place where experts collaborated, working on multiple inventions at the same time. Research and **marketing** happened under one roof. In this idea-rich environment, Edison invented the **phonograph**—the first device for recording sound!—and the incandescent lightbulb, his most famous invention.

By the time he died, in 1931, Edison had patented an astounding 1,093 inventions in the United States, and more abroad. These also include the Kinetoscope (which launched the movie industry), the microphone, the rechargeable battery, and a cement manufacturing process. Edison believes this list cements his place in history.

Check for Understanding

Ask students to hold up their readers and point to the Edison invention that helped people listen to the music. Call on a student to say the word (phonograph), and ask students for examples of other inventions that help us listen to music. (Listen for radio, CD-player, iPod, computer media player.)

COMPLETE INVENTOR CARD: THOMAS EDISON (20 MIN.)

- Pass out the inventor card for Edison to each student. As a class, complete the inventor card for Thomas Edison. Work as a class together, but instruct students to complete their own card and explain that each student must fill out a card for Edison for their lab to receive the point.
- As you guide students to answer the questions on the card, ask them to point out their evidence in the text for their answer.

ENGLISH LANGUAGE LEARNERS

Writing

Write brief summaries of texts using complete sentences and key words

Beginning
Make a list of seven of Edison's inventions. Complete this sentence: A challenge Edison faced was having a ___ family.

Intermediate
Ask students to list inventions in the biography. Then write a sentence describing a challenge or disappointment Edison faced.

Advanced/ Advanced High
Ask students to write complete sentences, answering the questions on the cards.

ELPS 4.G; ELPS 5.B

Thomas Edison Inventor Card

Name: Thomas Edison

Birthdate: February 11, 1847

Birthplace: Milan, Ohio

Invention(s):

Lighbulb, phonograph, microphone, telephone transmitter, rechargeable batteries, kinetoscope, cement manufacturing process

Describe a challenge or disappointment that this inventor faced.

Not much formal education, went to work at 12 years old

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

Check for Understanding

Circulate and ensure that each student is completing the card. Check that they are supporting answers with facts and evidence from the text, and prompt them to refer to evidence in the reader when necessary.

INVENTOR CARDS RESEARCH WEDGE CHALLENGE (25 MIN.)

- Pass out inventor cards for the other three judges. Instruct students to meet in their labs and divide up the remaining three judges. In order to win the wedge for this challenge, each student must complete their own inventor card. (Depending on the size of the lab, there may be some repeats.)
- Remind students to read the entire biography for their judge and to refer to their glossaries to look up the bold vocabulary words.
- When they are done with the cards, ask students to share their research from their inventor's biography and their completed inventor card with their team lab. Each student should have a chance to share.
- When all students are finished, lead a class discussion and ask for a few sample answers to the inventor card questions. **TEKS 4.13.A**

TEKS 4.13.A Generate and clarify questions on a topic for formal and informal inquiry.

Activity Page 2.1

ENGLISH LANGUAGE LEARNERS

Writing
Write brief summaries of texts using complete sentences and key words

Beginning
Which invention(s) is this inventor known for? Where and when were they born? What does (select bold vocabulary word) mean?

Intermediate
What is a disadvantage or challenge this inventor had to cope with? What do you find interesting about this inventor?

Advanced/ Advanced High
Why is _______ an important inventor?

ELPS 5.B

Eureka! Files: Jacques Cousteau

Jacques Cousteau

Lover of croissants and aquatic life, seafaring Frenchman Jacques Cousteau returns to *Eureka!'s* judging panel

Producers are frustrated that Jacques Cousteau has returned this season as a judge on *Eureka!*, despite the fact that he was not invited back after the mess he caused last season. Jacques, however, is thrilled to be on the panel, and claims that this will be *Eureka!*'s most exciting season ever!

Jacques Cousteau likes excitement. Born on June 11, 1910, in the small town of Saint-André-de-Cubzac, France, Cousteau was a curious child. Although not a good student, he was always building things and taking things apart to see how they worked. At age twenty-six he was in a terrible car accident that required months of **rehabilitation**. Armed with a pair of goggles, he began swimming daily in the sea. He quickly realized that he wanted to be able to explore the ocean, but to do so he would need better equipment for breathing under water. So he decided to try inventing it.

10 Inventor | Eureka! Files

Cousteau and his inventing partner developed the Aqua-Lung, which allowed people to stay under water while breathing from air cylinders (small tanks that can hold hours' worth of air). This advance opened human eyes to **aquatic** life in a new way, and also allowed for undersea rescues and recoveries that would have been impossible before.

Cousteau also helped invent a deepwater camera. (As an **avid** undersea explorer he wanted to share with the world what he experienced in person.) He increased interest in underwater archeology by **spearheading** the exploration of a famous Roman shipwreck. He went on to lead many more explorations, to write books, and to make films about his voyages and about ocean life. His television series, *The Undersea World of Jacques Cousteau*, was so popular it ran for eight years (a distant hope for *Eureka!*).

Jacques died at the age of eighty-seven in Paris, on land. But he was most himself when he was at sea. He once said, "From birth, man carries the weight of gravity on his shoulders. He is bolted to earth. But man has only to sink beneath the surface and he is free."

Jacques Cousteau Inventor Card

Name: Jacques Cousteau

Birthdate: June 11, 1910

Birthplace: Saint-André-de-Cubzac, France

Invention(s):

Aqua-lung; deepwater camera

Describe a challenge or disappointment that this inventor faced.

Answers will vary, but might include:
Difficulty of breathing deep under water; recovery from serious car accident.

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

George Washington Carver

Peanut expert George Washington Carver joins *Eureka!* as judge, brings love of plants, general human kindness to program

Producers are pleased to announce that well-known inventor, professor, and all-around good guy George Washington Carver has joined the cast of *Eureka!* Carver brings to the judging panel a love of research, a deep knowledge of plant life and **agricultural** inventions, and a much-needed friendly and **optimistic** perspective.

A biography of George Washington Carver might as well also be a biography of the peanut. And the sweet potato. Carver **arguably** devoted more time, care, and love to these two crops—finding over 400 new uses for them—than any person devoted to plant life before or since. The road to **botany**-based greatness wasn't easy, however. Carver was born into slavery in Diamond, Missouri, around January 1864 (he wasn't sure of his exact birth date). He could not enroll at the first college to which he'd been admitted because of his race. When he finally started college in 1890, he studied painting and drawing (and piano!) because his school, Simpson College in Iowa, did not have a science program. But these studies led him back to science and nature when an instructor was impressed by his pictures of plants. The instructor pointed Carver toward Iowa State Agricultural College's botany program, where he was the first black student.

This is where his unlikely career **took root**. He was a talented **botanist** and was soon hired to lead the **prestigious** Tuskegee Institute's agricultural department. While at Tuskegee, Carver set out to help struggling farmers and **sharecroppers** in the South. He worked hard to get the latest information about farming methods to them, even in remote locations, to help them remain **self-sufficient**. Until this time farmers in the South had produced mostly cotton. Carver helped to introduce many more cash crops—crops that could be sold for money. He also instructed farmers to grow crops that broke down the soil, such as cotton one year, and then the next year to grow crops that improved the quality of the soil, such as peanuts, sweet potatoes, peas, and soybeans. This method of **crop rotation** kept the soil rich and **fertile**.

Carver became an inventor when he turned his attention to finding new uses for some of these new crops. He developed countless paints, dyes, and plastics made from peanuts, sweet potatoes, pecans, and soybeans. And, of course, he is often credited with inventing (or at least popularizing) peanut butter! When asked why he didn't try to make a personal **profit** from his inventions, he said, "God gave them to me. How can I sell them to someone else?"

George Washington Carver Inventor Card

Name: George Washington Carver

Birthdate: January, 1864

Birthplace: Diamond, Missouri

Invention(s):

Many products from peanuts, sweet potatoes, soy beans and pecans. Some of the products are paints, dyes, plastics, gasoline, and of course—peanut butter.

Describe a challenge or disappointment that this inventor faced.

Answers will vary, but might include: poverty, racial discrimination—not allowed to enroll in some colleges. The college he enrolled in had no science programs.

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

Eureka! Files: Hedy Lamarr

Hedy Lamarr

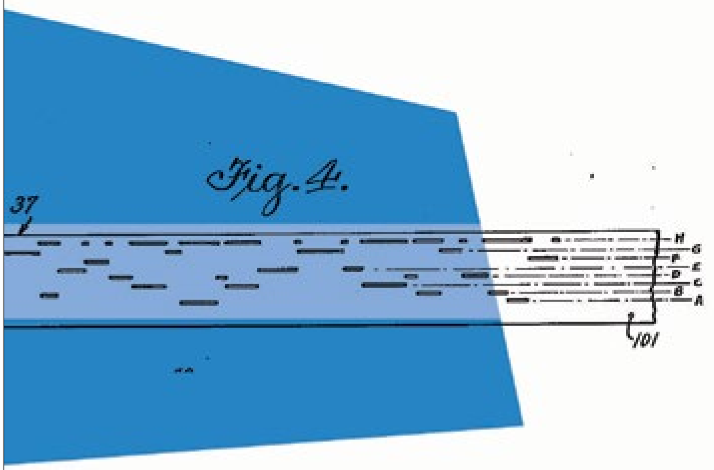
Brainy beauty Hedy Lamarr reluctantly agrees to judge season two of *Eureka!*, citing boredom and a salary that will help pay for her guilty pleasure: strudel

Producers are reportedly "OK" with Hedy Lamarr rejoining *Eureka!* as a judge. For her part, Ms. Lamarr claims "**indifference**" about returning to the panel. Her hopes for the student contestants include that they don't give her a head cold, or lice.

Born on November 9, 1914, as Hedwig Eva Maria Kiesler, to Jewish parents in Vienna, Austria, Hedy Lamarr changed her name in the early 1940s and became a movie star known for her stunning looks. But there was more to Hedy Lamarr than starring roles in popular Hollywood films, great beauty, and six marriages. She was also an avid inventor.

Her inventing began out of a need to entertain herself. She disliked Hollywood parties, so she had free time. She dedicated a room in her house entirely to inventing. Some of the things she developed there were everyday items (a better traffic signal, an improved Kleenex box—neither of which succeeded). But some of her other inventions were advanced technologies. She is best known as an inventor for coming up with ***frequency*** *hopping*, the concept of changing the frequencies of the radio signals steering a torpedo so that an enemy would not be able to block them. She and her friend and inventing partner, a composer named George Antheil, stumbled on the idea when discussing a piece of music he'd composed that made use of **synchronized player pianos**. The two hoped to help America in World War II with their idea. It was acquired by the US Navy, but the navy never found a way to use it. It took twenty more years for the idea to be put to use, a major disappointment to Lamarr. Today a more advanced version of frequency hopping is used in wireless phones, GPS—anything that makes use of Wi-Fi.

Lamarr never profited from the idea and she was rarely appreciated for her brilliant mind. This oversight **irked** her to no end and certainly contributes to her sometimes, shall we say, "quick-tempered" responses on *Eureka!*



Hedy Lamarr Inventor Card

Name: Hedy Lamarr

Birthdate: November 9, 1914

Birthplace: Vienna, Austria

Invention(s):

Frequency hopping

Describe a challenge or disappointment that this inventor faced.

Answers will vary, but might include: Her invention was hard for people to find a use for. She was not taken seriously as an inventor because she was also a beautiful actress.

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

Reinforce value of inventor cards and introduce bonus inventor card opportunities

In future episodes you will read about additional inventors and complete more inventor cards for bonus points. I also encourage you to practice your research off-camera! Find a book or a good article (online or in print) about an inventor or invention. I will give you extra blank inventor cards.

As you make inventor cards, you will gather extra information, which will come in handy. If only last year's contestants had read the biography of Peter Cooper, the inventor of gelatin desserts, we might've never had that pudding disaster. . . sorry, sorry. The network producers really don't like it when I bring up last season.

KNOW YOUR JUDGES CHALLENGE (15 MIN.)

Introduce: Know Your Judges Challenge

You've researched the judges and learned about their distinguished careers. Now use that research to prepare for some of the crazier situations you might encounter as an inventor.

I'll read a few sentences to introduce a problem you might run into as an inventor. Select the judge you would approach for help with this crisis, and find evidence from the *Eureka! Files* or inventor cards to support your choice. BE CAREFUL—without good evidence to back up your decision, you run the risk of offending the other judges. Friends, you do not want to do that. Not even to Professor Carver, as kind as he may seem.

Once you've made your choice and have your evidence, raise the judge's inventor card you've selected.

Note: To make this exercise more competitive, you can freeze everyone once the first card goes into the air and ask for evidence. If the student has evidence, the lab gets a point and you move on to the next clue.

- To encourage greater participation, wait until all students have made their choices, then spot-check for evidence by consulting with one member from each lab. Every lab with evidence gets a point.
- Sample answers are provided, but there may be a good reason why you'd want to ask Jacques Cousteau about adhesives! Any answer with a sound supporting evidence should be accepted.
- Award a point to the top team, and collect inventor cards to review for the research wedge.

Check for Understanding

Use the second approach to ensure that each group makes a choice and supports its choice with textual evidence. Correct misunderstandings or incorrect use of evidence when necessary.

Support

Explain that the phrase *build a better mousetrap* means to take an existing product and make it even better.

Know Your Judges Challenge Questions

In order to build a better mousetrap, you plan to experiment with new adhesives made from things found in nature. Whom do you ask for help?

- » George Washington Carver
- » Evidence might be: he worked with peanuts and sweet potatoes, he studied botany, he worked with farmers

You want to hire a consultant to advise you on how to bring your fantastic new invention to market. You will need advice on manufacturing and selling it. Whom do you ask for help?

- » Thomas Edison
- » Evidence might be: research and marketing both happened at his Menlo Park lab

You are interested in inventing equipment to assist in space travel, particularly, better oxygen tanks for astronauts. Whom do you ask for help?

» Jacques Cousteau

» Evidence might be: his invention helped explorers breathe in the ocean, which is like space in that it's hard for people to breathe there

You're interested in a career in inventing, but you get bored so easily! You want to work on lots of different kinds of inventions. Whom do you ask for a job?

» Thomas Edison, Hedy Lamarr

» Evidence might be: Edison—he had over 1,000 patents; his lab had many inventions in progress at one time. Lamarr—she invented because she was bored; her inventions included everyday and high-tech things

You want to use remote controls in your invention to ensure that it can be used secretly. Whom do you ask for help?

» Hedy Lamarr

» Evidence might be: her invention is used in many inventions that use Wi-Fi; her invention used radio signals to steer, like a remote control

Challenge

Ask students to brainstorm additional tasks an inventor might face and to explain which judge would be most helpful in solving that task.

RUTH WAKEFIELD INVENTOR CARD (10 MIN.)

Play audio, read aloud, or invite student to read Judges' Note 2B

Judges' Note 2B

A Note from George Washington Carver:

Good work! We should look at another inventor while your research muscles are all warmed up. As the inventor of peanut butter, I am partial to tasty inventions—the very talented Ruth Wakefield, inventor of the chocolate-chip cookie, has graciously agreed to share her story of invention and the importance of careful research.

Sincerely,

George Washington Carver

- Students read Ruth Wakefield's biography, found in the *Eureka! Files*.

  Note: This activity can be done as a class, individually, or in groups, as you prefer.

- The Wakefield reading includes information about how her story has become a legend, with some errors.

Ruth Wakefield

Good day, children. I am Ruth Graves Wakefield, and I am so very pleased to have the opportunity to clear up some disappointing untruths that people have written over the years about me and the invention of the chocolate-chip cookie.

I was born June 17, 1903, in East Walpole, Massachusetts. Articles about me almost always get that right, at least. But then the stories people tell! Here are some of the false stories that exist about me on the Internet. Some have claimed that the invention of America's favorite cookie was an accident. They say I ran out of nuts and, in a panic, chopped up a Hershey bar to throw into the cookie dough. It's utter nonsense! I kept a strict **inventory** of my food pantries' contents, and would certainly have noted an absence of pecans, cashews, or our own Professor Carver's peanuts prior to the dinner rush. I have also read that I mistakenly spilled chocolate chunks into cookie dough after being startled by a **malfunctioning** mixer. Having spent most of my life in kitchens—including my college years, during which I studied the household arts—I assure you that my response to a broken appliance would have been mild **irritation** followed by a call to the repairman.

Here is the truth about my cookie. It may not be the most thrilling story in the world, but I can't concern myself with that. In 1930 my husband Kenneth and I opened a restaurant near Boston called the Toll House Inn. The Inn was my pride and joy, and I took its operation very seriously. Some have suggested I was a bit of a tyrant with the staff, and I don't deny it. If a waitress wasn't able to fold a napkin exactly right, I would suggest that perhaps her skills were better suited to one of those "**greasy spoons**." Yes, I wanted my restaurant to be the best, and I'm fairly certain that's no crime. Therefore I was always trying to come up with new dishes and desserts to attract more business. So I set out, *quite* ***deliberately***, to invent a new cookie. And, after some trial and error with different ingredients, I created the chocolate-chip cookie in 1938 by improving a butterscotch cookie already on the menu. That's all there is to it.

And while I know quite well that my cookie did not change the course of history, I'll leave you with this question. If you were stranded on a desert island, which would you prefer to have with you—a box of lightbulbs or a box of chocolate-chip cookies?

- Once students have finished reading, pose the following questions:

  1. Why does Wakefield feel the need to "clear up some untruths"?
     - » Many false versions of the story are repeated on the Internet.
  2. Why do you think the false stories about the chocolate-chip cookie are so widespread?
     - » Many possible answers. One: the real story is less exciting.
  3. As a researcher, how do you think you can avoid being misled in this way?
     - » Many possible answers. One: read several sources.

Enthuse about the chocolate chip cookie. Take a phone call from offended Thomas Edison.

> What a brilliant woman. I really love cookies. I think they may be the most delicious and important invention—ever. Yes, I think I could argue that the chocolate chip cookie is the most important invention in the history of the world. If we start the inventor card. . .

(The host stops suddenly, interrupted by a signal, or call, from the "judges.")

> . . . What! Excuse me, I'm getting a message from our judges . . . apparently the judges do NOT think cookies are the most important invention in the history of the world, not even the chocolate chip ones. Mr. Edison is PARTICULARLY cranky. Ugh. OK, OK, OK. He's demanding to address the contestants. He feels he was grievously wronged.

Play video: Irate Thomas Edison

Hard to understand, but the gist of it: cookies, stupid, light bulb much more important. Saves lives! Makes work easier! Improves quality of life!

ENGLISH LANGUAGE LEARNERS

Reading
Reading Closely

Beginning
What is Wakefield's invention? What is an example of a false story found on the Internet about the chocolate chip cookie? Why did Wakefield try to invent a new cookie? In what year did she invent the chocolate chip cookie?

Intermediate
Which stories about the invention of the chocolate chip cookie are false, and which is true? What is the central message of this biography?

Advanced/ Advanced High
What is the key idea of the Wakefield biography?

ELPS 4.G ; ELPS 4.I

Summarize Edison plot point, preview next episode

Contestants—Mr. Edison is really, really mad. And—he's the biggest name on this show, he's threatening to walk out if I don't immediately retract my statement and ensure that the viewing audience knows that the light bulb is more important than the chocolate-chip cookie. I have to write him a letter of apology with as much evidence about the value and importance of the light bulb as possible, and I have to do it tonight. Can you guys help me? We're running out of time, so we'll make it the second part of the challenge for the research wedge, the center of tomorrow's episode. That will make Mr. Edison happy.

CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Introduce "Introspective Inventors"

Since we're almost out of time, let's go straight to "Introspective Inventors."

- Invite a student to come to the front of the room and "face the camera, for the audience at home." Ask two or three questions, which might include:
  1. Secretly, right now, which do you think is better—the light bulb or the chocolate chip cookie?
  2. What will it take to convince you that the light bulb is better?
  3. How do you think you can use research to keep Mr. Edison on the show?
- Distribute Ruth Wakefield Inventor Cards.

Assign homework and sign off

Please join us next time for another action-packed episode of *Eureka!* Until then, remember Judge Edison's words of wisdom, "Have a great idea. Have a lot of them."

Please finish your Ruth Wakefield inventor card tonight for homework. When you complete an inventor card off the air, you can bring it in and earn a bonus point for your team. You've got a head start with this one, since you've already done the reading. Remember, I have extra blank inventor cards for any other independent research you want to complete over the course of the Quest.

That's all our business for today. Please join us next time for another action-packed episode of *Eureka!*, and until then, remember Judge (at least for now) Edison's words of wisdom: "Have a great idea. Have a lot of them."

Homework

- Ruth Wakefield inventor card

After Class

- Review the inventor cards. Check that each student has provided complete answers and used evidence from the text. Provide prompts to encourage more details or evidence from the text.

Ruth Wakefield Inventor Card

Name: Ruth Wakefield

Birthdate: June 17, 1903

Birthplace: East Walpole, MA

Invention(s):

Chocolate chip cookie

Describe a challenge or disappointment that this inventor faced.

In order to keep customers interested, she needed to have new recipes; many misconceptions about how the chocolate chip cookie was invented.

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

LESSON

3

Lovin' the Light Bulb—Research/Introduction to Pitching

PRIMARY FOCUS OF LESSON

Reading

Students will read complex informational texts about major inventions and discuss their development and impact. **TEKS 4.6.G; TEKS 4.7.C**

Writing

Students will write an opinion piece about the importance of the light bulb, providing evidence to support their argument. **TEKS 4.12.C**

Speaking and Listening

Students will recognize and summarize best practices for making an oral presentation and analyze sample presentations. **TEKS 4.1.A**

Students will discuss and choose audio recordings to enhance their oral presentations. **TEKS 4.13.H**

Language

Students will acquire domain-specific vocabulary associated with the major inventions they are researching. **TEKS 4.7.F**

FORMATIVE ASSESSMENT

Activity Page 3.2	**Research Wedge Challenge** Write two paragraphs, stating an opinion about the light bulb and providing evidence as support. **TEKS 4.12.C**
Activity Page 3.3	**Edison's Invention Evidence** Read and summarize information about inventions, citing evidence from a complex text. **TEKS 4.6.G; TEKS 4.7.C**

TEKS 4.6.G Evaluate details read to determine key ideas; **TEKS 4.7.C** Use text evidence to support an appropriate response; **TEKS 4.12.C** Compose argumentative texts, including opinion essays, using genre characteristics and craft; **TEKS 4.1.A** Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.13.H** Use an appropriate mode of delivery, whether written, oral, or multimodal, to present results; **TEKS 4.7.F** Respond using newly acquired vocabulary as appropriate.

Writing Studio

WRITING STUDIO

If you are using Writing Studio, you may begin Unit 3, Lesson 1 after completing this lesson. If you have not done so already, you may wish to review the Writing Studio materials and their connection to this unit.

LESSON AT A GLANCE

	Time	Materials
Episode 3 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Light Bulb of Glory ❏ *Eureka! Files* ❏ *Inventor's Notebook* ❏ Judges' Note 3A, 3B (Digital Components) ❏ Video: Good Pitch, Bad Pitch (Digital Components)
Researching the Light bulb	20 min.	
Research "Letter to Mr. Edison"	15 min.	
Introduction to Pitching Wedge	5 min.	
Invention Pitch	20 min.	
Good Pitch, Bad Pitch	15 min.	
Adding Audio to the Pitch	10 min.	

EPISODE OVERVIEW

Contestants dive further into the *Eureka! Files* to research the light bulb, and appease the temperamental Thomas Edison. Contestants then apply their research skills to the great inventions after which their labs are named. The host also previews *pitching*, the skill they'll use to share their research in Episode 4. Students will learn about the elements of a successful oral presentation, and become "experts" on their invention.

ADVANCE PREPARATION

Read

- Review students' work on inventor cards from Episode 2 for research wedge and bonus points.
- Review lesson scripts in the Teacher Guide, invention articles in *Eureka! Files*, and the video script, available on the program's digital components site.

Prop Master

- Test audio and video resources.
- Prepare to project the "Image of the Day" if desired.

Universal Access

- Prepare sentence frames and prompts for writing Activity 3.2.
    - The light bulb is one of the greatest inventions because it helps us ___. Before the light bulb was invented, people lit their homes with ___ or ___. One drawback to this was ___.
    - Three activities we are able to do at night because of the light bulb are:

      1.

      2.

      3.

- One thing we could not do without the light bulb is ___. In conclusion, I believe the light bulb is a more important invention than the chocolate chip cookie, because it ___.
    - Why is the light bulb an important invention?
    - How did people light their homes before the light bulb, and what was a drawback to this?
    - What activities does the light bulb allow us to do at night?
    - How did the light bulb lead to other important inventions?

- If we did not have the light bulb, what could we not do today? As a conclusion, tell Mr. Edison why you think his invention is so important.

- Prepare sentence frames and prompts for "Reading and Evidence Gathering" (Activity 3.3).
  - This invention helps us by ___. Before the invention of ___, people had to ___ if they wanted to ___.
  - If this invention had not happened, we could not ___ today.
  - What two changes happened because of this invention? Write two quotes from the text and provide page numbers.
  - What do people use this invention for?
  - How does it work? How did people ___ before this invention?
  - Can you find two examples in the article of how this invention changed people's lives?
  - Can you find a quote in the article that suggests how modern life would be different if this invention had never existed?

ACADEMIC VOCABULARY

Students will encounter the following words across their reading and/or homework in today's episode. They are listed here for your reference, bolded in the student reading at their first occurrence, and compiled in the glossary of the *Eureka! Files*.

airborne, adj. in flight

charred, adj. burnt

diaphragm, n. a thin disk or piece of material that vibrates when producing or receiving sound waves

dim, adj. not bright

drawbacks, n. disadvantages, problems

ecosystems, n. systems formed by the interaction of communities of organisms with their environments

English Channel, n. a body of water separating England and France

evaporate, v. change from a liquid state into a vapor

illumination, n. brightness

inspire, v. give rise to, lead to

intricate, adj. detailed, complicated

isolated, adj. far away from other places, buildings, or people; remote

parchment, n. animal skin prepared for use as a writing surface

pendulum, n. a weighted, swinging lever that regulates the speed of a clock

potential, n. qualities or abilities that may be developed and lead to future success

sundial, n. an instrument showing the time with the shadow of a pointer cast by the sun onto a plate marked with the hours of the day

telegraph, n. a machine that transmitted and received messages across great distances using electrical signals and wires. Messages were transmitted in codes that had to be received and translated by specially trained operators.

tinker, v. to work at something

transmitter, n. a set of equipment used to generate and transmit electromagnetic waves carrying messages or signals, especially those of radio or television

vaccines, n. medicines to make people immune to diseases

Start Lesson

Episode 3: Lovin' the Light Bulb

Research/Introduction to Pitching

90M

Primary Focus: Students will read complex informational texts about major inventions and discuss their development and impact. **TEKS 4.6.G; TEKS 4.7.C**

Students will write an opinion piece about the importance of the light bulb, providing evidence to support their argument. **TEKS 4.12.C**

Students will recognize and summarize best practices for making an oral presentation and analyze sample presentations. **TEKS 4.1.A**

Students will discuss and choose audio recordings to enhance their oral presentations. **TEKS 4.13.H**

Students will acquire domain-specific vocabulary associated with the major inventions they are researching. **TEKS 4.7.F**

TEKS 4.6.G Evaluate details read to determine key ideas; **TEKS 4.7.C** Use text evidence to support an appropriate response; **TEKS 4.12.C** Compose argumentative texts, including opinion essays, using genre characteristics and craft; **TEKS 4.1.A** Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.13.H** Use an appropriate mode of delivery, whether written, oral, or multimodal, to present results; **TEKS 4.7.F** Respond using newly acquired vocabulary as appropriate.

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor—*where puppets pull the strings and "making it work" is only the beginning.*

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!* Ensure they include information about research, inventor cards, and Edison's crankiness.

Housekeeping

- Return the inventor cards. For those students who did not successfully complete the wedge writing, explain the process for making it up so that they, too, can earn their wedge.
- Collect any bonus inventor cards students made and award points for them.
- Award the Light Bulb of Glory to the leading lab.

RESEARCHING THE LIGHT BULB (20 MIN.)

Introduce light bulb reading activity.

> Welcome back, inventors. As you know, we've hit our first hiccup of the season, but with the research skills you started mastering last episode, I have high hopes we can get back to easy breathing. In order to calm down our crankiest judge, we have to convince him and our viewing audience that we believe the light bulb is the most important invention ever. You'll do this by writing Judge Edison a letter on the subject, and that letter had better be full of evidence or he's not going to believe it. Mr. Edison loves evidence.

How will you find that evidence?

Well, here's a hint: Which wedge are we working on?

That's right. Research is going to get us out of this mess.

We're going to read this article about the light bulb and work through this evidence worksheet together.

Activity Page 3.1

- As a class, read the article "The Light Bulb" from the *Eureka! Files*, find evidence, and complete "Edison's Invention Evidence" in the *Inventor's Notebook* (Activity Page 3.1).
- Before reading, inform students that today's research will introduce some technical language related to the inventions. Go over bold vocabulary words in the text and ask students if they are familiar with these terms. If not, find definitions in the glossary.

  Note: For this article, ensure students comprehend the meaning of *illumination*.
- Draw student attention to the way the headers in the article provide clues to the questions they answer:
  - "Before the Light Bulb"—What came before this invention?
  - "How the Light Bulb Changed Things"—How did this invention change things?

ENGLISH LANGUAGE LEARNERS

Reading
Reading Closely

Beginning
Ask, "What are some ways people lit their homes before the light bulb? What are some drawbacks to these ways? What is filament? What did Thomas Edison use for filament and how did it help?"

Intermediate
Ask, "What does the light bulb do and how does it work? How did people live before the light bulb?"

Advanced/ Advanced High
Lead students through the prompts in Activity Page 3.1. Draw attention to the headings in the article to provide clues.

ELPS 4.G

The Lightbulb

BEFORE THE LIGHTBULB: Life in the Dark

For most of human history, people got up at sunrise and didn't do much after sunset because there wasn't much light indoors and traveling in the dark was dangerous—people could easily get lost or fall and hurt themselves.

Of course people lit their homes before the lightbulb, but there were lots of **drawbacks** to these early sources of light. Candles, for example, didn't give off much light. Wood fires took a lot of effort to build and gave off unwanted heat when the weather was warm. Some species of whales almost became extinct because the oil in their blubber was used as fuel for oil lamps. Accidental fires were a problem with all of these light sources and with the gas lamps that became popular in the nineteenth century.

INVENTING THE LIGHTBULB: Edison's Innovation

Electric lights existed before Thomas Edison's lightbulb, but they were expensive and unreliable, and the lighting was very **dim**. One reason is that early inventors could not come up with a proper filament, which is the tiny wire that runs through the center of a lightbulb. When the filament heats up, it glows, which is the source of the bulb's light. Before Edison, inventors made filaments from metals that would catch fire at the slightest heat. As a result the bulbs burned out very quickly, or the filament would burn so hot that the bulb would explode. Starting in 1878, Edison experimented for two years before he came up with a **charred** bamboo filament that provided 1,200 hours of **illumination**.

HOW THE LIGHTBULB CHANGED THINGS: The Impact

As a smart businessman, Edison realized the **potential** in selling both lightbulbs and electricity. He quickly started a company to supply electricity to customers, and in 1882 his first power station lit up fifty-nine homes in New York City.

Almost every part of our lives has been affected by electric light. Think about all the things people do before sunrise or after sunset that would not have been possible before the lightbulb. Today, factories that would have shut down at night can run around the clock because of the lightbulb. The headlights on all sorts of vehicles, including ambulances and fire engines, allow for safe travel after dark. And nighttime activities that we take for granted, from sleepovers to concerts to reading in bed, would be more difficult or impossible without electric light. The lightbulb also led to lots of other inventions, because once electric outlets were installed in homes, many inventors realized that things other than lamps could be plugged into these outlets. They then got busy inventing all sorts of home appliances—like the toaster, dishwasher, and electric fan—that make our lives easier and more comfortable.

ACTIVITY 3.1

Name: ____________________

Date: ____________________

EDISON'S INVENTION EVIDENCE

Invention: Lightbulb

What this invention does:

____

____

____

____

What came before this invention:

____

____

____

____

____

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Support

Have students think about times during their day when they use light bulbs, then speculate about how those times would be different without electric lights.

How did this invention change things? Give two examples and include quotes from the article as evidence.

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Check for Understanding

Ensure that students are writing notes and answers to the questions on "Edison's Invention Evidence" (Activity Page 3.1). Provide guidance if students do not understand the questions or need help finding evidence in the text.

RESEARCH "LETTER TO MR. EDISON" (15 MIN.)

Introduce "Letter to Mr. Edison"

> You guys, this evidence is great—it really helps me to understand why the light bulb MIGHT be more important than the chocolate chip cookie. OK, let's make it really count. Last season Mr. Edison sent two labs home because he felt they didn't show the light bulb proper respect, and I really like you guys!

> I have the research wedges here, but there's no way Mr. Edison is going to sign off on awarding them before you have this under control. This letter will be the second part of the Research Wedge Challenge. Write the letter, get your wedge.

> Please! Save the show! Demonstrate how well you can use your research!

- Have students open their *Inventor's Notebooks* to "Research Wedge Challenge: Letter to Mr. Edison" (Activity Page 3.2).

ENGLISH LANGUAGE LEARNERS

Writing
Supporting Opinions

Beginning
Provide pre-prepared sentence frames from Universal Access.

Intermediate
Provide pre-prepared prompts from Universal Access.

Advanced/ Advanced High
Provide light support to ensure students use evidence and details to support their opinion. What is an example of this from your reading? Can you quote some of the evidence from your research? Based on what you know about Mr. Edison's personality, how can you write a letter that will satisfy him?

ELPS 1.C; ELPS 5.B

Activity Page 3.2

ACTIVITY 3.2

Name: ____________________

Date: ____________________

RESEARCH WEDGE CHALLENGE: LETTER TO MR. EDISON

Write a letter to Thomas Edison extolling the virtues of the lightbulb.

Your letter should be about two paragraphs long. That means you might not have time to cover all the arguments and evidence you gathered earlier, so choose your material judiciously. Think about the story of the lightbulb you want to tell. As you develop your letter, you may also want to think about information you learned about Mr. Edison's personality and life from his inventor card.

20

Here's an opening to get you started:

Dear Mr. Edison,

Eureka! Student Inventor could not possibly succeed without you as a judge. What show about invention can be taken seriously if it doesn't include the inventor of the lightbulb, one of the greatest inventions of all time?

The lightbulb is a truly great invention because:

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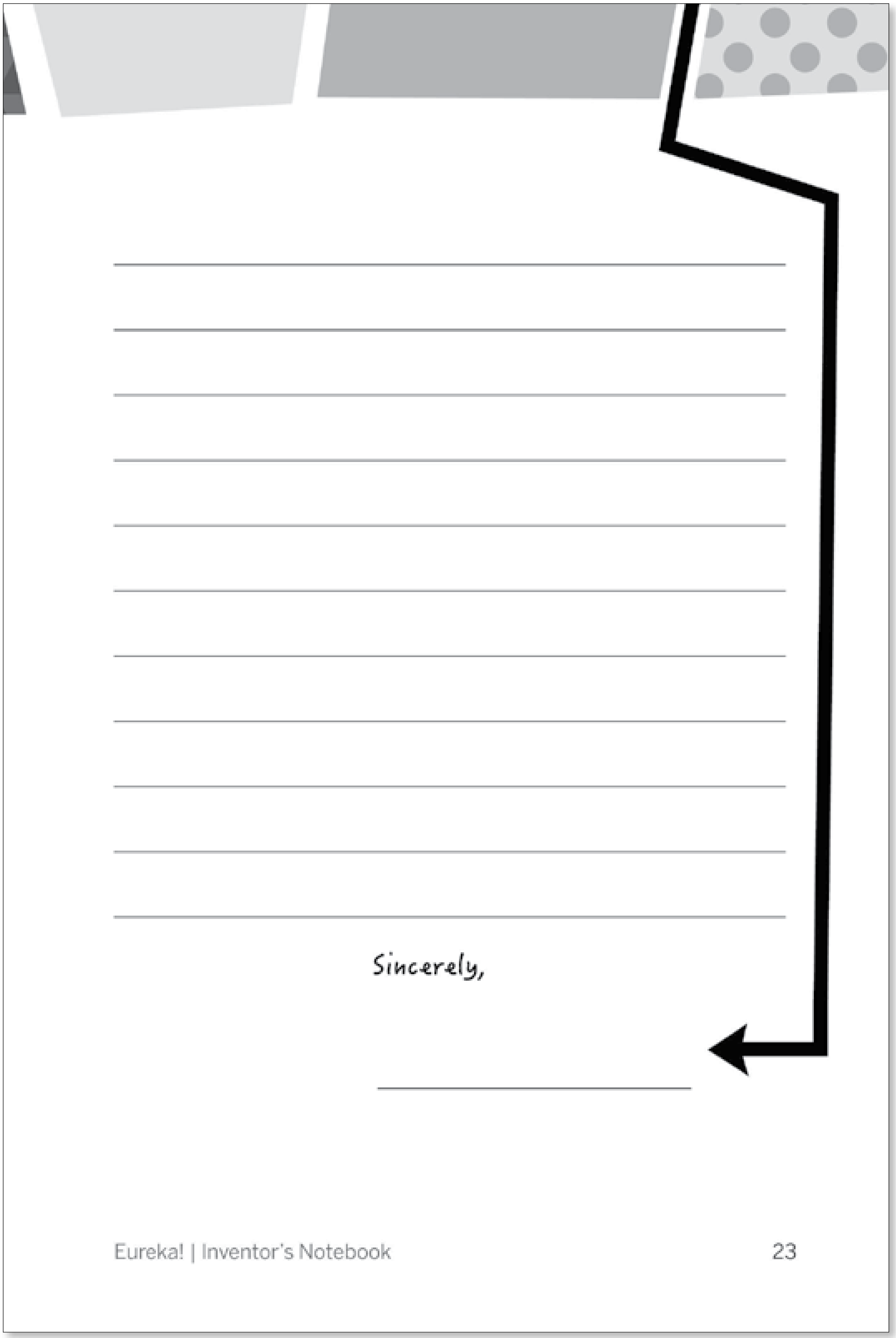
Sincerely,

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Challenge

Ask students to explain why they chose to include the particular evidence they selected and why they omitted other pieces of evidence from their letter. What made their evidence the best for convincing Edison?

- Once students have written their letters, select two to three students to read theirs aloud.

Wrap up letter writing

> We're going to have to hold off on awarding wedges until we have confirmation that all the letters meet Mr. Edison's standards, but we seem to be off to a great start.

INTRODUCTION TO PITCHING WEDGE (5 MIN.)

Introduce pitching skill.

> That's enough research for the moment. What else lies in store on today's episode of *Eureka!*? Let's watch as contestants embark on their pursuit of the pitching wedge.

(Turn head dramatically, as if looking to another camera.)

> PITCHING. Explaining your inventions, and persuading audiences that they can't live without them. A combination of explanation and advertisement, with enough energy and pizzazz to get anyone's attention. Today we'll learn more. First, another word from Mr. Edison.

Play audio, read aloud, or invite student to read *Judges' Note 3A.*

Judges' Note 3A

Dear widgets:

Hmph. Well, from what I've seen and heard so far, you seem to be doing a solid job on your analysis of the light bulb. Not everyone knows all the details of its illustrious history, but your research skills are serving you well. Let's make things a little more interesting. I am in the final-proof stage of my book, *I Judge Inventions*. Obviously, the light bulb is THE MOST important invention of all time, and the light bulb is going on the front cover. But the back cover needs art too. One of the inventions after which your labs are named, but only one, can be that back-cover art. Convince me that it should be yours.

Sincerely,

Thomas Edison

Note: Depending on the dynamics of your class, this is an activity where you can encourage a bit of healthy competition and lab pride.

Introduce Pitching Wedge Challenge

Thomas Edison—he just has to see everything in black and white. I mean, obviously these are all very important inventions, and there's no reason at all for you to engage in juvenile trash-talking and posturing. Right? Who cares which lab is the best, and who deserves this incredible honor?

You will be creating a pitch for your invention that you'll present orally as a lab. This pitch is the Pitching Wedge Challenge—complete it successfully and earn the pitching wedge. Everyone can earn a wedge, but there will be only one winner, selected by Mr. Edison. In addition to a spot on the back cover, and the glory of representing the second-most-important invention on *Eureka!*, the winner will get a bonus point.

This is your third wedge challenge, and you will need to use all the skills you've mastered to accomplish it. Collaborate! Research! Then pitch!

ENGLISH LANGUAGE LEARNERS

Reading
Reading Closely

Beginning
Remind students to read each section, one at a time. Provide pre-prepared sentence frames from Universal Access to develop their evidence.

Intermediate
Prompt students to look for evidence in their article to respond to the writing prompts you prepared in Universal Access.

Advanced/ Advanced High
Check that students are answering the questions in "Edison's Invention Evidence." Provide guidance to help students understand the questions.

ELPS 4.D

INVENTION PITCH (20 MIN.)

Introduce lab readings

Before we get into the nuts and bolts of pitching, you'll need to read some more about your invention and pull evidence of its importance in the world. There is a detailed article about your invention in the *Eureka! Files*. Read it with your lab members, then complete another "Edison's Invention Evidence" page about your lab invention. You can work together on this, but you EACH need to complete your own evidence sheet for the lab to get credit

We've been doing a lot of research, but do you remember all the rules of collaboration?

When your "Edison's Invention Evidence" page is complete, raise your hand so I can approve it.

- Labs read *Eureka! Files* articles and complete "Edison's Invention Evidence."
- Remind students to look up the bold vocabulary words in the glossary of their Reader. Encourage students to include relevant technical vocabulary in their evidence. Additionally, ask students if other words are new and need definitions.
- Remind students that they must each complete their own "Edison's Invention Evidence" page in their *Inventor's Notebook*.

Activity Page 3.3

Check for Understanding

As you circulate, check that students are understanding and using the technical vocabulary in the readings. Encourage them to use these terms in their evidence. Students may need support in understanding phrases such as "centuries marched on," "time marches on," and "the naked eye."

Paper

BEFORE PAPER: A Record-Keeping Nightmare

Throughout most of history, only a very small amount of human knowledge was ever written down. Most knowledge was communicated through spoken words. This meant that what a person knew was limited to what he or she could remember. One reason for this is that writing was very inconvenient. The writing surface made from the papyrus plant in ancient Egypt was extremely fragile. In other parts of the world people wrote on vellum, a **parchment** made from animal skin. But vellum was expensive and time-consuming to produce.

Almost two thousand years ago, around the year 105, a man named Cai Lun was keeping official government records for the Chinese Emperor He of Han. At that time in China people wrote on silk, which was very expensive, or on scrolls of bamboo, which were very heavy and difficult to manufacture. Cai Lun was frustrated with those choices and believed he could come up with a better option—a writing surface that was light, cheap, and easy to make.

INVENTING PAPER: The First Paper

Cai Lun experimented with lots of different materials and methods before discovering his winning formula: He mixed tree bark, old cloth, and discarded pieces of rope and fishing nets in a big kettle of boiling water. As the water **evaporated**, he mashed up the mush that was left into a paste, which he then set to dry on screens in thin layers. As they dried, these layers of Cai Lun's strange mixture hardened into the first sheets of paper! Cai Lun's lightweight invention made writing, transporting, and storing records much easier. Emperor He was very pleased. He rewarded Cai Lun with great wealth. Neither of them could have predicted that a few hundred years later the Chinese would find two new uses for Cai Lun's invention that would become hugely popular: paper money and toilet paper.

HOW PAPER CHANGED THINGS: Portable Knowledge

Cai Lun's invention changed civilization. People could now spread knowledge of science, literature, and art over great distances by carrying paper documents with them when they traveled. Paper also helped people communicate across hundreds and even thousands of years because stories, poems, artwork, and history could now be recorded, stored, and copied over generations. By allowing political thinkers to share their ideas with many people, paper also toppled mighty kings and brought about great revolutions. For example, Tom Paine's *Common Sense*, a pamphlet that **inspired** the American Revolution, would not have been read up and down the thirteen colonies had it not been printed on paper. Paper is also used for fun—coloring books, comics, crosswords, and novels would not exist without paper! Through the spread of books, paper has enabled billions of people to learn to read, receive an education, and read for pleasure.

Inventor's Notebook

ACTIVITY 3.3

Name: ______

Date: ______

EDISON'S INVENTION EVIDENCE

Invention: Paper

What this invention does:

It provides a writing surface that's light, cheap and easy to make.

What came before this invention:

Knowledge was communicated through spoken words.

How did this invention change things? Give two examples and include quotes from the article as evidence.

1. Allowed knowledge to be spread all around. "People could now spread knowledge over great distances by carrying paper documents with them when they traveled."

2. Preserves art, knowledge and writing across time. "Stories, poems, artwork and history could now be recorded, stored and copied over generations."

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Answers will and can vary. Some might include: a world where only the rich have access to the news (when it's only available electronically); a world where museums would be full of electronic art...

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The Airplane

Leonardo's Flying Machines

Leonardo da Vinci (1452–1519), the famous artist who painted the *Mona Lisa*, was also a brilliant inventor. About four hundred years before the Wright Brothers' first flight, he was writing and sketching his ideas for man-powered flying machines. After carefully studying the way birds and bats fly, da Vinci drew plans for a human-powered flying machine with giant flapping wings. He also sketched ideas for a helicopter. The technology for this kind of flight didn't exist during his life, so his ideas were ahead of their time.

BEFORE THE AIRPLANE: Flights before the Wrights

Human beings first flew in the year 1783 in a hot-air balloon, but people wanted to do more than float in the sky. In the 1800s, a German man named Otto Lilienthal made over two thousand flights in gliders, motorless aircraft that ride air currents as a bird does in between flapping its wings. As new and more powerful engines were developed, lots of inventors attached them to aircraft frames and tried to fly. They failed because they didn't understand that successful flight requires a pilot to carefully balance and control the aircraft.

INVENTING THE AIRPLANE: The Wright Brothers Take Control

Orville and Wilbur Wright understood the importance of control. That's why they practiced flying and steering gliders for two years before building the *Flyer*, their first motorized plane. They succeeded in keeping the *Flyer* **airborne** at Kitty Hawk, North Carolina, in 1903 because they had installed controls to keep the plane balanced and steady. Afterward they continued experimenting for two more years, eventually building the *Flyer III*. That plane had improved controls to adjust its pitch (lifting the nose or tail), roll (tilting from side to side), and yaw (steering right or left). These controls are still found on airplanes today. They help planes take off, fly, and land much more safely, especially in bad weather or high winds.

Orville and Wilbur Wright's the *Flyer*

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HOW THE AIRPLANE CHANGED THINGS: The Sky's the Limit

It wasn't long before people saw the potential of the Wright Brothers' invention. Planes began carrying mail in 1911. In 1914, at the start of World War I, France and Germany used airplanes for military purposes for the first time, permanently changing how wars are fought. That same year a businessman in Florida started the very first airline, charging passengers five dollars to fly between St. Petersburg and Tampa, Florida. In 1927 Charles Lindbergh made the first flight across the Atlantic Ocean. By the end of the next decade, an airline called Pan Am was offering weekly passenger and mail flights between the United States and England. A trip that had taken a week by boat now took less than a day, with a few stopovers. Today that trip takes less than seven hours on a jet.

Hundreds of millions of people travel on airplanes every year. Airplanes have also saved countless lives by quickly bringing aid to areas hit by natural disasters. The Space Shuttle, a descendent of the airplane, sent men, women, and equipment, like communications satellites, into space. By making it possible for us to travel the world, the airplane has helped people appreciate and value different cultures, as well as understand what all people have in common.

ACTIVITY 3.3

Name: ______________________

Date: ______________________

EDISON'S INVENTION EVIDENCE

Invention: Airplane

What this invention does:

It flies!

What came before this invention:

People flew in hot air balloons and gliders.

How did this invention change things? Give two examples and include quotes from the article as evidence.

1. Mail could be more quickly delivered around the world. "Planes began carrying mail in 1911."

2. People can travel more easily and come to "appreciate and value different cultures."

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Answers will and can vary. Some might include: a world where no one travels great distances, a world where it takes a long time to help people in an emergency...

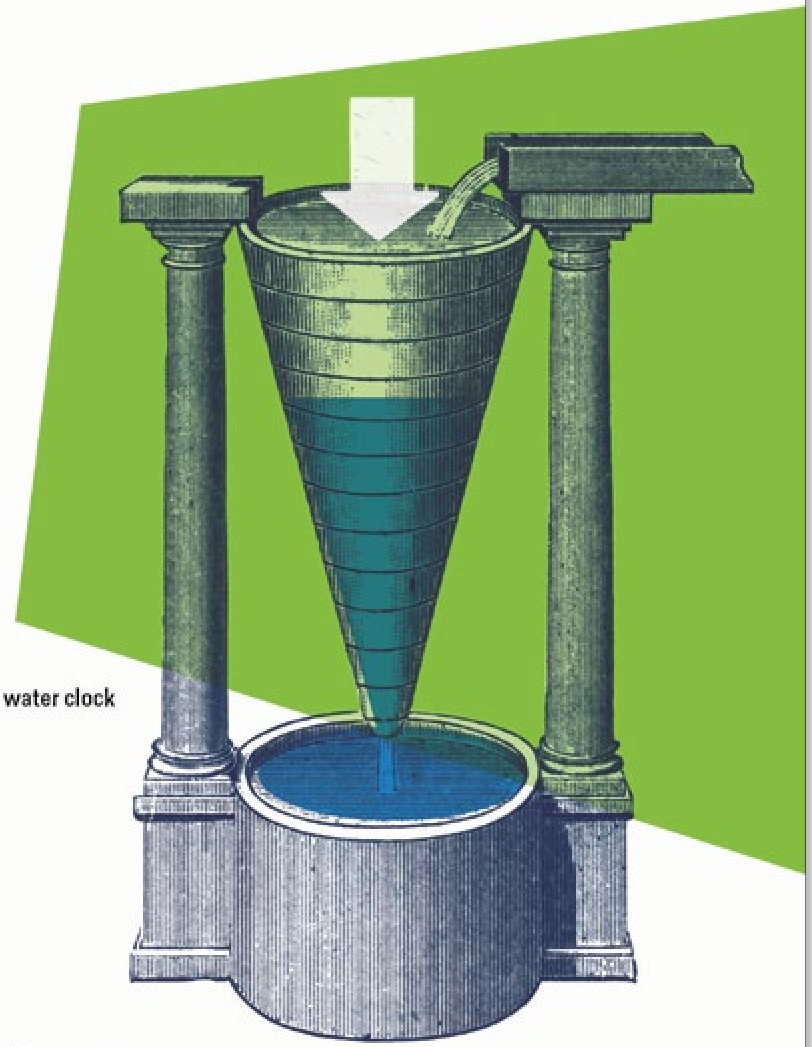
The Clock

BEFORE THE CLOCK: Telling Time

Even prehistoric men and women kept track of the passing of time. They noted the sunrise and sunset, the locations of the stars and planets, the changes in weather, and the cycle of the moon. These clues helped them know when to plant, when to hunt, and perhaps when to move to someplace warmer. As time went on, people began measuring smaller units of time with **sundials**, which told time using the direction and size of shadows cast by the sun. But sundials could not tell the exact time and were of no use on cloudy days or at night. As people started interacting with each other in more complicated ways, they divided the day into twenty-four hours and needed more accurate ways of keeping track of those hours.

INVENTING THE CLOCK: Water Clocks

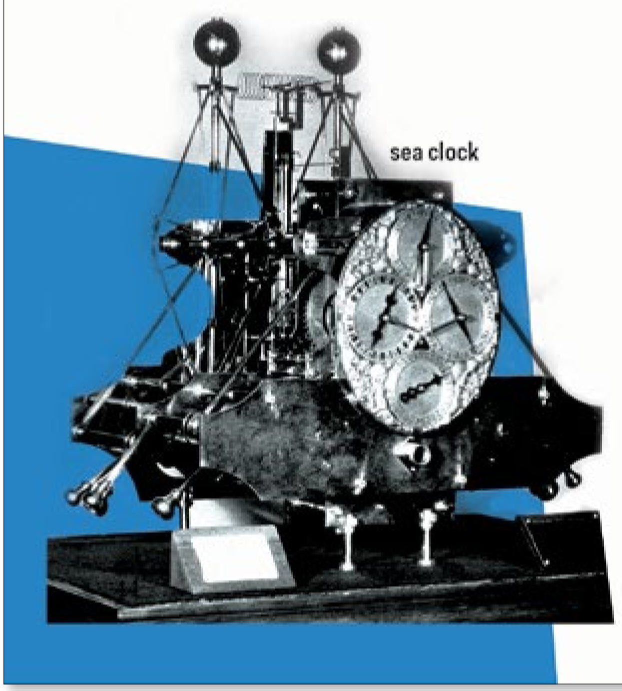
The next great innovation in timekeeping was the water clock. The first water clocks, which the Egyptians started using about 1400 BCE, were simple bowls with holes carved into them. If you knew how long it took for all the water to flow out of a full bowl, you could measure the passage of time by checking the water level. Over time water clocks improved, and in the eleventh century a Chinese engineer named Su Song built a water clock that was an architectural and mechanical wonder. Su Song's clock was powered by a waterwheel and stood forty feet high. **Intricate** puppets playing musical instruments emerged from five different doors to announce each hour. It also displayed the positions of the planets. Water clocks like Su Song's were the most accurate timepieces for hundreds of years.



water clock

Keeping Time at Sea

As the centuries marched on, clocks became more accurate as water power was replaced by springs and **pendulums**. However, these early clocks were very breakable and didn't work on ships because of all the motion caused by the sea. Sailors were desperate for a clock that would keep working on a ship. Knowing the time at home by using such a clock, and the time on board, which they could calculate using the stars, would let them figure out their ship's exact longitude (its location on one of the horizontal lines that circle a globe). Not knowing longitude often led to shipwrecks or ships becoming lost at sea. After more than 1,400 British sailors drowned in 1707 because of the "longitude problem," a carpenter named John Harrison spent almost fifty years designing clocks and watches that kept time at sea. His inventions helped sailors navigate safely.


sea clock

HOW THE CLOCK CHANGED THINGS: Time Marches On

As the number of clocks in the world continued to grow, more and more people were better able to coordinate with one another because of their shared understanding of time. Friends who planned to get together at 10:30 a.m. instead of "midmorning" were much more likely to arrive at the same time. Clocks also made workplaces run more smoothly because bosses could plan and assign work knowing exactly when their employees would be arriving and leaving. Railroads and airlines, which need to operate according to schedules, would not have been possible without clocks. And television stations need clocks to schedule their programming. Let's just hope the clock doesn't run out on *Eureka!*

ACTIVITY 3.3

Name: ______

Date: ______

EDISON'S INVENTION EVIDENCE

Invention: Clock

What this invention does:

It tells time. It divides the day into hours and keeps track of those hours.

What came before this invention:

Observing sunrise and sunset, locations of stars and planets, weather patterns, and cycle of the moon; sundials; water clocks…

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How did this invention change things? Give two examples and include quotes from the article as evidence.

1. Saved lives of sailors by solving "the longitude problem." "John Harrison spent almost fifty years designing clocks and watches that kept time at sea. His inventions helped sailors navigate safely."

2. Enabled railroads and airlines to "operate on schedule."

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Answers will and can vary. Some might include: a world where no one meets up at a specific time, so there'd be a lot of waiting around; a world where the natural rhythms of the day dictated things so school might be over when the sun went down, etc.

Eureka! | Inventor's Notebook 25

The Microscope

BEFORE THE MICROSCOPE: Bad Air

One reason doctors and scientists had difficulty curing many diseases before the invention of the microscope is that they couldn't see the tiny **organisms** that often spread sickness. Until about 150 years ago, most people believed that dirty, smelly air rising from rotting plants or dead animals formed a poisonous gas that spread illness. This idea of bad air causing disease made some sense at the time. After all, people could smell the bad odor of rotten meat, but could not see germs. A few scientists in ancient and medieval times suggested the existence of tiny living organisms, but not many people believed them. "Seeing is believing," they thought. And by the middle of the seventeenth century, no one had figured out how to examine tiny objects and organisms.

INVENTING THE MICROSCOPE: An Amateur Inventor

In 1654 a young man named Antonie van Leeuwenhoek opened up a shop in Holland selling cloth and textiles. Although he was a successful merchant, he was more interested in science, and began experimenting with glass lenses, like those used in eyeglasses. Van Leeuwenhoek manufactured a tiny lens that was double convex, which means the glass bulged out on both sides of the lens, like two tiny domes. He attached his lens to a brass plate and eureka!, he'd made a microscope. He started studying the tiniest details of organisms like mold, bees, and lice, while working on improving his lenses. By 1676 he had invented a microscope so powerful that he was able to see single-celled organisms, like bacteria. He wrote to a group of famous scientists in London about his discoveries, but they didn't believe him. "Seeing is believing," they thought. But when they sent representatives to look through the microscope themselves, they realized the importance of van Leeuwenhoek's invention.

HOW THE MICROSCOPE CHANGED THINGS: Tiny Organisms, Huge Impact

Over the years the microscope has been an important tool in great scientific and medical discoveries. Thanks to the microscope, nineteenth-century scientists like Robert Koch and Louis Pasteur were able to see the bacteria that cause many deadly diseases. Once these bacteria had been identified, scientists invented **vaccines** that saved millions of lives by preventing these diseases. The microscope has also helped the environment. For example, by studying river water samples, scientists have been able to analyze and improve the health of **ecosystems**.

Van Leeuwenhoek's most powerful microscope had a magnification of 270, which means tiny objects appeared 270 times their actual size. Today's most powerful microscopes can achieve a magnification of ten million. Modern microscopes have more uses than van Leeuwenhoek could have imagined. They are used to manufacture tiny computer parts. They also make possible many complicated medical procedures, like surgery on the eyes and blood vessels.

ACTIVITY 3.3

Name: ______

Date: ______

EDISON'S INVENTION EVIDENCE

Invention: Microscope

What this invention does:

It allows people to see things that aren't visible to the naked eye. It led to the discovery of how disease truly spread.

What came before this invention:

People believed in the miasma theory—that bad air caused disease.

How did this invention change things? Give two examples and include quotes from the article as evidence.

1. People could have new kinds of surgeries that would have been impossible without the microscope "surgery on the eyes and blood vessels."

2. Microscopes led to the creation of vaccines that wiped out many diseases. "Once these bacteria had been identified, scientists invented vaccines that saved millions of lives by wiping out these diseases in some parts of the world."

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Answers will and can vary. Some might include: a world where disease runs rampant and no one knows where it comes from; a world where scientists are limited to understanding only what they can see with their own eyes.

The Radio

BEFORE THE RADIO: Wired!

For most of the nineteenth century, many Americans lived fairly **isolated** lives. They may not have ever traveled more than twenty or thirty miles from their homes. For entertainment they visited with neighbors, played cards and games, and maybe danced, sang, and played music together. Concerts and the theater were mostly for those who lived in cities. People didn't have much reason to communicate with those outside their communities, and when they did it was by mail, which could take weeks or months to arrive.

In 1861 the Western Union Company completed the first transcontinental electric telegraph, connecting the East and West Coasts of the United States. The telegraph was a machine that sent coded messages over a wire in the form of electricity in a matter of minutes. A telegraph operator tapped out the message in code in one city, and then a second operator decoded and wrote down the message in another city. At the

time the telegraph was the fastest and most efficient means of communicating over long distances, but putting up the wires (and making sure they stayed up) was so expensive that telegraph companies did it only where there were significant populations. This left many Americans who lived far from big cities out of reach of the telegraph.

INVENTING THE RADIO: Wireless

In 1894 a young man in Italy named Guglielmo Marconi read a book that explained electromagnetic waves—that's electricity that travels through the air. He reasoned that if electricity could travel through the air without a wire, then he could send telegraph messages wirelessly. He quickly got to work in his attic building a wireless **transmitter** (to send messages) and a wireless receiver (to receive messages). Soon Marconi was sending wireless signals across the room, and by 1895 he was sending them over a distance of a mile and a half.

Marconi wrote to an Italian official asking the government for money to help him further develop his invention. The official thought he was crazy, so Marconi moved to England, where he found people who believed in him. In 1898 Marconi sent a wireless message across the **English Channel** to France, and in 1902—only eight years after he built his first machine in the attic—Marconi sent a wireless message all the way across the Atlantic Ocean! Soon scientists and businesspeople realized that the future of Marconi's technology was in sending sound directly to receivers in people's homes. These receivers were called radios.

HOW THE RADIO CHANGED THINGS:
Radio Waves of the Future

The first commercial radio station began broadcasting in 1920, and by 1930, long before televisions were available, radios were in twelve million American homes. Radio stations broadcast news, music, comedies, adventure shows, game shows, soap operas, talent contests—almost everything you can see on TV today. Lots of families gathered in the evenings to listen to the radio the same way many families now watch TV together. And along with the movies, the radio created national celebrities, as many radio performers became superstars. Today the electromagnetic waves that Marconi first sent across his attic are also used for cell phones, GPS, radar, and TV (including *Eureka!*), and even to control satellites in outer space.

Inventor's Notebook

ACTIVITY 3.3

Name: ______________________

Date: ______________________

EDISON'S INVENTION EVIDENCE

Invention: Radio

What this invention does:

It communicates across long distances and connects people to ideas and culture happening far away.

What came before this invention:

People were unable to communicate with people far away, except by mail, or by traveling long distances. Americans lived isolated lives, and entertained themselves.

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How did this invention change things? Give two examples and include quotes from the article as evidence.

1. The radio brought "news, music, comedies, adventure shows, game shows, soap operas, talent contests" into people's homes.

2. The radio "created national celebrities."

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Answers will and can vary. Some might include: a world where people have no idea what's happening even one town over; a world without national celebrities.

The Telephone

BEFORE THE TELEPHONE: Voiceless Communication

For thousands of years, the only way for most people to stay in touch with those who lived far from them was through the mail, and letters could take weeks or even months to arrive. In the middle of the nineteenth century an invention called the telegraph was revolutionizing long-distance communication around the world. With the telegraph, an operator in one city could transmit a message to an operator in another city in minutes by sending an electric current over a wire. The telegraph did have some drawbacks, however. Most importantly, the telegraph could not transmit sound—only a complicated code of clicks that few people could understand. People couldn't hold back-and-forth conversations over a telegraph line. They had to go to special telegraph offices to give their messages to an operator to send, which meant messages were never completely private. And sending a message over the telegraph might require a lot of traveling if you didn't live in a city or town with an office.

INVENTING THE TELEPHONE: The Voice!

The telegraph proved that electrical signals could be sent across a wire. Alexander Graham Bell aimed to send the human voice across a wire by turning it into electrical signals. In 1875 he was **tinkering** in his lab when he accidentally spilled acid on his pants. He called to his assistant, Thomas Watson, who was in the next room, where the receiver of Bell's invention sat on a table. Eureka! Watson heard Bell's voice coming out of the machine. The first phone call!

Bell worked on improving the invention and the next year, he and Watson had a telephone conversation over a distance of two miles. When Bell spoke into the telephone, his voice caused a thin piece of parchment (the **diaphragm**) to vibrate. A magnet turned those vibrations into electricity that traveled over the telephone line. At Watson's end, a second magnet and diaphragm turned the electrical signal back into sound vibrations.

HOW THE TELEPHONE CHANGED THINGS: A Ringing Success

By 1886 more than one hundred thousand Americans had telephones in their homes. The country, and eventually the world, became much more connected because people were able to pick up their phones and speak to anyone anywhere. Businesses saved money, as meetings that had once required long-distance travel could now be held over the phone. People who lived in isolated areas were now able to call for help in an emergency. News traveled more quickly and long-distance friendships became possible. Eventually the telephone put the telegraph out of business and became one of the most successful inventions of all time.

Inventor's Notebook

ACTIVITY 3.3

Name: ______

Date: ______

EDISON'S INVENTION EVIDENCE

Invention: Telephone

What this invention does:

It sends the human voice across a wire by turning it into electrical signals.

What came before this invention:

People could only stay in touch through the mail. The telegraph was starting to change long-distance communication, but couldn't transmit sound.

24 Eureka! | Inventor's Notebook

How did this invention change things? Give two examples and include quotes from the article as evidence.

1. "The world became much more connected because people were able to pick up their phones and speak to anyone anywhere."

2. "People who lived in isolated areas were now able to call for help in an emergency."

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

Answers will and can vary. Some might include: a world where you would struggle to stay in touch with someone who didn't live near you; a world where businesses couldn't be national or global.

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GOOD PITCH, BAD PITCH (15 MIN.)

- Once all groups have completed their worksheets and had them approved, reconvene.

Define *pitch*.

Now you know a lot more about your invention. But how will you *pitch* it? Does anyone even know what a pitch is?

So a *pitch* is basically a short presentation in which you introduce an idea, an approach, a product, or, in this case, an invention, with the aim of selling it to the listener or audience.

It sounds so simple, but as we learned last season, there are a lot of ways to do it really badly. Somehow this recording survived, so I can show you some clips . . .

Note: Students may refer to a baseball pitch. Explain that a *pitch* on our show is a little like a baseball pitch in that it involves throwing out an idea.

Play video: Good Pitch, Bad Pitch

Note: The video demonstrates an excellent pitch for the chocolate chip cookie, and a mediocre one for the light bulb.

Check for Understanding

By a show of hands, poll the class on which pitch was the "good" pitch. If students do not clearly recognize the first pitch as the good example, point out examples of good pitching during the following activity.

Support

Ask students questions such as "Which student's facial expression indicates that they are interested in the topic?" or "Which pitch is most focused on a single invention?"

Make a chart on the board (see below).

- Lead a discussion on the aspects of a good and a bad pitch, based on evidence from the video.
- Identify pitching in terms of content ("what you say") and presentation ("how you say it"). Suggestions are included below.

	Good Pitch	**Bad Pitch**
What You Say (Content)	many facts, well organized, interesting, surprising, reasonably drawn conclusion based on facts	boring, scattered
How You Say It (Presentation)	good eye contact, easy to understand, loud enough, energy	monotone, mumbling, too quiet

Wrap up discussion

These are all great ideas. As with collaboration, we have some specific guidelines for a quality pitch here on *Eureka!* Here's Hedy Lamarr with more:

Play audio, read aloud, or invite student to read ***Judges' Note 3B.***

Judges' Note 3B

A Note from Hedy Lamarr:

Meine kleinen inventors: Look, there are not a whole lot of ways my two great talents—inventing and acting—overlap. Except with pitch presentations! This is where they overlap. So I have made a list: you would benefit from following it. Jacques is not the only one with rules.

Sincerely,

Hedy Lamarr

Activity Page 3.4

- Have students open their *Inventor's Notebooks* and read Hedy Lamarr's Rules for Pitching.

3.4

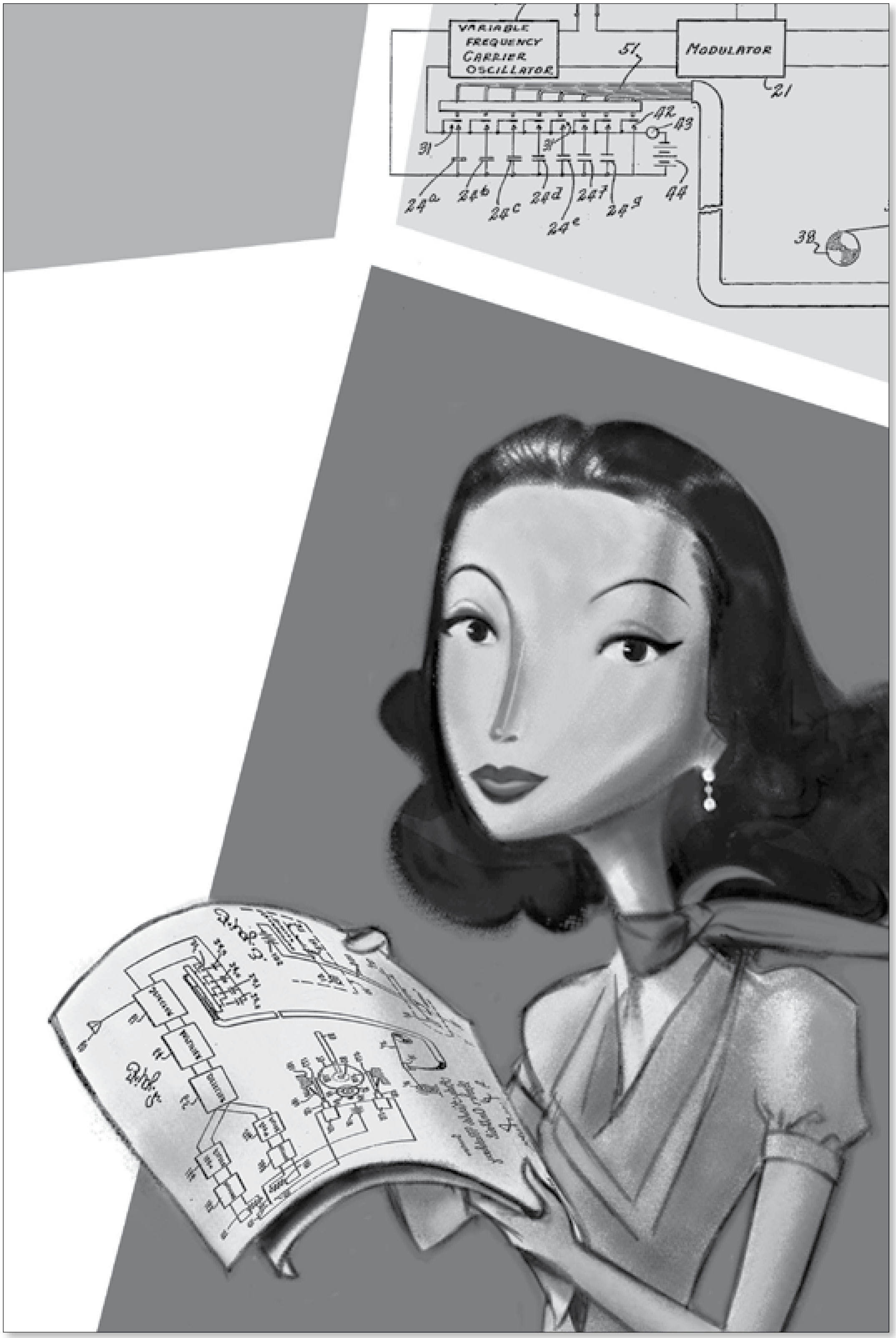
HEDY LAMARR'S RULES FOR PITCHING

WHAT YOU SAY:

- ☐ Be focused on your topic.
- ☐ Be specific.
- ☐ Be interesting.

HOW YOU SAY IT:

- ☐ Make eye contact.
  (Look at your audience!)
- ☐ Show energy and passion.
- ☐ Watch your volume and speed.


VARIABLE
FREQUENCY
CARRIER
OSCILLATOR
MODULATOR

ADDING AUDIO TO THE PITCH (10 MIN.)

Introduce "Introspective Inventors"

> Before we sign off for the day, I'd like you to think of one more element of pitching. Adding an audio recording to your presentation is one way to keep your audience's attention. Maybe music, maybe a sound effect, maybe some introductory narration. Just make sure your audio engages the audience and relates to the ideas and content of your pitch.

> Let's think about a light bulb pitch. What sort of audio might make the pitch more fun *and* help emphasize the key ideas?

- Discuss potential audio for a light bulb pitch. Encourage students to think of songs relating to light, electricity, persistence, etc., as well as sound effects that would enhance a presentation. You might also ask about some brief audio narration that would introduce the presentation and set the proper mood.

> Take a few minutes to talk with your lab-mates about adding audio to enhance your pitch. Come to a decision about audio and assign someone in your lab to bring in a physical recording or a sound file tomorrow. Another option is for your group to record something together. You'll have time to do that tomorrow if that's what you decide on.

- Give the labs a few minutes to decide on audio for their pitches.

Sign-off

> That's all our business for today. Please join us next time for another action-packed episode of *Eureka!*, and until then, remember Judge (at least for now) Edison's words of wisdom: "Have a great idea. Have a lot of them."

ENGLISH LANGUAGE LEARNERS

Speaking and Listening

Viewing Closely

Beginning

Ask, "Which was the good pitch? Which was the bad pitch? Did the first speaker use good eye contact? Were they interesting? Enthusiastic? Focused?"

Intermediate

Ask, "In the first pitch, what were the strengths of the content (WHAT they said)? What were the strengths of the presentation (HOW they spoke)? What were the weaknesses of the second pitch?"

Advanced/ Advanced High

Ask, "How is the content of a good pitch different from a bad pitch? How is the presentation different?"

ELPS 2.C; ELPS 2.F; ELPS 2.G; ELPS 3.D; ELPS 3.J

After Class

- Collect *Inventor's Notebooks* and review student work.
    - "Letter to Mr. Edison": Ensure that each student has written two paragraphs, stating an opinion about the importance of the light bulb and supporting their argument with facts and evidence.
    - "Edison's Invention Evidence": Ensure that each student has answered all the questions for their invention with evidence and quotes from the article. Note use of new vocabulary, or suggest places to use a new term from the article.

LESSON

4

Speaking with Style—Pitching

PRIMARY FOCUS OF LESSON

Speaking and Listening

Students will use their research to create an oral pitch for their lab's invention, including facts and details to support their argument. **TEKS 4.1.C**

Students will listen to presentations, take notes, and paraphrase what they have learned about each invention. **TEKS 4.1.A; TEKS 4.7.E**

Students will use audio recordings to enhance their oral presentations. **TEKS 4.13.H**

Writing

Students will write and present a skit with dialogue to show the importance of their lab's invention. **TEKS 4.12.A; TEKS 4.13.H**

FORMATIVE ASSESSMENT

Activity Page 4.2	**Hedy Lamarr's Pitch Planner** Write an introduction to the pitch for the invention and share with labs. **TEKS 4.1.C**
Activity Page 4.3	**Hedy Lamarr's Notes for Knowledge** Listen actively and take notes during the pitches about each invention. **TEKS 4.1.A; TEKS 4.7.E**

TEKS 4.1.C Express an opinion supported by accurate information, employing eye contact, speaking rate, volume, and enunciation, and the conventions of language to communicate ideas effectively; **TEKS 4.1.A** Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.7.E** Interact with sources in meaningful ways such as notetaking, annotating, freewriting, or illustrating; **TEKS 4.13.H** Use an appropriate mode of delivery, whether written, oral, or multimodal, to present results; **TEKS 4.12.A** Compose literary texts such as personal narratives and poetry using genre characteristics and craft.

LESSON AT A GLANCE

	Time	Materials
Episode 4 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Light Bulb of Glory ❏ *Eureka! Files* ❏ *Inventor's Notebook* ❏ Judges' Note 4A, 4B (Digital Components) ❏ Wheels of Invention ❏ Research wedges
Pitching Review	10 min.	
Planning: Pitch Introductions	10 min.	
Planning: Skit Writing and Audio	10 min.	
Pitches	30 min.	
Invention Pitch Lightning Round	10 min.	
Louis Braille Inventor Card	10 min.	
Closing	5 min.	

EPISODE OVERVIEW

Contestants will write and present dramatic pitches of great inventions. Students will practice public speaking and learn about great inventions.

ADVANCE PREPARATION

Read

- Review inventor cards from Episode 2 and read "Dear Mr. Edison" Research Wedge Challenge writing from Episode 3 in *Inventor's Notebook*.
- Determine which labs will receive research wedges.
- Review lesson scripts in Teacher Guide.

Customize

Establish a rubric for scoring pitches.

Prop Master

- Separate Louis Braille inventor cards from sheets to prepare to distribute to students.
- Print Judges' Notes if you wish.
- Test audio resources.
- Ensure students have access to equipment for recording and playing audio.
- Prepare to project the "Image of the Day" if desired.

Universal Access

- Prepare to support students in Activity Pages 4.1 and 4.2 by reviewing invention articles in *Eureka! Files* and highlighting the evidence students will need to include in their introductions.

ACADEMIC VOCABULARY

Students will encounter the following words across their reading and/or homework in today's episode. They are listed here for your reference, bolded in the student reading at their first occurrence, and compiled in the glossary of the *Eureka! Files*.

practical, adj. useful

quelle guigne!, French for "what bad luck!"

quelle merveille!, French for "how marvelous!"

stylus, n. a pointed, pen-shaped instrument used to make an imprint on a surface

très magnifique, adj. French for "really wonderful"

Start Lesson

Episode 4: Speaking with Style

Pitching

90M

Primary Focus: Students will use their research to create an oral pitch for their lab's invention, including facts and details to support their argument. **TEKS 4.1.C**

Students will listen to presentations, take notes, and paraphrase what they have learned about each invention. **TEKS 4.1.A; TEKS 4.7.E**

Students will use audio recordings to enhance their oral presentations. **TEKS 4.13.H**

Students will write and present a skit with dialogue to show the importance of their lab's invention. **TEKS 4.12.A; TEKS 4.13.H**

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor*—where puppets pull the strings and "making it work" is only the beginning.*

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!*

Housekeeping

- Return the *Inventor's Notebooks*. For those students who did not successfully complete the wedge writing, explain the process for making it up so that they, too, can earn their wedges.
- Collect any bonus inventor cards that students made and award points for them.
- Assign a building manager for each lab for the episode.
- Award the Light Bulb of Glory to the leading lab.

TEKS 4.1.C Express an opinion supported by accurate information, employing eye contact, speaking rate, volume, and enunciation, and the conventions of language to communicate ideas effectively; **TEKS 4.1.A** Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.7.E** Interact with sources in meaningful ways such as notetaking, annotating, freewriting, or illustrating; **TEKS 4.13.H** Use an appropriate mode of delivery, whether written, oral, or multimodal, to present results; **TEKS 4.12.A** Compose literary texts such as personal narratives and poetry using genre characteristics and craft.

Award the research wedge and review today's Pitching Wedge Challenge.

What's in store for today? Well, friends, this usually happens only once a season, but today is a potential TWO-WEDGE episode! Even better, I'm pleased to report that, thanks to your letters, Mr. Edison has agreed to stay on the show, and the network is keeping us on the air!

By successfully completing those light bulb letters and the invention cards from Episode 2, labs earned their second victory as fledgling inventors—wedge 2 of 6—the research wedge!!!

The following labs can attach their wedges to their scorecards and bask in the glory!

All right, that's enough glory. We don't let anyone rest on their laurels, legumes, or light bulbs here on *Eureka!* Yesterday we introduced pitching, and you researched your invention, but today is the real thing. Can you convince Mr. Edison and the viewers at home that your invention is the greatest—sorry, the SECOND-greatest—invention in history and worthy of gracing the back cover of his soon-to-be best-selling book? Do a great pitch and earn your pitching wedge. Do the BEST pitch and earn a bonus point and bragging rights. Not to mention, the more interesting and exciting these pitches are, the more likely it is that this show will avoid being canceled—AND we can crown champion *Eureka! Student Inventors!*

PITCHING REVIEW (10 MIN.)

Review Hedy Lamarr's Rules for Pitching.

Yesterday we learned Hedy Lamarr's Rules for Pitching. Who remembers what they are? Let's review for anyone who missed yesterday's show.

List the activity steps on the board.

- As students list rules, put them on the board.
- Remind students that there are rules for content (what you say) as well as rules for presentation (how you say it).

Introduce "Hedy Lamarr's Pitch Planner" (template for pitches that students will use).

> So, we have some ideas about what makes a pitch strong. In order to keep things under control—we've had pitching get out of hand before—let's take a look at the pitch outline that we use on *Eureka!*, also created by our resident star of screen and laboratory, Ms. Hedy Lamarr.

- Have students open their *Inventor's Notebooks* to "Hedy Lamarr's Sample Pitch Planner."
- Complete it as a class, using the light bulb as a model.
- Remind students to refer back to their notes from the previous day and also to the light bulb article in their *Eureka! Files*.
- When doing the model pitch, don't write a skit, but brainstorm ideas about what that skit could be.
    - Clarify that when students create pitches in their labs, they will need to write and perform a skit.
    - Skits should use dialogue (how characters speak to each other) and can also include narration.

Check for Understanding

Check that students are taking notes on the Pitch Planner as you work through it together. Remind students to refer back to their evidence on the light bulb from the previous episode, and the article in the *Eureka! Files*.

Activity Page 4.1

ENGLISH LANGUAGE LEARNERS

Speaking and Listening

Presenting

Beginning
Review technical vocabulary words, including *filament*. Guide them to the relevant paragraphs. Ask, "According to the article, how did the light bulb improve life?" Reminder: a slogan is a catchy phrase used in advertising.

Intermediate
As you work with the class, ask them to point to the evidence in the article. Check in on technical vocabulary.

Advanced/ Advanced High
Guide students through each question, ensuring that they refer back to the article to support their answers.

ELPS 2.C; ELPS 3.F; ELPS 5.B

ACTIVITY 4.1

Name: ______________________

Date: ______________________

HEDY LAMARR'S PITCH PLANNER

Using the evidence you pulled for "Edison's Invention Evidence," plan the pitch your lab will present for your invention. This pitch will explain why your invention deserves to be on the back cover of Edison's new book! All members of your lab should participate in the pitch.

Introduction (15–30 sec.):

1. The name of your invention:

Lightbulb

2. The date (approximate is OK) of your invention:

1879

3. A sentence briefly explaining how it was invented:

It took Thomas Edison two years to find the key to his invention: using charred bamboo for the filament made an electric lightbulb that was long-lasting and bright.

4. A sentence explaining how it improved life:

By allowing cheap, clean, safe light, the lightbulb improved safety and made our lives much more interesting.

5. Your slogan—a catchy sentence that will grab your audience's attention (the slogan can be the one you created in Episode 1, or you can revise it):

Remember the lightbulb: it illuminates!

Skit (1–2 min.):

1. Create a skit to demonstrate the importance of your invention. Choose one of the following ideas for your skit:
   - Demonstrate how people lived before and after your invention was invented.

     OR

   - Interview the inventor.

Characters:

Brainstorm with the students.

Setting:

Brainstorm with the students.

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Summary (what happens in your skit):

You could write a skit in which we first see an evening at home pre-lightbulb—trying to read but having trouble, being told to blow out candles because they are too expensive, and going to bed at 7:00 p.m.; then post-lightbulb—playing games, reading aloud, and saying, "Thank goodness for the lightbulb!"

OR You could write a skit in which one character injures himself. In a world without the lightbulb, the doctor has trouble treating him, but with the lightbulb it's easy to see the wound and stitch it up.

Conclusion (15 sec.):

1. Sign off with your slogan.

Remember the lightbulb: it illuminates!

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Transition to lab pitch planning.

Activity Page 4.2

> Now it's time to do it for real. Turn to the next page in the *Inventor's Notebook* (Activity Page 4.2), another "Hedy Lamarr's Pitch Planner." To your labs, inventors!

> Prepare your pitches! Remember, part of collaboration is that all members of your lab should participate in the pitch. Your building manager can help keep you on task and divide up the parts.

PLANNING: PITCH INTRODUCTIONS (10 MIN.)

Break pitch planning into parts; have students complete the introduction individually.

Support

Allow students additional time to take their answers from Activity Page 4.1, questions 1–5 and develop them into a complete paragraph.

> To begin, I want each of you to write an introduction paragraph on your own. Refer to the article about your invention and your "Invention Evidence" page for any information you might need.

- Once students have written their paragraphs, have the lab members read their paragraphs to one another while the listeners consult Hedy Lamarr's Rules for Pitching checklist to ensure that all elements have been included.
- Each lab should then select one paragraph to present as part of its pitch.

PLANNING: SKIT WRITING AND AUDIO (15 MIN.)

Instruct students to complete Part 2 of pitch planning (skit writing).

OK, now that you have a great introduction, it's time to work on a skit. Remember that this is for the audience at home as well as for the chance to have your invention featured on the back of a book cover—so make sure it's both interesting AND informative. Be sure your characters are speaking in dialogue, and you can also include a narrator. Also take this time to make sure you have your audio and know where it comes in your presentation. Let's make some great television and make Mr. Edison AND Ms. Lamarr proud! Once you have a skit, you can start practicing. Remember Hedy Lamarr's Rules for Pitching! It's not just what you say: it's how you say it.

- Labs write their skits.
- Remind students to write dialogue for the characters in addition to narration.
    - To provide an example of dialogue, refer students back to the "Bad Collaboration" script on page 5 of their *Eureka! Files*.

Note: If students are having trouble getting started with their skits:

1. Have them start by listing their characters. Inventor plus TV host is a good combination.
2. Ask them for a secret the inventor might have about the invention (that students will know from the article). What questions can the TV host ask in order to get the inventor to reveal this secret?

- Labs practice giving their pitches and their skits.

PITCHES (25 MIN.)

Introduce note from Hedy Lamarr.

Before we see which lab's pitch is going to get it a spot on the back cover, I have another note from Hedy Lamarr.

Challenge

Ask students to describe the tone in which their characters are likely to speak, then to name words in the dialogue that show that tone. If students have no such words in their dialogue, have them revise as needed.

Play audio, read aloud, or invite student to read *Judges' Note 4A.*

Judges' Note 4A

A Note from Hedy Lamarr:

Inventors! I am very excited to learn more about zese inventions through your pitches. You should be too. Zese are some of ze most revolutionary inventions in ze history of human civilization. Ve do not have any namby-pamby silly inventions on zis program. *Nein!* Breakthroughs, plus ze most important snacks ONLY are permitted on *Eureka!*

Ze learning—no, ze KNOWLEDGE—you gain from zese presentations vill help you to be a better inventor. As you listen to zese pitches, you should take notes. Here, I have made you a helpfully formatted and structured form. It is in your Inventor's Notebook. Ve call it "Hedy Lamarr's Notes for Knowledge." Ve vill talk more about knowledge tomorrow.

You vill pitch only once! You vill listen five times! Do not vaste ze listening! You vill need zese notes soon!

Sincerely,

Hedy Lamarr

- Labs pitch their inventions.
- If not all students in the lab present during the pitch, ask how they contributed to the pitch in the planning process.

Check for Understanding

In order to evaluate each presentation and determine the winning group, score pitches as students are taking notes. One possible scoring system is 0–2 points for each of four categories: evidence, pitch writing, pitch presentation, and collaboration.

- After each pitch, students should take a minute to complete "Hedy Lamarr's Notes for Knowledge" (Activity Page 4.3).

Activity Page 4.3

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Presenting

Beginning
Review technical vocabulary words. Guide students to relevant paragraphs. Ask: According to the article, how did this invention improve life?
Reminder:
A *slogan* is a catchy phrase used in advertising.

Intermediate
For each question, guide students to refer back to the *Eureka! Files*. Check for understanding of technical vocabulary; refer them to the glossary if necessary.

Advanced/ Advanced High
Ensure that students are answering each question and referring back to the article to support their answers.

ELPS 2.C; ELPS 2.D; ELPS 3.F

Inventor's Notebook

ACTIVITY 4.3

Name: ______________________

Date: ______________________

HEDY LAMARR'S NOTES FOR KNOWLEDGE

Invention:	What is it used for?

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Why is it important?

1.
2.
1.
2.
1.
2.
1.
2.
1.
2.
1.
2.

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INVENTION PITCH LIGHTNING ROUND (10 MIN.)

Explain the lightning round.

While the judges are deliberating on the winner, let's quickly prove to Ms. Hedy Lamarr that you followed her instructions about listening and note-taking.

I will flip over a card with a picture of one of the inventions that was just pitched. If it is your invention, I may ask you for clarification or verification, but I will not call on anyone in your lab—you will sit that round out.

I will start with this lab. (Name a lab.) Give me one fact about the invention on the card, a fact you learned from the pitch, and your lab will earn a point. We will work our way around the room until we run out of facts.

In the next round, we will start with another lab and go in the same order. Don't worry—everyone will have a chance to go first; everyone will also have to go last.

We'll tally the score at the end and award a bonus point to the top team.

- Do six rounds (one per invention).
- Tally the points and award a bonus point to the winner.

Check for Understanding

Check that students can recall and discuss facts learned from the pitches. Poll to see how many students can provide facts. Call on students randomly to ensure participation.

Present the pitching wedge.

> Great inventions, a demonstration of skills, AND interesting television—that's what we live for here on *Eureka!* So, without further ado, here's the SECOND wedge of the episode . . . the pitching wedge. Come collect it and bask in the glory.

- Award wedges to all the groups that completed acceptable pitches.

Announce the pitch winner.

> They were all good pitches, but one rose above the rest, exemplifying the ideals of our judges: Professor Carver's research, Jacques's collaboration, Mr. Edison's interest in what you say, and Hedy Lamarr's tips on how you say it. The winner of the pitch contest—the lab whose invention will appear on the back of *I Judge Inventions* and that has earned honor and a bonus point to go with its wedge—is . . .

- Announce the winner! Bonus point for that lab.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening

Listening Actively

Beginning

Work as a class on the Notes for each invention and make sure each student completes their own worksheet.

Intermediate

For the first invention, work through the Notes as a class. In the following presentations, guide students through the columns. Provide support by asking, "What did they say about this invention that made it seem important?"

Advanced/ Advanced High

Remind students to use what they heard in the presentation to complete each column.

ELPS 2.C; ELPS 2.I; ELPS 3.E

LOUIS BRAILLE INVENTOR CARD (10 MIN.)

Play audio, read aloud, or invite a student to read Judges' Note 4B.

Judges' Note 4B

A Note from Hedy Lamarr:

Vell done, *meine kleinen* pitchpeople. Now ve are getting somewhere! Zree vedges. Zat is half. Zat is not so bad. Ve have a little extra time today, so let us get to know another outstanding inventor, a man who vas not very much older than you ven he began his great invention. I do not vant to give tomorrow's program away, so all I vill say as you read his note and complete his inventor card—VICH IS NOT OPTIONAL! NEIN! YOU VILL DO IT AND VHY VOULD YOU NOT?—is "invention breeds invention." Vat does zat mean? Ponder zat, and tomorrow it vill be revealed.

Sincerely,

Hedy Lamarr

- Students read the biography of Louis Braille and complete his inventor card.

  Note: If you run out of time, assign the Louis Braille inventor card for homework. Be clear that this is not an optional card: it's important for earning the next wedge, and Hedy Lamarr will NOT be amused if it isn't completed.

Louis Braille

Bonjour!

Where to start … well, I was born on January 4, 1809, in Coupvray, France, a small town not too far from Paris. When I was a child, my favorite place to play was my father's workshop. Oh, it was ***très magnifique***! He made saddles and harnesses for horses. I'll never forget the wonderful smells and sounds of the leather and the tools. But these simple joys would not last. The entire course of my life changed when I was only three years old. One day, when I was using some of my father's tools, I managed to poke myself in the eye. But this was not just any poke. ***Quelle guigne***! What bad luck—the eye became infected and the infection spread to my other eye. By the age of five I was completely blind. While it made learning more challenging, being blind didn't dampen my desire. As you probably hunger for chocolate or pizza, I hungered to read. Unfortunately, at that time, books for the blind to read by touch were scarce. They featured giant raised letters, but they were very heavy, difficult to produce, and not at all **practical**. Consequently, almost everything I learned from books was read *to* me by my teachers at the school for the blind in Paris.

Then, when I was twelve, a French army captain named Charles Barbier visited my school. He told us about *night writing*, a communication system he'd invented for soldiers on the battlefield. Night writing was a complicated code of dots pressed into paper. And I do mean complicated! The system was so hard to learn that the army gave up on it. But it got me thinking … what if there were an alphabet for the blind that could easily be read but didn't have to be written in extra-large letters? And what if blind people could also write in this alphabet without using big, clunky machines?

Transforming night writing into this new alphabet became my mission, and by age fifteen I had done it. In my new system, each letter was represented by a simple arrangement of tiny raised dots. Just as I hoped, my invention allowed full-length books for the blind to be lighter and smaller, so they were much easier to print. And even more importantly, my alphabet was very easy to read by touch, and also gave the blind a practical way to write using only a simple **stylus**. In the years that followed, I added to my invention so that blind people could read and write music and mathematical equations. The *Braille alphabet* caught on, and Braille books have been published all over the world. ***Quelle merveille***! It is incredible, don't you agree?

Louis Braille Inventor Card

Name: Louis Braille

Birthdate: January 4, 1809

Birthplace: Coupvray, France

Invention(s):

Braille (alphabet and method of writing)

Describe a challenge or disappointment that this inventor faced.

Because he was blind, he had trouble reading and writing until he created his invention.

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

CLOSING (5 MIN.)

Sign-off

Thanks for all your hard work, inventors. We've had a lot of speaking, and we don't want anyone to lose their voices—that would be a disaster worthy of last season!—so we're going to skip "Introspective Inventors" today.

We're almost out of time, but please join us on our next action-packed episode of *Eureka!* Until then, remember Judge Edison's words of wisdom: "Have a great idea. Have a lot of them."

Homework

- Assign Louis Braille inventor card if students did not complete it in class.

After Class

Activity Pages 4.2 and 4.3

- Collect the *Inventor's Notebooks* and review students' work.
    - Activity Page 4.2: Ensure that students have responded to the Introduction prompts, citing facts from their reading as evidence. Provide feedback if questions are not answered or are not adequately supported by facts.
    - Activity Page 4.3: Ensure that students took notes during the presentations. If notes are incomplete, address the importance of listening actively and taking notes during oral presentations.

EPISODE

5

Invention Breeds Invention—Knowledge

PRIMARY FOCUS OF LESSON

Reading

Students will describe the chronology, causes, and effects of Louis Braille's invention in order to understand that "invention breeds invention."
TEKS 4.9.D.iii; TEKS 4.10.B

Students will read technical texts and interpret diagrams about simple machines. **TEKS 4.1.D; TEKS 4.6.G; TEKS 4.6.H**

Writing

Students will integrate information about prior inventions and simple machines to write a creative solution to a technical challenge.
TEKS 4.7.B; TEKS 4.12.B

FORMATIVE ASSESSMENT

Activity Page 5.1	**Simple Machines Dance Party Challenge** Summarize information and draw facts from technical texts. **TEKS 4.1.D; TEKS 4.6.G; TEKS 4.6.H**
Activity Page 5.2	**Knowledge Wedge Challenge: Letter to Mi-Shell** Write an inventive solution with clear instructions and a diagram, using simple machines and previous inventions. **TEKS 4.7.B; TEKS 4.12.B**

TEKS 4.9.D.iii Recognize characteristics and structures of informational text, including: organizational patterns such as compare and contrast; **TEKS 4.10.B** Explain how the use of text structure contributes to the author's purpose; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities; **TEKS 4.6.G** Evaluate details read to determine key ideas; **TEKS 4.6.H** Synthesize information to create new understanding; **TEKS 4.7.B** Write responses that demonstrate understanding of text, including comparing and contrasting ideas across a variety of sources; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft.

LESSON AT A GLANCE

	Time	Materials
Episode 5 (90 min.)		
Introduction	5 min.	❑ Audio: Opening ❑ Light Bulb of Glory ❑ Judges' Note 5A (Digital Components) ❑ Invention Cards ❑ Video: Simple Machines (Digital Components) ❑ *Inventor's Notebooks* ❑ *Eureka! Files* ❑ dance music (optional) ❑ 6 copies of "Know the Simple Machines!" (Digital Components) ❑ Bette Nesmith Graham Inventor Card ❑ copies of Bette Nesmith Graham bio from *Eureka! Files*
Invention Breeds Invention	10 min.	
Timeline of Invention	10 min.	
Simple Machines: Introduction	10 min.	
Reading and Dance Party Challenge	30 min.	
Knowledge Lightning Round	10 min.	
Knowledge Wedge Challenge	10 min.	
Closing: "Introspective Inventors"	5 min.	

EPISODE OVERVIEW

Contestants learn about simple machines so they can present a simple machine dance party. With this knowledge, and their knowledge of great inventions from Episode 4, they complete a creative writing assignment that will help save the show from cancellation.

ADVANCE PREPARATION

Read

- Review lesson script in Teacher Guide, and video script, available online.
- Read simple machine articles in *Eureka! Files*.

Customize

- Decide which simple machine article each lab will read and use for its simple machine challenge.

Prop Master

- Prepare classroom set up for the physical activities in this lesson (Timeline and dance challenge)
- Test audio and video resources.
- Prepare six copies of the "Know the Simple Machines!" Activity Page for the Knowledge Lighting Round. The page is found in this lesson of the Teacher Guide.
- Select and bring in dance music for simple machine dance challenge (optional).
- Separate Bette Nesmith Graham inventor cards from sheets for distribution.
- Prepare additional copies of the Bette Nesmith Graham article if you would prefer students not take the *Eureka! Files* home.
- Prepare to project "Image of the Day" if desired.

Universal Access

- Prepare to help students understand read and comprehend the simple machine articles for Activity Page 5.1:
    - Preparing an explanation for the terms *load*, *effort* and *mechanical advantage*. Prepare sentence frames: One example of a ___ is ___. Another example is ___.
    - Highlight words or phrases in the articles that describe how this simple machine works.

    - Look at illustrations and consider using this to help student reading and understanding.
- Prepare sentence frames to guide students through writing on Activity Page 5.2:
    - You will use the (simple machine) by __.
    - You will use the (other invention) by __.
    - You can transport the cookies by ___.
    - You can travel by ___.
    - Provide a blank checklist of the steps Mi-Shell can take.

Academic Vocabulary

Students will encounter the following words in their reading and/or homework in today's episode. They are listed here for your reference, bolded in the student reading at their first occurrence, and compiled in the glossary of the *Eureka! Files*.

baboon, n. a kind of monkey

bigwigs, n. important people

cylinder, n. an object with identical flat ends and a circular or oval section

humble, adj. not significant; modest

manure, n. a substance made from animal poop that is spread on plants to help them grow

primates, n. a category of mammals that includes humans, monkeys, and apes

producers, n. people who supervise a television production

revolutionary, adj. bringing about major change

simians, n. monkeys

Stone Age, n. a period in the history of mankind marked by the use of tools and weapons made of stone

upshot, n. result

Start Lesson

Episode 5: Invention Breeds Invention

Knowledge

90M

Primary Focus: Students will describe the chronology, causes, and effects of Louis Braille's invention in order to understand that "invention breeds invention." **TEKS 4.9.D.iii; TEKS 4.10.B**

Students will read technical texts and interpret diagrams about simple machines. **TEKS 4.1.D; TEKS 4.6.G; TEKS 4.6.H**

Students will integrate information about prior inventions and simple machines to write a creative a solution to a technical challenge.

TEKS 4.7.B; TEKS 4.12.B

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor*—where puppets pull the strings and "making it work" is only the beginning.*

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!*

Housekeeping

- Collect any bonus inventor cards students made and award points for them.
- Pass out Louis Braille inventor cards from the previous episode, or ask students to have them ready if they were done for homework.
- Assign a building manager for the episode.
- Award the Light Bulb of Glory to the leading lab.

TEKS 4.9.D.iii Recognize characteristics and structures of informational text, including: organizational patterns such as compare and contrast; **TEKS 4.10.B** Explain how the use of text structure contributes to the author's purpose; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities; **TEKS 4.6.G** Evaluate details read to determine key ideas; **TEKS 4.6.H** Synthesize information to create new understanding; **TEKS 4.7.B** Write responses that demonstrate understanding of text, including comparing and contrasting ideas across a variety of sources; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft.

Introduce the knowledge wedge.

Welcome back, inventors!

Knowledge. Today you pursue the knowledge wedge. Yesterday, before we heard your pitches, Hedy Lamarr exhorted you to grab on to the knowledge that was being thrown at you. In the lightning round, you proved that you had learned something about those inventions—that, as instructed, you'd gained knowledge. Knowing facts can be useful in all sorts of unexpected circumstances. On today's program we gain some more knowledge, about the building blocks of inventions—particularly the simple machines—and then apply this knowledge.

INVENTION BREEDS INVENTION (10 MIN.)

Introduce the note from Hedy Lamarr.

How will knowledge be useful, you ask, other than by making you a champion at family trivia night? Ah! Here on *Eureka!* we have learned that you can take knowledge and build on it, and in that way make great things happen. But why listen to me? Hedy Lamarr has more:

Play audio or read aloud Judges' Note 5A.

Judges' Note 5A

A Note from Hedy Lamarr:

Invention breeds invention! Zat is the use of knowledge. Ze inventions you know can lead to ze inventions you create. Vat does zat mean? It means zat ze rely on the work of ze inventors who came before us! I am an outstanding example of invention breeding invention: you know zat I invented ze spread-spectrum technology? In order to do zat, I used technology zat had already been developed for ze first remote controls for radios, and also ze technology of player pianos—pianos zat play zemselves! True fact! Many years later, technology from my invention vas used to invent cell phones, Wi-Fi, GPS—all sorts of vireless communication! I got an Electronic Pioneer Award in 1995 ven someone finally noticed zis! I am only a little bitter zat by zen I vas too old to travel to accept it.

You see, my invention led to other inventions. Invention breeds invention!

Sincerely,

Hedy Lamarr

- Ask students to open their *Eureka! Files* to the article on Louis Braille and to take out the inventor card they completed yesterday or as homework.

Check for Understanding

Poll students on whether or not they think Louis Braille proves the case of "invention breeds invention." If students disagree, ask why and use this to segue to the next discussion.

Discuss the concept "invention breeds invention" using Braille as an example.

So, putting Hedy's invention, which is pretty technical, aside for a minute, let's look at some more accessible examples.

Yesterday you read about Louis Braille. How did Louis Braille's invention come from another invention?

» He took the night-writing code Charles Barbier developed for the army and improved it.

What inventions did his invention lead to?

» books published in braille

Note: Braille can be found on menus, signs, and ATM keypads. Almost anything that can be printed as a text can also be printed in braille.

What about the light bulb? Think back to your light bulb reading. Did the light bulb lead to other inventions?

» Headlights. Also, because electric light led to more homes being wired for electricity, many other electric inventions were created because more people could use them.

What does it mean to you when I say, "Invention breeds invention"?

Write responses to "Invention breeds invention" on the board.

Final list of ideas should include:

1. We use inventions to make other inventions.
2. We rely on earlier inventions within new ones.
3. Some inventions are improvements on old inventions.
4. Some inventions create new needs, which in turn generate new inventions.

ENGLISH LANGUAGE LEARNERS

Reading
Reading Closely

Beginning
Ask, "What happened to Braille when he was three? Who is Charles Barbier? What did Braille invent? Could Braille have invented his alphabet without Barbier's night writing system?"

Intermediate
Guide students to find evidence in the article to answer the questions and explain how "invention breeds invention" in this instance.

Advanced/ Advanced High
Remind students to use information in the Braille article for this discussion.

ELPS 4.G

TIMELINE OF INVENTION (10 MIN.)

Explain Timeline of Invention activity.

Now that you can use the new knowledge you acquired through your research and pitches, the judges want to challenge you with a game.

You will get a card that depicts an invention. Think about what other inventions had to be invented BEFORE the item on your card. Then, I'd like you to make a human timeline, putting yourselves in the order in which these items were invented. You'll notice that there aren't any dates on these cards. Some of the dates you have learned from your reading, and you should feel free to consult the *Eureka! Files* or your notes from the pitches yesterday.

For other inventions you're going to have to use logic and make some educated guesses about where things go. For example you probably had to have cars before you needed windshield wipers, right?

- Distribute invention cards, and ask students to think about the invention on the card. What had to be invented BEFORE the item on your card?

Check for Understanding

Before forming the timeline, ask students if they can think about a previous invention that was necessary for their item to be invented. For students who say "no," check on their invention and affirm or correct. After they create the timeline, ask a few students how they determined where they belonged.

- Give students time to put themselves in order. Depending on the layout of your classroom, decide where the first and last inventions should go.
- If you have fewer than twenty-five students in your class, post the extra invention cards as landmarks in the timeline for students to use as additional guidelines.

Note: This is a very challenging (but fun) activity, and we do not expect students will get the order 100 percent correct! That would require incredible luck. They will need to make some guesses.

- Here are clues to help guide them:
  - Inventions marked ◆ have their date of invention in the reading.
  - Inventions marked ❍ are referenced in the reading, and there is information there that will help.
- Compare the order with the correct answers.

Support

Some placements to note (If students have trouble offer the following hints:):

Eyeglasses—before the microscope, because we know that van Leeuwenhoek was improving lenses

Printing press—after paper

TV remote control—after TV became popular, which was after radio

Rollaboard® suitcase—invented to use on airplanes

Flashlight—after light bulb AND dry-cell battery (related: dry-cell battery must be before flashlight!)

Cookie dough ice cream—after chocolate chip cookie dough! So after the chocolate chip cookie

Answers to the Invention Timeline Activity:

❍Wheel	3500 BCE (approx.)
◆Water clock	1400 BCE
◆Paper	105
❍Toilet paper	6th century CE
Eyeglasses	1282
Printing press	1453
❍Pendulum clock	1656
◆Microscope	1676
❍Sea clock	1736
◆Hot air balloon	1783
❍Telegraph	1844
◆Telephone	1875
◆Light Bulb	1880
◆Radio	1894
Dry-cell battery	1896
Flashlight	1899
◆Airplane	1903
❍Toaster	1909
◆Chocolate chip cookie	1938
TV remote control	1956
Microchip	1959
Rollaboard® suitcase	1972
❍Cell phone	1973
❍Space Shuttle	1981
Cookie dough ice cream	1984

Wrap up Timeline of Invention.

Not bad! That was tricky, and you had to do some educated guessing.

So those are some examples of how inventions have bred inventions in the past. How can YOU use knowledge of inventions to breed inventions?

SIMPLE MACHINES: INTRODUCTION (10 MIN.)

Play video: Simple Machines.

The judges introduce simple machines.

Introduce simple machines.

If you want some knowledge to help in inventing, one of the best places to start is with some of the earliest inventions, inventions that bred many others: the simple machines. You might choose to use simple machines in your own invention. Even if you don't, you'll need to understand them. Once you've learned about simple machines, you will see them everywhere—and whenever you do, you'll remember that invention breeds invention.

READING AND DANCE PARTY CHALLENGE (30 MIN.)

Introduce dance party challenge.

Excellent. Hang on a second—call from the network. (*Listens in earpiece.*) Sir, they're really more scientists than . . . of course I want a lot of people to watch the show and learn about invention and bring us fame and fortune.

(*To class.*) We've got a problem. Apparently the show is losing a lot of viewers. They're all changing the channel to watch . . . a dance contest? So, strange as it seems, you're going to use dance to demonstrate your knowledge of simple machines.

For the next challenge, each lab will read an article about one of the six simple machines. Once you have read the article, complete your own notes on the "Simple Machine Dance Party Challenge" page in your *Inventor's Notebook*. Your lab can work together, but make sure you each complete your notes for your lab to get credit for it.

Then create a movement or dance to explain that simple machine. The movement should show that your lab understands how that machine functions.

What's that? Oh, Hedy Lamarr wants you all to remember that even though we're doing this because the network insisted, choreography is a good way to practice creativity, an important skill for inventors. She had some of her best ideas for inventing while working on the musical film *Ziegfeld Girl*. And remember—Jacques's Rules for Collaboration always apply!

- Assign each lab one of the simple machine readings in the *Eureka! Files*.
- Point out that the writers of these articles want to describe inventions and explain how those inventions work. The writers use different text structures to do this, often using more than one structure within a text. They use a sequential structure if they want to describe how an invention works or how it was developed over time. They use cause and effect to explain how or why something works the way it does. They use a descriptive structure to provide details about the invention. All of the writers provide diagrams that explain how the inventions work in a visual way that supports the text. Tell students to pay attention to how the writers present the information.
- Students read their articles and complete the "Simple Machine Dance Party Challenge" (Activity 5.1). Students can work on the activity together, but each student must complete their own notes.

Activity Page 5.1

ENGLISH LANGUAGE LEARNERS

Reading

Reading Closely

Beginning
Explain *load*, *effort*, and *mechanical advantage*. Provide sentence frames: One example of a ___ is ___.

Intermediate
Ask, "What is the simple machine called? What example does the article give? What words describe how the machine works?

Advanced/ Advanced High
Guide students to relevant sections of the article; encourage them to use the diagram in their explanations.

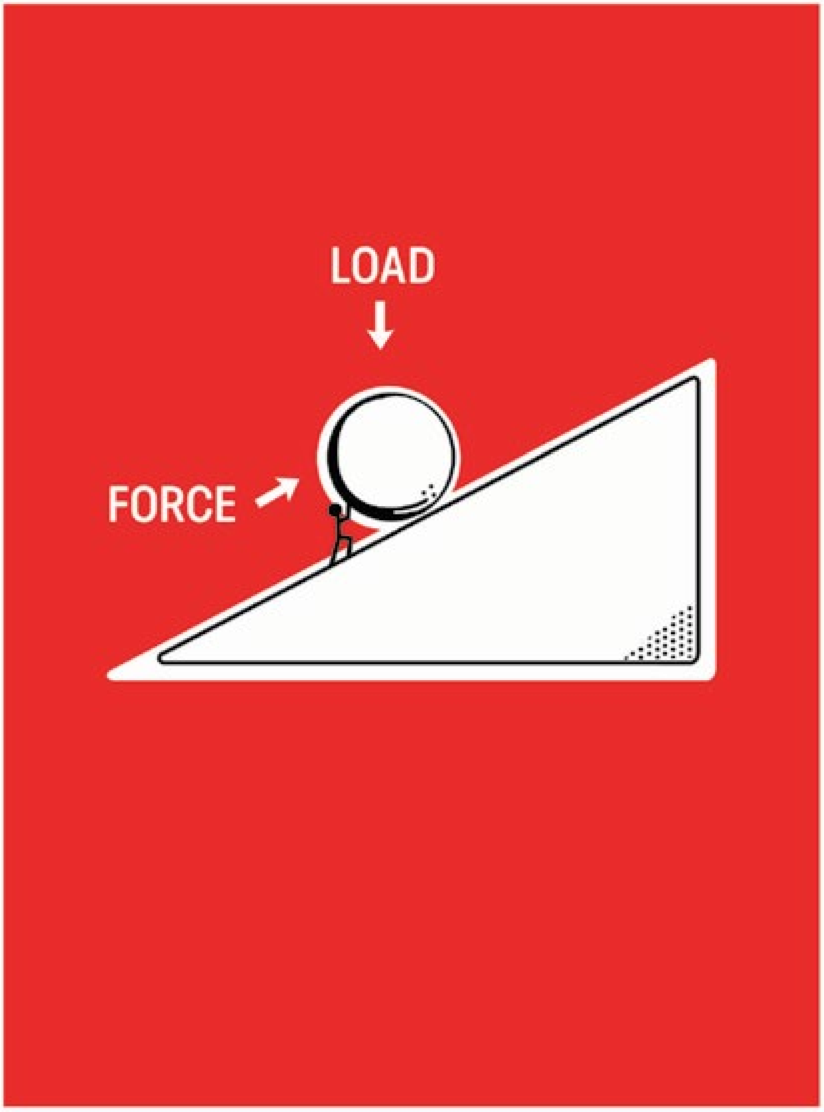
ELPS 4.D; ELPS 4.F

The Inclined Plane

An inclined plane is really just a ramp—a flat surface tilted so that one side is higher than the other. It is the one simple machine that doesn't move, but it sure makes moving things a lot easier.

Here's an example of how it might be used: There is a rumor going around that the network is thinking of replacing *Eureka!* with a monkey modeling competition (*Next Top Monkey Model*, in case you were wondering). Now let's say some network **bigwigs** are planning to load a barrel of beautiful **baboon** contestants into the trailer of a truck to bring them down to the studio. (Don't worry, the barrel is equipped with air holes, and magnifying mirrors for last-minute makeup application). The barrel may be too heavy to lift into the truck, but it's probably not too heavy to roll up an inclined plane into the trailer. That's because by lifting the barrel, you are carrying the entire weight of those stunning **simians**, but when you roll the barrel up the inclined plane, a big part of the weight is now supported by the plane (and not you). That's the *mechanical advantage* of the inclined plane—it helps you accomplish a task *indirectly* (by rolling the barrel instead of lifting it) and with less effort.

You probably encounter inclined planes all the time. A winding trail up a mountain is an inclined plane. So is a wheelchair ramp. The inclined plane is a tool that has been around a long, long time. Archaeologists tell us that humans were using inclined planes to move things way back in prehistoric times. The ancient Egyptians hauled stones to build the pyramids by sliding them up inclined planes. And just the other day, some desperate TV producers used an inclined plane to roll a barrel of monkeys into a truck. For *Eureka!*'s sake, I hope those **primates** aren't ready for prime time.



Inventor's Notebook: The Inclined Plane

ACTIVITY 5.1

Name: ______________________

Date: ______________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: Inclined Plane

1. List an invention from the article that uses this simple machine:

Wheelchair ramp

2. List another invention, not in the article, that uses this simple machine:

Answers will vary.

3. Find three descriptions of action or movement from the article that refer to the simple machine:

"Roll the barrel"; "hauled stones"; "sliding"

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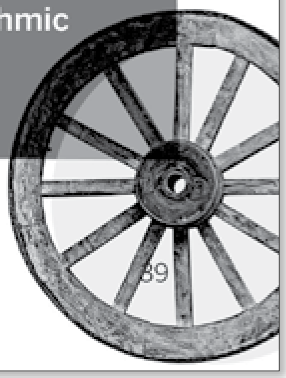
4. In your own words, simply describe how this simple machine works:

Answers will vary.

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.

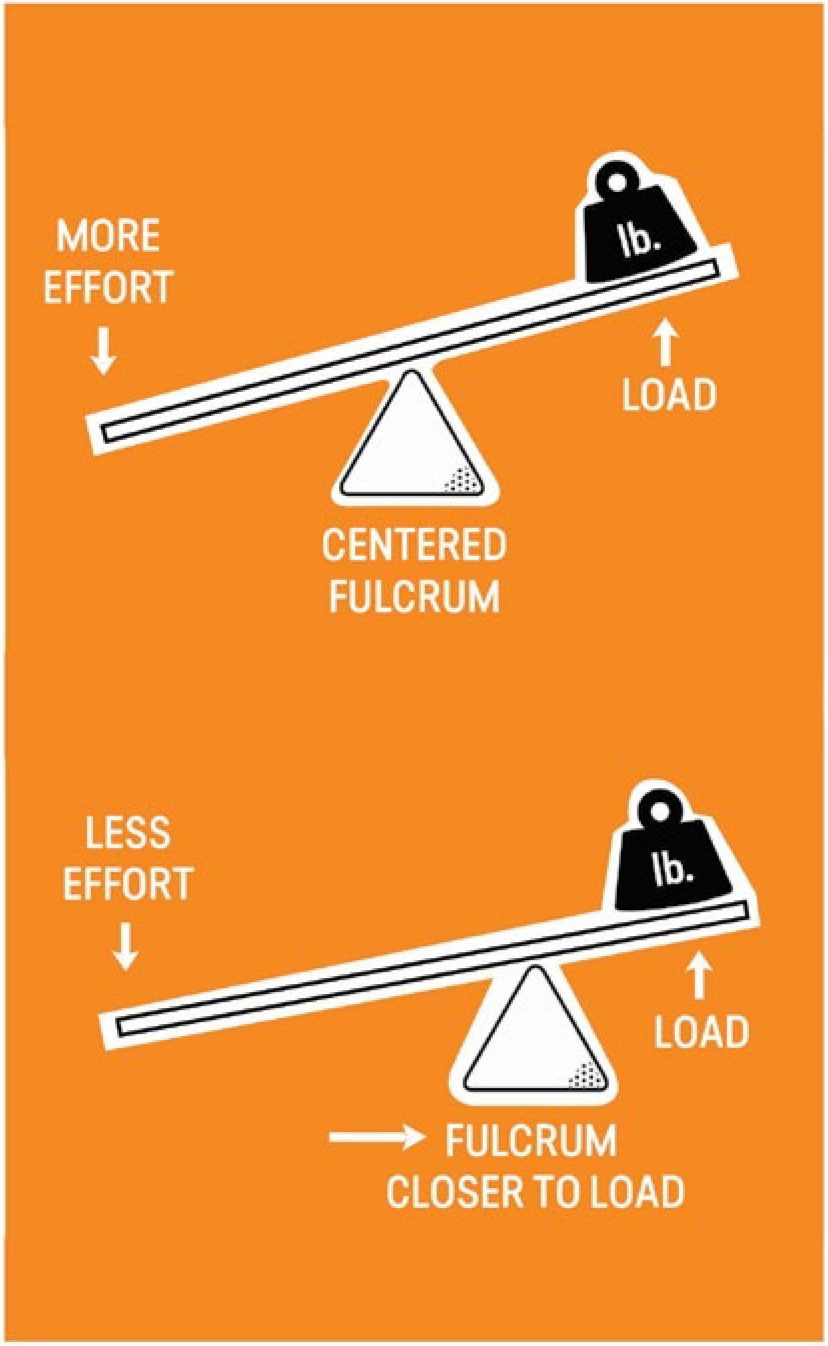


The Lever

We don't know who made the first lever, but the ancient Greek scientist Archimedes figured out the math of how levers work. He once said, "Give me a place to stand, and I shall move the earth." He meant that with a big enough lever (and it would have to be really big), one person could lift up our whole planet.

A lever consists of a beam and a *fulcrum*, which is the hinge or support that the beam rests on. The object lifted by the lever is called the *load*, and the work that you put in to operate the lever is called the *effort*. Like all the simple machines, the lever provides a mechanical advantage allowing you to do more with less effort. The size of the mechanical advantage depends on the location of the fulcrum. The closer the fulcrum is to the load, the easier it is to lift the load by pushing down on the other side of the lever. A playground seesaw is one example of a lever.

Now, suppose Professor Carver hears that Mr. Edison is interested in planting a garden. The professor is thrilled to share his passion for agriculture with his friend, so he brings Mr. Edison a gift to help him get started: a two-hundred-pound bag of **manure**. Mr. Edison isn't around, so Professor Carver decides to leave the bag on Mr. Edison's dressing room coffee table. Perhaps the bag is too heavy for the professor to lift onto the table, but if he manages to get it onto one end of a lever beam, he can push down on the other end to lift the manure, and then just slide it onto the coffee table. The closer the fulcrum is to the bag of manure, the easier it will be for Professor Carver to lift the bag. Let's hope Mr. Edison enjoys his gift!


MORE
EFFORT
lb.
LOAD
CENTERED
FULCRUM
LESS
EFFORT
lb.
LOAD
FULCRUM
CLOSER TO LOAD

ACTIVITY 5.1

Name: ____________________

Date: ____________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: Lever

1. List an invention from the article that uses this simple machine:

Playground seesaw

2. List another invention, not in the article, that uses this simple machine:

Answers will vary.

3. Find three descriptions of action or movement from the article that refer to the simple machine:

"lift up"; "push down"; "move the earth"

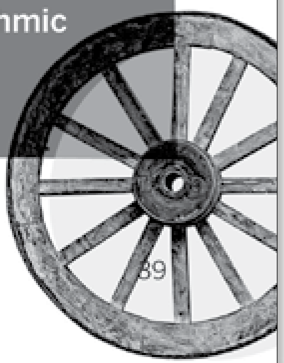
38 *Eureka! | Inventor's Notebook*

4. In your own words, simply describe how this simple machine works:

Answers will vary.

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.



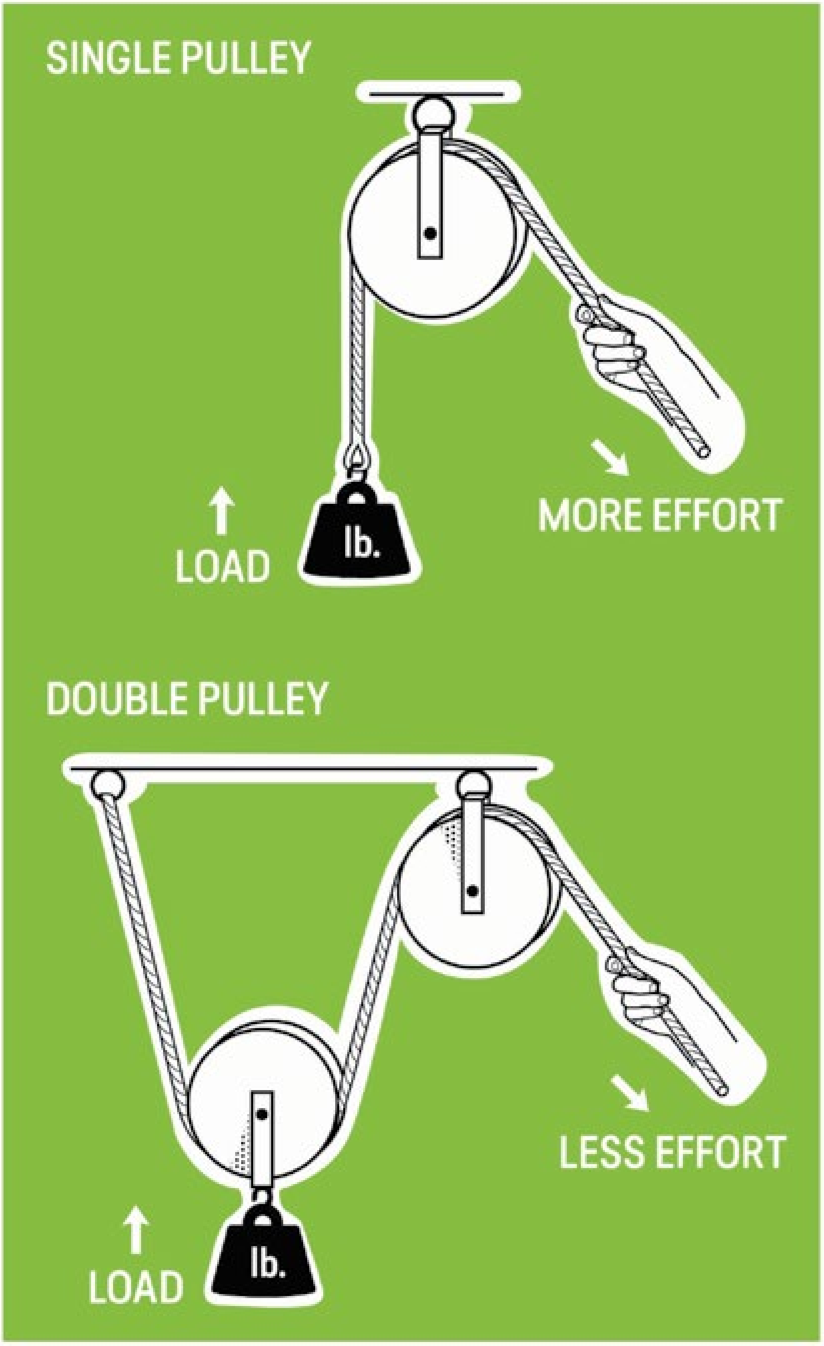
Eureka! | Inventor's Notebook 89

The Pulley

Ever opened up the blinds? You've used a pulley. Ever flown a flag up a flagpole? You've used a pulley. Ever had a dream where you were being chased by a tiger? No pulley there, but it happens to the best of us. The important thing to remember is that a simple pulley is just a wheel that is attached to something sturdy and has a rope running over it. The elevator is another important invention that makes use of a pulley.

How does it work? Last season Jacques needed to load two hundred pounds of jellyfish food onto his boat, the *Calypso*. As we know now, that was a big mistake, but let's take a look at how he did it anyway. First he hoisted the bag onto his shoulder and tried carrying it up the gangplank, but it was too heavy. Then he attached a simple pulley to a beam hanging over the edge of the boat. He tied the jellyfish food to one end of the pulley's rope and pulled on the other end. This way he was using his body weight to help lift the jellyfish food, but the bag was still too heavy.

Don't worry, though. Jacques knew that by attaching one end of the pulley's rope to the beam, and then hanging a second pulley from that rope, he could make a double pulley, which would give him a mechanical advantage. That means the machine lets him do more with less effort. Specifically, with a double pulley, a bag that actually weighs two hundred pounds feels as if it weighs only one hundred pounds. Unfortunately, that mechanical advantage almost got *Eureka!* canceled for good!



Eureka! Files | Simple Machine 65

ACTIVITY 5.1

Name: ____________________

Date: ____________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: Pulley

1. List an invention from the article that uses this simple machine:

An elevator

2. List another invention, not in the article, that uses this simple machine:

Answers will vary.

3. Find three descriptions of action or movement from the article that refer to the simple machine:

"Flown a flag up a flagpole"; "pulled on the other end";

"hanging a second pulley"

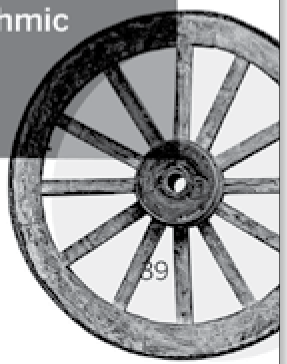
38 *Eureka! | Inventor's Notebook*

4. In your own words, simply describe how this simple machine works:

Answers will vary.

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.



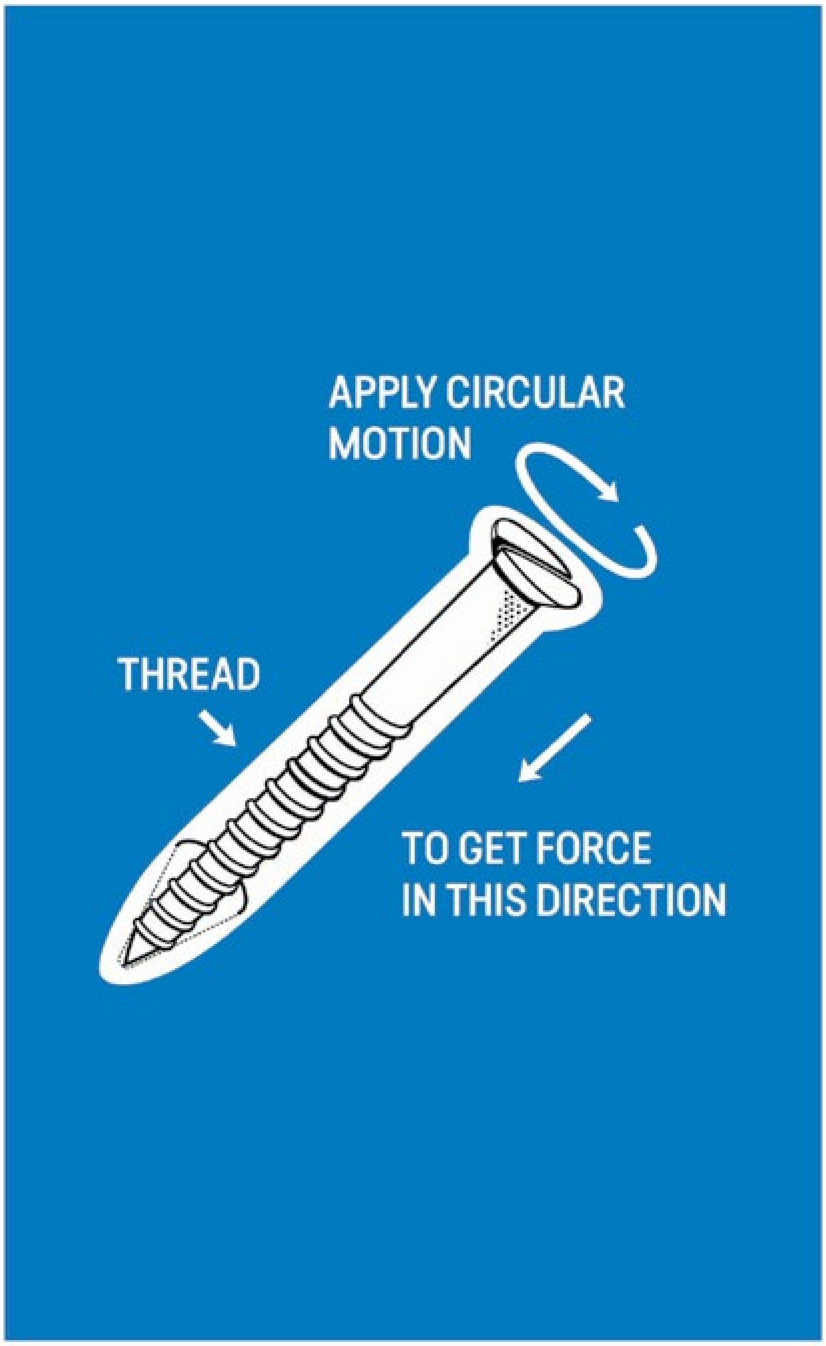
The Screw

The humble screw is everywhere. Hardware stores have thousands of them. The desk or table you're sitting at was probably put together with screws. But don't take the screw for granted; it is actually a remarkable simple machine that makes tough jobs a lot easier.

Just ask Professor Carver. Not surprisingly, he is the only judge who regularly offers to pitch in to help the *Eureka!* construction crew build the set. Today the crew is working on a wooden banner that will hang over the judges' table. Professor Carver has generously volunteered to fasten together two planks of wood that will make up part of the letter *E* in *Eureka!*

Using a screw and a screwdriver will make the job so easy that Professor Carver will be able to finish the whole *E* and maybe even start on the *U* during his break (while the other three judges drink coffee and eat pastries). After all, it doesn't take a lot of strength to turn a screw clockwise with a screwdriver, but the screw then converts that circular movement into a powerful force that drives it through the wood. That's called a mechanical advantage.

A final word: one of your esteemed judges should thank his lucky stars for this simple machine. We won't name names, but how many inventors does it take to screw in a lightbulb?



Eureka! Files | Simple Machine 67

ACTIVITY 5.1

Name: ____________________

Date: ____________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: Screw

1. List an invention from the article that uses this simple machine:

Lightbulb

2. List another invention, not in the article, that uses this simple machine:

Answers will vary.

3. Find three descriptions of action or movement from the article that refer to the simple machine:

"Fasten together"; "turn a screw"; "drives it through the wood"

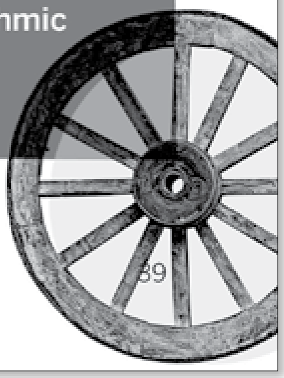
38 *Eureka! | Inventor's Notebook*

4. In your own words, simply describe how this simple machine works:

Answers will vary.

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.



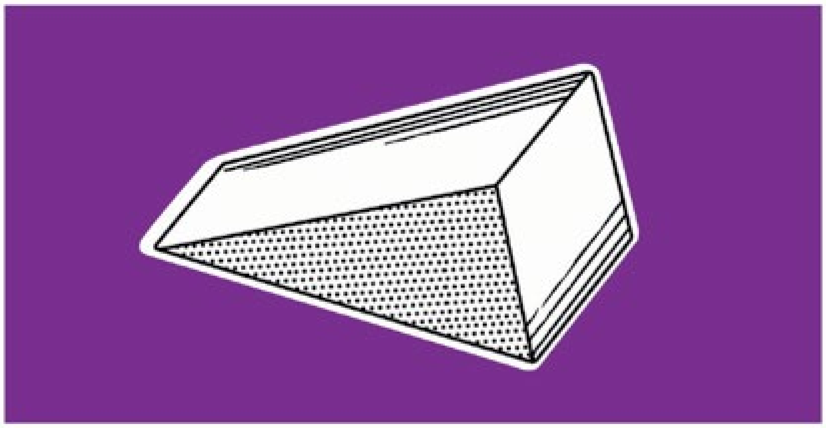
The Wedge

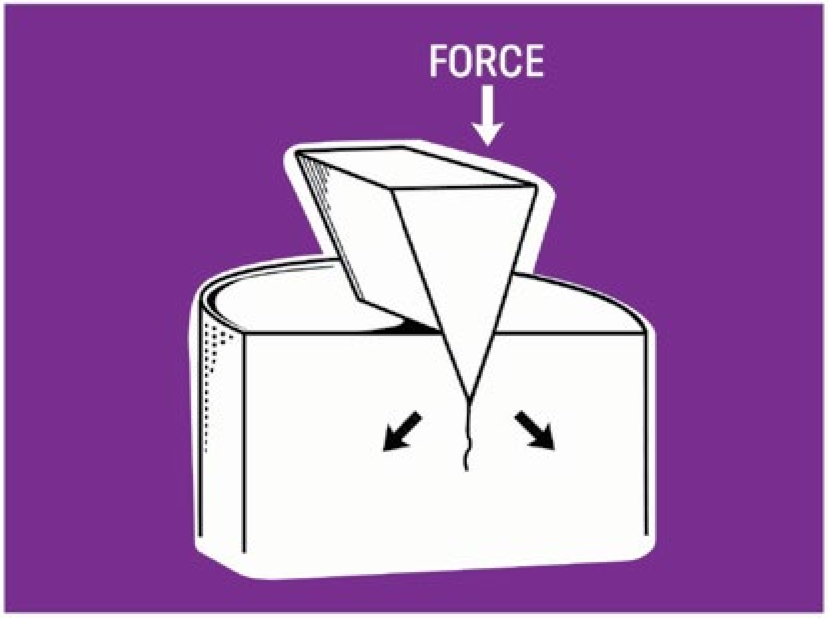
This article is about wedges, not wedgies. If you want to read about wedgies, you'll have to look somewhere else (and also, you're probably a little weird). A wedge is a piece of material (usually hard) with two sloping sides that meet to form an edge (usually sharp). Pound a wedge into something hard enough, and it will split that something apart. The blade of an ax is a good example of a wedge. The two large sides of the blade slope diagonally toward each other until they meet to form the sharp edge.

Like all the simple machines, the wedge offers a mechanical advantage. In other words, it takes whatever effort you put into a task and provides an output that is greater. Imagine, for example, that you are a lumberjack splitting a tree stump with an ax. The wedge shape of the blade turns the force of your swing into an even stronger force once the blade makes contact with the stump.

You can find wedges all over. The pointed ends of a fork are wedges. The slider you pull down to unzip your jacket is a wedge that splits apart the "teeth" of the zipper. And speaking of teeth, you have about ten wedges with you at all times—built right into you, as a matter of fact. Feel the upper and lower teeth near the front of your mouth. (Ms. Lamarr hopes your hands were clean. Otherwise, "Yuck.") Your teeth start out thick near your gums, and then narrow to a sharp edge. Those tiny personal mouth wedges work the same way as an ax blade. The force of your bite causes the sharp edges of your teeth to split apart that delicious brussels sprout.

Humans were using wedges to split things way back in the **Stone Age**, which makes the wedge one of the first inventions ever. Wedges helped early humans cut wood for fire, hunt (the sharp ends of spears and arrows are wedges), and grow food (the blade of a plow, a very important farming tool, is a wedge). Think about that as you're brushing your mouth wedges tonight.





ACTIVITY 5.1

Name: ______________________

Date: ______________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: Wedge

1. List an invention from the article that uses this simple machine:

Ax

2. List another invention, not in the article, that uses this simple machine:

Answers will vary.

3. Find three descriptions of action or movement from the article that refer to the simple machine:

"Pound a wedge"; "splitting a tree stump"; "force of your swing"

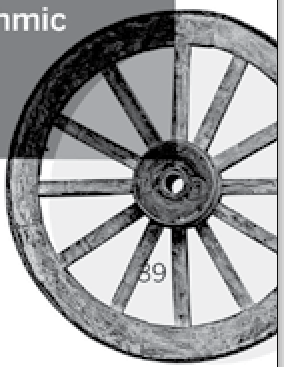
38 *Eureka! | Inventor's Notebook*

4. In your own words, simply describe how this simple machine works:

Answers will vary.

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.



Challenge

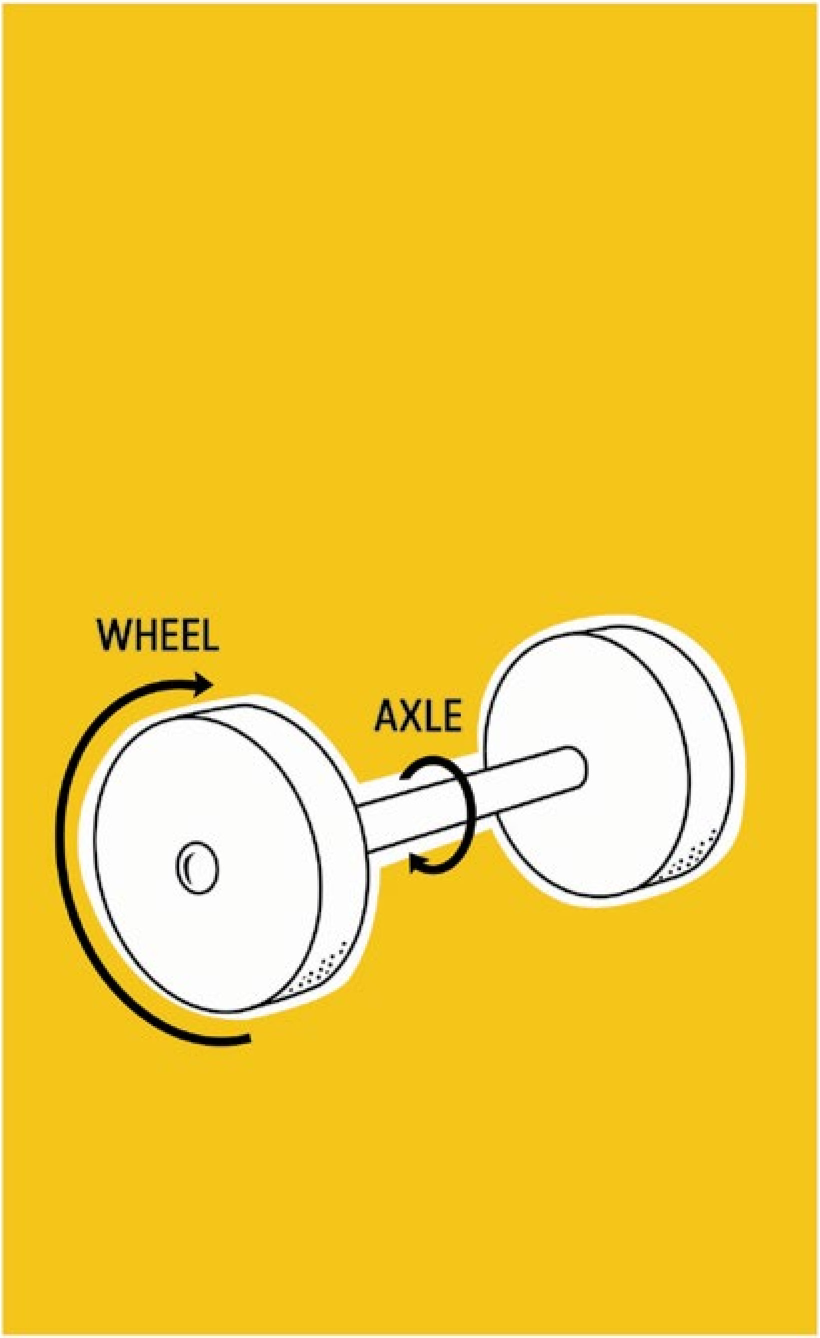
Ask students to develop a song with lyrics that help explain their dance movement and the simple machine it demonstrates.

The Wheel and Axle

When you finally have all those invention wedges you're competing for, they are going to form a wheel. Join a wheel with an axle and you're looking at a simple machine that has been a building block for many other machines.

You might think of the wheel as an invention mainly connected with transportation. But wheels can be used for a lot more than moving things from place to place. Attach a long, thin cylinder (an axle) to a wheel and you've got a simple machine that offers a mechanical advantage, helping you accomplish more with less effort. For instance, imagine pulling a bucket full of water up from an old-fashioned well. The bucket hangs from a **cylinder** (the axle) that you turn with a crank (the wheel). You could try raising the bucket by pulling the rope directly or by turning the axle by hand, but either of those methods would require more effort than hoisting the bucket by turning the crank (the wheel).

When Jacques steers his boat, the *Calypso*, he's using a wheel and axle, too. Boats change direction when the rudder, a flat plank attached to the back of a boat, moves left or right. But at sea, a boat's rudder is under water, which means moving it by hand would be a very hard (and wet) job. The wheel and axle make the job easy. A boat's steering wheel (which sailors just call the wheel) is attached to an axle, which is connected by rope to the rudder. With very little effort, Jacques can turn the wheel of his boat, which turns the axle. Then the axle does the hard work of moving the rudder left or right. Let's hope he steers clear of jellyfish.



Eureka! Files | Simple Machine 71

ACTIVITY 5.1

Name: ______________________

Date: ______________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: Wheel and axle

1. List an invention from the article that uses this simple machine:

Ship's steering wheel

2. List another invention, not in the article, that uses this simple machine:

Answers will vary.

3. Find three descriptions of action or movement from the article that refer to the simple machine:

"Pulling a bucket full of water up"; "hoisting the bucket";

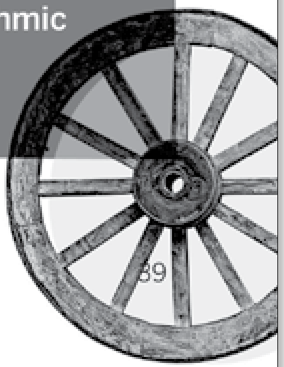
"turning the crank"

4. In your own words, simply describe how this simple machine works:

Answers will vary.

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.



- After the reading, instruct students to prepare a movement. They will need to get up and work physically on the dance.
- After ten to fifteen minutes, bring the class back together.
- For each simple machine, first have students read the paragraph aloud.
    - If necessary, ask questions to clarify or try to correct any misperceptions.
- Then have the lab present its dance. If you can, play music.
- Once they've finished dancing, interview the contestants about how their routine reflects their simple machine and where their inspiration came from.

Comment on dancing.

> Oh, it is so great to see you dance. Fantastic, now you will never forget simple machines! What a fancy way to retain KNOWLEDGE!

KNOWLEDGE LIGHTNING ROUND (10 MIN.)

- Distribute the "Know the Simple Machine!" worksheets facedown, one per lab.
- Explain that students will use what they learned about the inventions from reading and from listening to presentations and apply this knowledge to how some simple machines work.

Explain the lightning round.

> And now . . . you can prove your knowledge in a lightning round.
>
> I am putting a quiz facedown on your table. When I say "go," your group should go through and identify the simple machine at work in each invention. When you are finished and confident about your answers, put the paper high in the air. In order to get your point you need to get them all correct, so I will tell you if any are incorrect and you can fix them. Each team to get 100 percent of the simple machines correct in under five minutes will receive a bonus point. The first team to do it will get an additional bonus point.
>
> Ready . . . begin!

- A completed worksheet follows.

Name: ______________________ Date: ______________

! KNOW THE SIMPLE MACHINE!

Indicate the Simple Machine used in each invention.

1. **Electric Drill:** Screw
2. **Window Blinds:** Pulley
3. **Egg Beater:** Wheel and Axle
4. **Dump Truck:** Inclined Plane
5. **Jar Lid:** Screw
6. **Ladder:** Inclined Plane
7. **Crane:** Pulley
8. **Seesaw:** Lever
9. **Shovel:** Wedge
10. **Stapler:** Lever
11. **Pencil Sharpener:** Wheel and Axle
12. **Knife:** Wedge

Name: ______________________ Date: ______________

KNOW THE SIMPLE MACHINE!

Indicate the Simple Machine used in each invention.

1. **Electric Drill:** ______________________
2. **Window Blinds:** ______________________
3. **Egg Beater:** ______________________
4. **Dump Truck:** ______________________
5. **Jar Lid:** ______________________
6. **Ladder:** ______________________
7. **Crane:** ______________________
8. **Seesaw:** ______________________
9. **Shovel:** ______________________
10. **Stapler:** ______________________
11. **Pencil Sharpener:** ______________________
12. **Knife:** ______________________

Check for Understanding

When each team has completed the quiz, check answers and point out any incorrect answers.

KNOWLEDGE WEDGE CHALLENGE (10 MIN.)

Introduce the story of Mi-Shell, and the Knowledge Wedge Challenge.

Inventors, you have increased your knowledge a lot this week. But the judges grow bored with trying to challenge your whip-smart recall. Let's see if you can apply your knowledge to a real-life—or at least a television-life—problem. For the knowledge wedge, help us save the show.

In an effort to convince the network of the importance and television-worthiness of invention, and to save the show, the judges are sending two dozen delicious chocolate chip cookies to the network executives. (They already have many, many light bulbs at the network, so Mr. Edison is appeased.) Unfortunately, we are so busy here on the set advising you that we don't have time to deliver this bribe—errrr, gift—personally, so we are forced to send an emissary to undertake the delivery. Jacques's pet turtle, the extremely smart and well-trained Mi-Shell, has agreed to help us out.

Fortunately, Mi-Shell is less prone to emotional outbursts than your judges, and much cuter, so we have high hopes for this mission! But Mi-Shell, as is often the case with turtles, is not so speedy, or so chatty (although he is very good at communicating his needs—for a turtle—and understands commands in English, French, and German). He is a sheltered little turtle. He knows nothing about the inventions you have studied! He has never learned how invention breeds invention! He needs your help.

Mi-Shell is allowed to use any of the simple machines, lab inventions, or inventions from the inventor cards—anything we've covered in research up to this point—to aid him in his journey and mission. He may also use these inventions to breed other inventions that could help him.

Remember, his mission has two challenges:

1. He must transport the cookies, which are very large and heavy. Remember, he is a small turtle!
2. He must travel eight miles, and over a river. There are a bridge, a bus, and a subway within reasonable turtle walking distance. There is no airport within turtle walking distance.

Make sure you provide very clear instructions, so that Mi-Shell understands what to do each step of the way.

- Have students open their *Inventor's Notebooks* to the "Knowledge Wedge Challenge" (Activity 5.2) and go over the prompt with them.
- If time allows when students have completed their writing, invite one or two of the groups to share their letters.

Check for Understanding

As students are working, circulate and check that all lab members are participating in the letter writing. Remind students that everyone must participate in order for their lab to win the Wedge Challenge. Provide support if necessary to bring everyone into the conversation.

Activity Page 5.2

ENGLISH LANGUAGE LEARNERS

Writing
Writing

Beginning
Use these sentence frames: You will use the (simple machine) by ___. You will use the (other invention) by ___.

Intermediate
Ask students to create a list of steps Mi-Shell should take. Which inventions should he use at each step?

Advanced/ Advanced High
Clarify that students must create a detailed explanation to Mi-Shell, including how to use the two inventions.

ELPS 5.G

ACTIVITY 5.2

Name: ______________________

Date: ______________________

KNOWLEDGE WEDGE CHALLENGE: LETTER TO MI-SHELL

Mi-Shell needs to get from his terrarium in the *Eureka!* production office in Brooklyn to the network headquarters in midtown Manhattan (about eight miles away), while transporting two dozen cookies and a message of friendship and respect to save the show.

He may use ANY of the simple machines or inventions you have learned about so far, and you should encourage him to be creative, so he will impress the executives! He must use one simple machine and one additional invention we have studied (it can be another simple machine, but doesn't have to be) to make his journey easier. He can use inventions to ask people for help, and he can build his own inventions as long as they include the ones we have studied.

Please write him a letter to help him achieve his task.

40

Dear Mi-Shell,

Thank you for agreeing to deliver cookies to the network and save the show! You should use

______________________ and ______________________
(a simple machine) (a second invention)

to make your journey easier.

Here is how you should do it:

____

____

____

____

____

____

____

____

41

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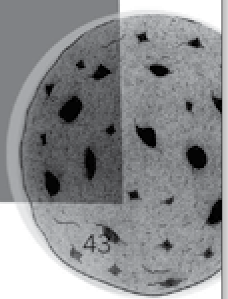
Sincerely,

Checklist:

- ☐ Does your letter include a simple machine?
- ☐ Does your letter include another invention?
- ☐ Does your letter explain how Mi-Shell should transport the cookies?
- ☐ Does your letter explain how Mi-Shell should travel?



CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Assign homework and introduce homework bonus.

Congratulations, inventors! I look forward to passing on your advice to Mi-Shell. Let's hope his mission is successful and we're back here tomorrow to collect knowledge wedges.

Tonight you will be completing an inventor card for Bette Nesmith Graham. We'll talk more about her tomorrow.

While you have your research hats on, in honor of your work today and the knowledge you get from research, we will be awarding double points for any extra inventor cards that illustrate the principle that "invention breeds invention." In the "interesting fact" section of the card, just write a sentence explaining how the saying "invention breeds invention" applies to this inventor's life.

Before we wrap up, let's pause for a moment of "Introspective Inventors" and give the viewers at home a peek into the mind of one of our contestants.

- Invite a student to come to the front of the room and "face the camera, for the audience at home." Ask two or three questions, which might include:

1. How did you use knowledge today when you worked on your invention for Mi-Shell?
2. How is collaboration going? Have you had any great collaboration moments today?
3. Speaking personally, which simple machine is your personal favorite, and why?

Sign-off

Please join us next time for another action-packed episode of *Eureka!*, and until then, remember Mr. Edison's words of wisdom: "Have a great idea. Have a lot of them."

Homework

- Students read the biography of Bette Nesmith Graham, inventor of what is today known as Liquid Paper and complete her inventor card.

After Class

- Review students responses to the "Simple Machine Dance Party Challenge" (Activity 5.1). Check that they have drawn accurate facts from their article, described the machine, and demonstrated an understanding of the illustration. Provide feedback if there are misunderstandings or incomplete answers.
- Review each lab's "Knowledge Wedge Challenge" (Activity 5.2). Identify whether students have addressed all the criteria on the checklist and provided clear instructions in the letter. Provide feedback on any incomplete or unclear areas.

Bette Nesmith Graham

Howdy, guys and gals. And thank you all so much for the chance to appear on the program. I'm afraid my invention may seem a little old-fashioned today, but in the 1950s it was **revolutionary**. Back then I worked as a secretary at a big bank in Dallas, Texas—which also happens to be the town where I was born on March 23, 1924. Of course, we didn't have computers and printers in those days. All our letters and business documents were typed on typewriters. You've seen typewriters, haven't you? Oh gosh, maybe not—you're all so young! Anyway, we had the darndest time if we typed even one letter wrong. A pencil eraser doesn't work on typewriter ink. No eraser does—believe me, I tried lots of them. The **upshot** was, if you made a mistake, you had to go back to the beginning and start again. Can you imagine?

Then, one December, I was painting holiday snowflakes on the bank windows when it suddenly hit me. Painters don't erase their mistakes; they paint over them. Maybe the same idea would work for fixing typing mistakes! So I mixed up a batch of quick-drying paint that matched the color of the bank's typing paper, and put it in a bottle with a tiny little paintbrush. The next day at work, when I made a mistake in my typing, I just painted over the wrong letters and then typed the correct ones over the paint after it dried. Soon all the secretaries at the bank were asking for my magical Mistake-Out. A chemistry teacher at the local high school helped me improve the formula, and all of a sudden I was selling my invention—now called Liquid Paper—all over the world. I ran my own company, bringing a rarely seen feminine touch to the business world: for instance, it was almost unheard of in the 1970s for a company to have a child care center, as mine did. I was unstoppable and one of the most successful women in business (My company sold for nearly fifty million dollars in 1979!). So you little pups should really keep your eyes open for problems to solve, and keep your minds open for all kinds of different ways to solve them. You never know what you'll think up!

Bette Nesmith Graham Inventor Card

Name: Bette Nesmith Graham

Birthdate: March 23, 1924

Birthplace: Dallas, Texas

Invention(s):

White-out

Describe a challenge or disappointment that this inventor faced.

Erasers would not work on typewriters. Had a good idea, but not an expert in chemistry of paint

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

LESSON

6

Looking at It from Many Perspectives—Documentation

PRIMARY FOCUS OF LESSON

Writing

Students will create explanatory texts to document their inventions, including diagrams (and domain-specific vocabulary) to convey information.

TEKS 4.11.A; TEKS 4.12.B

Speaking and Listening

Students will collaborate in their lab groups to generate multiple ideas and respond to a new building challenge. **TEKS 4.1.A; TEKS 4.1.D**

FORMATIVE ASSESSMENT

Diagrams on Board	**Introduction to Diagrams** Collaboratively create a diagram for an object on the board. **TEKS 4.1.A; TEKS 4.1.D**
Activity Page 6.6	**Documentation Wedge Challenge: Diagram and Directions** Create a detailed diagram and explanation to convey instructions about their invention. **TEKS 4.11.A; TEKS 4.12.B**

TEKS 4.11.A Plan a first draft by selecting a genre for a particular topic, purpose, and audience using a range of strategies such as brainstorming, freewriting, and mapping; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft; **TEKS 4.1.A** Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities.

LESSON AT A GLANCE (90 MIN.)

	Time	Materials
Episode 6 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Wheels of Invention ❏ Knowledge Wedges ❏ Light Bulb of Glory ❏ Judges' Note 6A, 6B (Digital Components) ❏ *Inventor's Notebook* ❏ building materials ❏ Classroom Boards or Posterboard ❏ markers or chalk ❏ Alexander Fleming Inventor Card ❏ *Eureka! Files* or Copies of Alexander Fleming Bio (Homework)
How Many Ways Can You Solve It?	10 min.	
Document Your Materials	15 min.	
Introduction to Diagrams	15 min.	
Documentation Building Challenge 1	10 min.	
Documentation Building Challenge 2	15 min.	
Documentation Wedge Challenge	15 min.	
Closing: "Introspective Inventors"	5 min.	

EPISODE OVERVIEW

The judges challenge labs with detailed observation exercises and with another building assignment.

ADVANCE PREPARATION

Read

- Review students' knowledge wedge writing (letter to Mi-Shell) to determine which labs have earned their knowledge wedges.
- Review lesson script.

Prop Master

- Identify six objects in the classroom for labs to use in the Introduction to Diagrams. Make sure each object has enough features to include each student in the lab in labeling.
- Assemble six identical sets of building materials for the building challenge. Materials might include cardboard, paperclips, toilet paper rolls, Popsicle sticks, pipe cleaners, tape, scissors, and/or egg cartons. Ensure you have six trashcans or boxes for students to use during the building challenge invention.
- Prepare to distribute Alexander Fleming inventor cards to students.

Universal Access

- Prepare prompts and sentence frames for Documentation Wedge Challenge Activity 6.6:
    - What materials does your invention use?
    - Draw your own illustration of how this invention works.
    - Complete these sentences:
        - Our group tried to ___.
        - We chose to try ___'s idea, because ___.
        - When we built our invention, it worked best when we ___.

ACADEMIC VOCABULARY

Students will encounter the following words across their reading and/or homework in today's episode. They are listed here for your reference, bolded in the student reading at their first occurrence, and compiled in the glossary of the *Eureka! Files*.

abscesses, n. inflammations caused by bacteria

antibiotic, n. a medicine that kills or stops the growth of diseased cells

antiseptics, n. substances that prevent the growth of disease-causing microorganisms

bacteriologist, n. a scientist who studies microscopic organisms that often cause disease

boils, n. a painful skin condition

contaminated, adj. harmful or unusable due to contact with something unclean

cultures, n. growths of microorganisms in a nutrient medium

digress, v. get off the subject

heed, v. pay attention to

petri dishes, n. shallow, circular, transparent dishes with flat lids, used for the culturing of microorganisms

Start Lesson

Episode 6: Looking at It from Many Perspectives

Documentation

90M

Primary Focus: Students will create explanatory texts to document their inventions, including diagrams (and domain-specific vocabulary) to convey information. **TEKS 4.11.A; TEKS 4.12.B**

Students will collaborate in their lab groups to generate multiple ideas and respond to a new building challenge. **TEKS 4.1.A; TEKS 4.1.D**

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor—where puppets pull the strings and "making it work" is only the beginning.

TEKS 4.11.A Plan a first draft by selecting a genre for a particular topic, purpose, and audience using a range of strategies such as brainstorming, freewriting, and mapping; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft; **TEKS 4.1.A** Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities.

“Last Time, on *Eureka!*”

- Ask one or two students to recap what happened last time on *Eureka!*

Housekeeping

- Return *Inventor’s Notebooks*. For those students who did not successfully complete the wedge writing, explain the process for making it up so that they, too, can earn their wedges.
- Collect Bette Nesmith Graham cards from last night’s homework and any bonus inventor cards students made and award points for them.
- Assign a building manager for each lab for the episode.
- Award the “Light Bulb of Glory” to the leading lab.

Award knowledge wedge. Introduce documentation wedge and note from Professor Carver.

> You’ve walked the walk and danced the dance. You’ve figured out how to influence powerful executives with baked goods and the help of a small and innocent French turtle. You’re more than halfway to master inventor status with this—wedge four of six—the knowledge wedge!!! Attach the wedge to your scorecard and bask in the glory!

> All right, that’s enough glory—you have much more work to do. What lies in store on today’s episode of *Eureka!*?

(Turn head dramatically, as if looking to another camera.)

> Documentation. Details are important in invention. Noticing how things work and how we use them enables inventors to communicate their ideas to the world! Careful observation leads to careful documentation—and vice versa. That’s a recipe for invention success! On to the documentation episode!

> So we begin the documentation episode with careful observation. Professor Carver has a few thoughts on observation and its labmate, perspective, which should help inspire your creativity while you practice documentation.

Play Audio or Read Aloud *Judges' Note 6A*.

Judges' Note 6A

A Note from George Washington Carver:

Hello, seedlings!

I used inventions in my work, but I also worked a lot with . . . vegetables. And legumes. The peanut, the peanut is not a simple machine. "Invention breeds invention" is a great tool for inspiration, but it's not the only one. Today we're going to think about perspectives—looking at things carefully and look at them from different angles.

Sincerely,

George Washington Carver

HOW MANY WAYS CAN YOU SOLVE IT? (10 MIN.)

Introduce different perspectives.

One of the most important things you can do as an inventor is embrace the fact that there are a lot of ways to solve a problem, and they can all be very, very different, and have their own pros and cons.

Let's think about inventions that already exist and use very different approaches to solve the same problem. Last night for homework, you read about Bette Nesmith Graham. She took a problem that had been solved one way in the past (erasers) and found a new approach with Liquid Paper.

As an example, let's think about eating. What are the devices we use to get food into our mouths?

Make a list on the board.

Possible answers include:

1. fork
2. spoon
3. bread
4. chopsticks
5. fingers (not an invention)

- Point out that there are things that spear, that scoop, that pinch—that is, several different approaches, as well as slightly different designs for the same approach (for example, a fork and a skewer both spear but are designed differently).

Explain the rules of "How Many Ways Can You Solve It?"

Activity Page 6.1

Let's make it interesting and practice this kind of thinking a bit more with a game. We'll throw in a bonus point for the winner. I'll read out the category, and your lab will have 30 seconds to generate as many ideas as you can. One member of your lab should write down your list in their *Inventor's Notebook* under "How Many Ways Can You Solve It?" (Activity 6.1). That member will read out the list when the time comes.

Be creative! Inventions that are unique to your lab count double!

- Play the game. Depending on time, you can play just one round, or all of them. (You may also wish to play one now and save the others for breaks later in the Quest or episode.)

List the activity steps on the board.

- After every round, have a member from each lab read out that lab's list; record them on the board.
- Labs earn one game point per accurate invention, plus an extra point if no other lab has the invention on its list. Keep a running tally of points on the board.

  Note: We recommend that these points not equal bonus points on a 1:1 basis! Students often have many answers, and this activity is not that important! Instead, use points just to determine the winner of the game and award one bonus point to the winning lab.
- The lab that wins the game earns a bonus point for the scoreboard.
- Suggestions for rounds:

  1. People need to travel far away: train, car, bus, airplane, etc.
  2. People need to do math: calculator, abacus, computer, etc.
  3. People need to record information: pens, pencils, tape recorders, video recorders, etc.

Check for Understanding

Check that all students are participating with their groups and contributing to the lists. Encourage non-participating students by asking for additional suggestions or providing clarifying instruction.

Inventor's Notebook

ACTIVITY 6.1

Name: ______________________________

Date: ______________________________

HOW MANY WAYS CAN YOU SOLVE IT?

Round 1	Round 2

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Round 3	Round 4

DOCUMENT YOUR MATERIALS (15 MIN.)

Introduction to Documenting an Object

When you think back to Episode 1 of our program, you may remember that our friend Jacques sent you a building task so you could practice working together. You have been doing an excellent job collaborating, but there is more we can learn from building! Because you have so many more skills now, the building task can be more challenging, and we can use more than three materials—as versatile as pencils, rubber bands, and tissues! But more materials can also lead to more trouble . . . so it's best to do a little preparation.

We have considered many types of inventions that essentially have the same functions. Now let's look at all the functions one invention can be used for. Think about your different building materials, for example. What are all the ways we can look at them; what are all the things they can do?

- First, ask students to brainstorm the kinds of observations they can make about an object using their senses.

List the activity steps on the board:

1. sight: color, size, shape
2. touch: texture, weight
3. sound: shake it, drop it
4. smell

- Select one item as an example to document as a class. A pencil works well.

Think about alternative uses for an object.

> Let's think about an object's functions—both what it is usually used for, and other uses it could have. For the pencil, for example: you can write with it, you can roll it, you can use it as a brace, and you can prop up things with it.

- Ask students to open their *Inventor's Notebooks* to "Professor Carver's Guide to Documenting Materials" (Activity Page 6.2).

Activity Page 6.2

Inventor's Notebook

ACTIVITY 6.2

Name: ______________________

Date: ______________________

PROFESSOR CARVER'S GUIDE TO DOCUMENTING MATERIALS

Name of object: Pencil

Description of object
Sight: Yellow, silver, pink, six inches long, narrow, cylindrical, pointy
Touch: Pointy, smooth, not heavy
Smell: Wood
Sound: Tapping, quiet

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1. What is the object usually used for?

Writing

2. What else can you do with it?

Roll it

Brace other things with it

Prop things up with it

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Activity Page 6.3

ENGLISH LANGUAGE LEARNERS

Writing
Interacting via Written English

Beginning
Ask, "What does ___ look like? How does it feel when you touch it? How does it smell? What sound(s) does it make? What is it used for?

Intermediate
Encourage students to come up with longer answers, writing as many words and descriptions for each category.

Advanced/ Advanced High
Make sure students understand each description category, provide clarification necessary, and prompt them to list as many words and descriptions as they can.

ELPS 1.E; ELPS 3.B; ELPS 5.G

Direct Students to "Professor Carver's Guide to Documenting Materials" (Activity Page 6.3).

> Each member of your lab should select one item from the building materials box to document the same way we just documented the pencil. Find the second copy of "Professor Carver's Guide to Documenting Materials" (Activity Page 6.3) in your *Inventor's Notebook*.

- When students have finished, come together and go through functions for another object or two.

ACTIVITY 6.3

Name: ____________________

Date: ____________________

PROFESSOR CARVER'S GUIDE TO DOCUMENTING MATERIALS

Name of object: ____________________

Description of object
Sight:
Touch:
Smell:
Sound:

What is the object usually used for?

What else can you do with it?

INTRODUCTION TO DIAGRAMS (15 MIN.)

Introduction to Drawing Diagrams

OK, so we've described the pencil with words. What about pictures? You could draw a sketch, but that wouldn't necessarily document all the details you need to build or use something.

- Have students take out the *Eureka! Files* and look at the simple machines articles again. Point out the way the diagrams of the simple machines are labeled.

Students draw diagrams on the board.

- Have a student come to the front of the room and draw a simple line drawing of a pencil. Then invite one member of each lab to label features of the pencil (for example, eraser, point, which part is yellow, which part is brown, which part is metal, etc.).
- Assign each lab an object in the classroom (pencil sharpener, scissors, desk) and have members draw a diagram of it on the board. The diagram should include at least five labeled components. Ensure that each lab member contributes to the diagram.
- Discuss the diagrams as a class.

Diagrams on Board

ENGLISH LANGUAGE LEARNERS

Writing
Interacting via Written English

Beginning
Point to the feature on the diagram and ask the student if they know what it is called. Provide help with specific vocabulary if necessary. Ask the student to write the name on the board.

Intermediate
Ask students to choose a feature on the diagram and label it, suggesting which area to label and helping with vocabulary.

Advanced/ Advanced High
Ask students to choose a feature on the diagram and label it.

ELPS 3.B; ELPS 4.F; ELPS 5.B

DOCUMENTATION BUILDING CHALLENGE 1 (10 MIN.)

Play audio, read aloud, or invite students to read *Judges' Note 6B.*

Judges' Note 6B

A Note from Professor Carver:

Seedlings, you are nearly ready to be transplanted into the wide-open garden that is Round 2. But not without building again! This building challenge is more . . . challenging. In your lab, you must create one invention and document how you did it.

The judges' office at *Eureka!* is . . . well, it's starting to be a fire hazard. We get so involved in our inventing, we don't want to stand up and walk two feet to throw the many, many irritating memos we get from the network into the recycling can. Please help!

Sincerely,

George Washington Carver

Introduce "Trash Building Challenge."

> Your challenge is to invent something that enables the judges to throw away a wad of paper. The bin is two feet away, but they do not want to leave their seats. The invention must have 75% accuracy. We don't need a perfect office, just a better one.

That means this invention is allowed to fail 25% of the time. We mentioned in Episode 1 that failure is part of the process of invention. You'll be hearing more about this today.

Once you have built your invention, you will need to provide a detailed diagram and instructions for building it so that the judges can re-create your invention and put it to work at home, in the office, and in labs.

- Have students open their *Inventor's Notebooks* and read "Professor Carver's Documentation Building Challenge" (Activity 6.4). You may also want to review "Jacques's Rules for Collaboration" from Episode 1.

Support

Explain that if something has 75% accuracy, that means that it is accurate three out of every four times.

Activity Page 6.4

Inventor's Notebook

ACTIVITY 6.4

Name: ______________________

Date: ______________________

PROFESSOR CARVER'S DOCUMENTATION BUILDING CHALLENGE

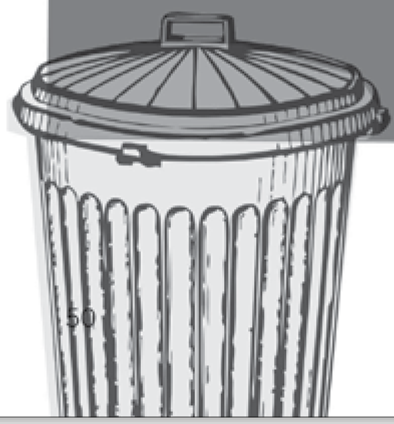
Building prompt:

You are building an invention the judges can use to throw out trash!

Challenge requirements:

- The trash can is two feet away.
- The user is sitting down.
- You can use anything in the building materials box.
- You cannot just throw the trash.
- Your invention must work 75% of the time.

You may practice using your invention and make changes to it as time allows. You are allowed to get out of your seat to build!



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Notes on group work:

You will work in a group to complete this building challenge. In order to be successful, you will need to work together! Be sure that everyone is given an opportunity to express their opinion, and that everyone is contributing to the process. Listen carefully to what the other members of your group have to say. Their ideas may help you come up with a new idea of your own.

One member of your lab will be assigned to be the building manager.

The building manager leads the decision-making process. This does not mean that the building manager has to do all of the work, or that the group uses all of the building manager's ideas! But sometimes, when a group has many ideas, it can be hard to decide which one to try first. The building manager should listen to the lab and help make that decision. They can call for a vote, or, if there's a tie, break the tie. If there are several tasks to be accomplished at the same time, the building manager can assign them. If you don't know what you should be doing to help, ask the building manager.

Brainstorming

Have students inventory building materials.

We'll begin this challenge with individual brainstorming. Before you begin, let's review what you have to work with.

- Allow students a minute to look at—not touch—the building materials in the box. Alternately, show them the materials from the front of the room.

Prepare students to brainstorm in *Inventor's Notebook*.

Activity Page 6.5

Find a brainstorming page in your *Inventor's Notebook* and record the date and the challenge. For the next five minutes, list and/or sketch different approaches to this challenge.

ACTIVITY 6.5

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ____________________ Date: __________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

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Draw your invention here:

DOCUMENTATION BUILDING CHALLENGE 2 (15 MIN.)

Instruct students to start building.

OK, come back together with your lab and share your brainstorming. Then build—try lots of things! Pay particular attention to what you do after something doesn't work.

The rules of collaboration—everyone should contribute, everyone should be heard—still apply.

Again, there is a building manager. The building manager will help lead the decision-making process as you try different approaches.

Remember that at the end of the challenge, you'll be practicing your documentation skills by creating a detailed diagram of your invention and writing instructions for building and using it.

- Have labs build for 15 minutes.
- Circulate as the students work.
- Let students know when there are five minutes left so that they have time to finish building and testing their inventions.

Check for Understanding

Circulate and observe the small group conversations, ensuring that the building manager is taking on their responsibilities, and all students are contributing to the discussion. If students are not moving forward on a solution, help them assess where they are in the process and to take the next step.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Exchanging Information/Ideas

Beginning
Prompt student conversation: Whose turn is it to talk? What is your idea? Does anyone have a question for ___? Can someone offer a suggestion? Does someone else have a different idea to share?

Intermediate
Prompt student conversation: Has everyone shared their ideas? What questions do we have? Which idea are we going to try?

Advanced/ Advanced High
Ensure all students are participating, and if not, prompt nonspeaking students to participate.

ELPS 2.C; ELPS 3.E

Activity Page 6.6

ENGLISH LANGUAGE LEARNERS

Writing
Interacting via Written English

Beginning
Ensure that all students participate in the documentation process. Encourage students to write notes and diagrams in their *Inventor's Notebook* even if they are not the building manager. Provide pre-prepared sentence frames from Universal Access.

Intermediate
Encourage students to write their own notes and diagrams in their *Inventor's Notebook*. Provide pre-prepared prompts from Universal Access.

Advanced/ Advanced High
Encourage students to write their own notes and diagrams in their notebooks.

ELPS 2.I; ELPS 5.B; ELPS 5.G

Challenge

Ask labs to switch documentation and see if they can successfully build each other's inventions. This will be extra fun if you can trade with another class, so the students haven't seen the inventions.

DOCUMENTATION WEDGE CHALLENGE (15 MIN.)

Introduce documentation.

OK, inventors, you won't always be building what you invent yourself—eventually you'll need to pass that off to manufacturers or other inventors. This is the documentation that will earn you a wedge and a chance to demonstrate your invention for bonus points and bragging rights! You will need to record what you built and how you built it with enough detail that people who have never seen your invention in real life can build and use it themselves. In our challenge, you will do this by making a detailed, labeled diagram and by answering a few questions.

Note: Although labs can submit a single document for the challenge, encourage students to use their own *Inventor's Notebook* for their individual documentation. Consider offering bonus points to labs that submit individuals' work.

ACTIVITY 6.6

Name: ______________________________

Date: ______________________________

DOCUMENTATION WEDGE CHALLENGE

1. On the next page, label a diagram for the judges so they can use your clever design in their office-cleaning project.

2. List of materials used:

____

____

____

____

____

____

____

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3. Write three sentences explaining how you made your invention.

Draw and label your invention here:

Labeled Diagram of Invention:

- ☐ Indicate what materials are used in various parts of your invention.
- ☐ Draw a star where the trash is placed.

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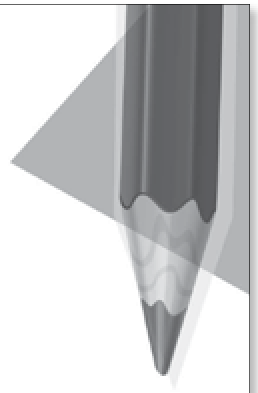

- [ ] Label the parts of your invention. (handle, basket, slingshot, ramp—whatever you've included).
- [ ] Draw an arrow that shows us where the trash goes when the invention is being used.

CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Assign homework and bring up students for "Introspective Inventors."

You're nearly there! The judges will review these diagrams and, assuming everything looks reasonably safe, we'll see how well these inventions work in demonstrations tomorrow. Plus, documentation wedges!

And who knows what other mysteries will be revealed in our next episode as you pursue the climactic final wedge in the wheel? Can anything top flying garbage? We'll find out. To prepare for whatever it is, please complete the Alexander Fleming invention card tonight for homework.

Before we wrap up, let's pause for a moment of "Introspective Inventors" and give the viewers at home a peek into our contestants' minds in the home stretch.

- Invite a student to come to the front of the room and "face the camera, for the audience at home." Ask two or three questions, which might include:
  1. What was frustrating about this building challenge? What was fun?
  2. Why is documentation an important part of inventing?
  3. Do you have any advice about documentation to our inventors watching at home?
- Collect *Inventor's Notebooks.*
- Have students store their inventions in a safe non-distracting place for tomorrow.

Sign-off

> Please join us next time for another action-packed episode of *Eureka!*, and until then, remember Judge Edison's words of wisdom: "Have a great idea. Have a lot of them."

Homework

- Assign Alexander Fleming inventor card for homework.

After Class

- Review students' work on "Professor Carver's Guide to Documenting Materials" (Activity Page 6.3). Ensure that they answered all questions and address any incomplete answers.
- Review Documentation Wedge Challenge (Activity Page 6.6). Check that students have created a clear illustration and indicated what materials are used in each part of the invention.
- You may want to take pictures of students' diagrams drawn on the board and save these as artifacts of their work.

Alexander Fleming

Hello and good day to you, student inventors! It's a pleasure to be on the show. My name is Alexander Fleming—well, Sir Alexander Fleming, as of the day I was knighted by King George VI in 1944. But I'm getting ahead of myself. I was born on August 6, 1881, on a farm in Ayrshire, Scotland. But I wasn't meant for farm life. I moved to London as a young man and became a **bacteriologist**—a scientist who conducts experiments on bacteria. During World War I, I served as a captain in the Royal Army Medical Corps. There I saw too many men die needlessly in field hospitals, where I suspected the **antiseptics** used to clean their infected wounds were more dangerous than the wounds themselves. But no one **heeded** my warnings and the antiseptics continued to be used—it was, to say the least, a frustrating time for me.

After the war I was busy at St Mary's Hospital in London, studying a particularly nasty bacterium called staphylococcus that causes **boils**, **abscesses**, and sore throats. I had a very good reputation amongst those studying bacteria, though I was known to be a little sloppy—OK, very sloppy—in my lab. I admit it: being orderly isn't my strength. You can't imagine the trouble this got me into growing up on the farm—I mean, do you know how angry a cow gets when you forget to milk her? But I **digress**. On September 3, 1928, I returned from a lengthy family holiday to find that I'd left a stack of **petri dishes** filled with live bacteria **cultures** sitting out on a bench (needless to say, this is not where cultures ought to be left, even for a night or two!). Unsurprisingly, one of the cultures had become **contaminated**—invaded—by a fungus, a kind of mold. But surprisingly, the fungus seemed to be preventing the bacteria from growing around it. This was curious. So I decided to grow the fungus, which I called penicillin, again, and realized that it successfully killed bacteria!

This was great, but I still didn't comprehend the huge import of what I'd discovered. What can I say? We can't always see precisely what we have when we have it. After all, I tested penicillin for a number of years, but came to the conclusion that it couldn't survive long enough within the human body to fight infection successfully, and I moved on. Luckily, other scientists stuck with it. By the end of World War II, penicillin was saving many soldiers' lives. And shortly thereafter I became Sir Alexander Fleming and shared the Nobel Prize in medicine. Penicillin was the first **antibiotic** and it unquestionably changed the world. It is widely considered one of the most important inventions of the twentieth century. The moral of the story? I think I'd put it something like this: "One sometimes finds what one is not looking for. When I woke up just after dawn on [that day in September, 1928], I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer. But I guess that was exactly what I did."

Alexander Fleming Inventor Card

Name: Alexander Fleming

Birthdate: August 6, 1881

Birthplace: Ayrshire, Scotland

Invention(s):

Penicillin

Describe a challenge or disappointment that this inventor faced.

No one would listen to his concerns about antiseptics. He had trouble keeping penicillin alive in the human body long enough for the invention to be practical.

Name one fact about this inventor or the story of their invention that you find interesting.

Answers will vary.

LESSON

7

If At First You Don't Succeed—Failure

PRIMARY FOCUS OF LESSON

Speaking and Listening

Students will participate in collaborative discussions to evaluate their inventions and offer suggestions for improvement. TEKS 4.1.A

Writing

Using examples from history and their own experiences, students will write an opinion piece on the usefulness of failure in the inventing process.

TEKS 4.12.C; TEKS 4.13.C

FORMATIVE ASSESSMENT

Activity Page 7.2

Failure Wedge Challenge: Letter to the Network

Write an opinion piece on learning from failure, citing examples from classwork and the inventors studied.

TEKS 4.12.C; TEKS 4.13.C

TEKS 4.1.A Listen actively, ask relevant questions to clarify information, and make pertinent comments: **TEKS 4.12.C** Compose argumentative texts, including opinion essays, using genre characteristics and craft; **TEKS 4.13.C** Identify and gather relevant information from a variety of sources.

LESSON AT A GLANCE

	Time	Materials
Episode 7 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Wheels of Invention ❏ Documentation Wedges ❏ Light Bulb of Glory ❏ Judges' Note 7A (Digital Components) ❏ Video: Failure (Digital Components) ❏ *Inventor's Notebook* ❏ building materials
Invention Demonstrations	20 min.	
Introduction to Failure	10 min.	
Rebuilding Challenge	10 min.	
Lab Discussion and Rebuilding	15 min.	
Rebuilding Demonstrations	15 min.	
Failure Wedge Challenge	10 min.	
Closing: "Introspective Inventors"	5 min.	

EPISODE OVERVIEW

Contestants revisit Episode 6's invention to improve its function, and learn how failure is everywhere and useful to the process of invention.

ADVANCE PREPARATION

Read

- Review students' documentation wedge writing (diagram your invention) and determine which labs have earned their wedges.
- Review lesson and video scripts.

Prop Master

- Reassemble building materials from Episode 6 for distribution to labs.
- Test audio and video resources.
- Prepare to project the "Image of the Day."

Universal Access

- Prepare sentence frames to support students' writing and use of evidence in Activity Page 7.2:
    - I experienced failing in *Eureka!* when ___.
    - As a result of this experience, I learned ___.
    - ___ experienced failure when they ___. As a result of this experience, they learned ___.
    - The network should allow *Eureka!* to stay on the air because ___.

Start Lesson

Episode 7: If At First You Don't Succeed

Failure

90M

Primary Focus: Students will participate in collaborative discussions to evaluate their inventions and offer suggestions for improvement. **TEKS 4.1.A**

Using examples from history and their own experiences, students will write an opinion piece on the usefulness of failure in the inventing process.

TEKS 4.12.C; TEKS 4.13.C

INTRODUCTION (5 MIN.)

Play audio: Opening.

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor—where puppets pull the strings and "making it work" is only the beginning.

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!*

Housekeeping

- Return *Inventor's Notebooks*. For those students who did not successfully complete the wedge writing, explain the process for making it up so that they, too, can earn their wedge.
- Ask students to have their Alexander Fleming card (yesterday's homework) available for discussion.
- Collect any bonus inventor cards students made and award points for them on the scoreboard.

TEKS 4.1.A Listen actively, ask relevant questions to clarify information, and make pertinent comments; **TEKS 4.12.C** Compose argumentative texts, including opinion essays, using genre characteristics and craft; **TEKS 4.13.C** Identify and gather relevant information from a variety of sources.

- Assign a building manager for each lab for the episode.
- Award the "Light Bulb of Glory" to the leading lab.

Award documentation wedge.

> Without further ado, your diagrams have passed muster and this is your penultimate (that means next-to-last) wedge! Wedge 5 of 6 is the documentation wedge. Great job, inventors. Remember when you first started working on these wedges? It seems so long ago that you were working on collaboration, and now it's almost second nature!
>
> Attach the wedge to the Wheel of Invention, and bask in the glory!

> All right, that's enough glory. You proved you could document your inventions, but let's see how you do when you're put to the test! It's demonstration time. Let's see what those inventions are made of!

INVENTION DEMONSTRATIONS (20 MIN.)

Activity Page 6.4

- Briefly review the building challenge (Activity 6.4).
- Each lab demonstrates its invention four times (to test 75% accuracy!). If the invention is successful, the team earns a bonus point.
- After each demonstration, ask the lab members if there's anything they would do to change their invention if they had more time.

Check for Understanding

Ensure that each lab presents its invention and understands the success rate. If any lab members do not participate in presentation, bring them into the discussion about changes they would make.

Segue out of demonstrations.

> Who knew there were so many ways to take out the trash?
>
> Well, I think we're all relieved that the judges now have some help cleaning up the office, even if it isn't perfect. You had some good ideas for improving your inventions. If only you had more time. Too bad we're subject to the time restrictions of a TV show . . . you never know when you'll have more time to look at an invention . . .

INTRODUCTION TO FAILURE (10 MIN.)

Introduce the failure wedge.

> But I do! Don't rest on your successes or wallow in disappointments, contestants—you ALL have more work to do. In some way, you've all failed! Which is great! Because—what lies in store on today's episode of *Eureka!*? The final wedge, the final frontier in the basic skills of inventions. The greatest risk, the greatest rewards: the FAILURE challenge.

(Turn head dramatically, as if looking to another camera.)

> FAILURE.
>
> What is failure? Well, it's a dramatic word that makes for good TV. In practice it's not quite as dire. Here, Mr. Edison wants to get a few words in:

Play audio, read aloud, or invite student to read *Judge's Note 7A.*

Judges' Note 7A

A Note from Thomas Edison:

Look, widgets, you know I don't pull punches. But here's the truth: I NEVER fail; I just discover what doesn't work. For true innovation, you must take a true risk and try things that MAY NOT WORK. You never know—because you're the first to try them! Sometimes they WILL NOT WORK—at all. That's OK. Sometimes you succeed in your basic goal, but fail to do it as well as you wanted. Sometimes failure is a matter of perspective: you may have failed to do what you thought you wanted to do, but accidentally achieved something else. In any case, it's better to take the risk and fail than not to take the risk at all—especially on TV. Risk is interesting. Here, all the judges have things to tell you about failure. Go to the tape.

Sincerely,

Thomas Edison

Play video: Failure.

- Judges explain their failures and what they learned.

Introduce the concept of identifying "failures"—sometimes obvious, sometimes just places to improve.

There you have some great stories about failure. But what does that have to do with your Wheel of Invention? You have built two inventions on this show! Most of them were successful. But they were also all failures.

Even if you succeeded in the demonstration, there is no way you created the best possible trash-disposal-assistance device in 20 minutes. There are quicker or cleaner or cooler ways of doing what you did. This shouldn't offend you; failure is not embarrassing or shameful. In fact, many, if not all, of the best inventions in history came about through failure, through people taking risks and being willing to get things wrong, sometimes very publicly.

- Discuss what we can learn from failure. Sometimes things don't work at all—we need to try to figure out why. Sometimes they don't work as well as we would like.
- Discuss the video and Fleming homework inventor card briefly; reinforce that the work of an inventor is to try to figure out why an invention isn't working or how it could be better, and continue from there.

Check for Understanding

Poll students on whether they agree/disagree that their inventions "failed" in some way. Ask students to discuss why they think this, and how they might improve their inventions.

Let's discuss.

So the task now is to return to what you built in the last episode and make it better. You will do this by revising your invention. You'll spend the next 15 minutes preparing your revision, and then I will give you your box of building materials back and you can make those revisions. We'll have time to see how your revised inventions work at the end of the episode.

Activity Page 7.1

REBUILDING CHALLENGE (10 MIN.)

Introduce "Edison's Invention Evaluation."

In order to make your revisions, let's first evaluate what you've already done. It probably won't surprise you that Mr. Edison has created a good way to figure out how things didn't succeed. Open your *Inventor's Notebook* to "Edison's Invention Evaluation" (Activity 7.1). You'll see that there are five areas to consider.

ACTIVITY 7.1

Name: ______________________

Date: ______________________

EDISON'S INVENTION EVALUATION

Check two areas where you think your invention failed/could be improved:

- ☐ **Accuracy**
- ☐ **Easy to build**
- ☐ **Easy to use**
- ☐ **Sturdiness** (how long your invention will last before it falls apart)
- ☐ **Flexibility** (how well your invention could handle ANY trash, not just a wad of paper)

Support

If students struggle to identify areas of improvement, ask them to review how their invention performed in the four demonstrations. Any place its performance wasn't perfect is an area that could be improved.

How would you revise your invention to improve it in the areas you checked?

- Read through "Edison's Invention Evaluation" as a class.
- Ask students to reflect on each area, and where their own invention can be improved.
- If they can't think of improvements, ask if the class has any ideas.
    - Try to ensure that each lab receives at least one suggestion from a student not in that lab.

Note: This is the trickiest wedge, so remind students that collaboration means working with ALL contestants, not just your lab, and that they should offer ideas in the discussions.

Sum up the conversation and instruct students to complete "Edison's Invention Evaluation" individually for their own inventions.

> Whatever you do, you have to be able to explain how you are improving upon your last model. We've got you started thinking, but everyone should do some individual reflection on last episode's building.

LAB DISCUSSION AND REBUILDING (15 MIN.)

Instruct labs to come up with a building plan.

> Now come together with your lab and share your answers. Decide how you will revise your invention. You may be able to implement more than one of your ideas!

> Once you have a plan, raise your hands. I will approve your lab's plan and give you your building materials.

- Students share ideas and develop a plan for redoing their inventions.
- Students redo their trash-throwing-out model.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Exchanging Information/Ideas

Beginning
Prompt student conversation: "What is your idea for improvement? Does anyone have a question for ___? Can someone offer a constructive suggestion? Does someone else have a different improvement idea to share?"

Intermediate
Prompt student conversation: "Has everyone shared their improvements? What questions do we have? Which improvements are you going to try?"

Advanced/ Advanced High
Ensure all students are participating by prompting nonspeaking students to participate.

ELPS 2.C; ELPS 3.E

Check for Understanding

Circulate and observe the small group conversations, ensuring that the building manager is taking on their responsibilities, and all students are participating. Offer supportive questions to ensure students are evaluating their own work and proposing solutions.

REBUILDING DEMONSTRATIONS (15 MIN.)

Introduce demonstrations.

> All right, inventors, time to test your inventions and see, assuming you failed again, if you at least failed better. Sometimes when you improve one feature of an invention, it hurts another. That's why (when you aren't on a game show), you can end up spending weeks or months or even years revising an invention!

- Students present their models to the class.
- Invite the class to ask questions to the lab about how they made their improvements.
- Ask students to tell "the viewers at home" why they think their revision is an improvement.

Challenge

Ask students what changes they would make if they had the opportunity to revise their inventions once more.

Check for Understanding

Assess which area(s) of improvement each lab has attempted in the new model. Depending on overall classroom collaboration, you can either allow the class to vote on whether the model is an improvement, or allow the lab to evaluate itself, or say that is coming through a call from the judges.

FAILURE WEDGE CHALLENGE (10 MIN.)

Introduce the Failure Wedge Challenge.

This season's revision of *Eureka!* is most definitely an example of improvement! Just as you carefully considered your inventions and looked for improvements, we looked at last season and tried to figure out how to avoid those disasters. And so far, so good! Because of our failures last season, we found ways to make this season the best ever! But the executives at the network have trouble understanding that failure can be a good thing because it can help us make things better. They think failure means you should just quit right now, and they're skeptical that we have made the show better.

They are so wrong! We still have three more action-packed, fun-filled episodes to get through, and you've already done so much work earning the wedges in your Wheel of Invention! For your final wedge-writing challenge, you will explain to these network executives how failure can be a good thing and lead to great success. Open your *Inventor's Notebook* to Failure Wedge Challenge (Activity 7.2).

All right, this is your FINAL letter and your FINAL wedge. Make. It. Count!

Activity Page 7.2

ACTIVITY 7.2

Name: ______________________________

Date: ______________________________

FAILURE WEDGE CHALLENGE: LETTER TO NETWORK EXECUTIVES

Write a letter to the network explaining how failure can be a useful tool in invention.

Give two examples of failure in your letter.

First, give an example of a failure you've experienced during the Quest so far. It can be a building failure, a collaboration failure, or any other kind of failure.

1. Explain how you failed.
2. Explain how you would change your actions in the future.

Second, give an example of an inventor's failure you learned about during the Quest from inventor cards or other reading.

3. Explain how the inventor failed.
4. Explain what they learned from that failure.

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Dear network executives,

Don't cancel Eureka! Student Inventor just because last season was a failure! On the program this year, we have learned that failure is an important tool in invention. The judges and our host have used their failures from last season to learn how to make the show better. Learning from failure works!

This season I learned by failing. Here's how:

I also learned about ______________________________,

a famous inventor who failed, too.

Save Eureka! Let us fail some more!

Sincerely,

ENGLISH LANGUAGE LEARNERS

Writing
Supporting Opinions

Beginning
Offer sentence frames to support students' writing and use of evidence:

I experienced failing in *Eureka!* when ___.

As a result, I learned ___.

Intermediate
Provide prompts to support students' writing:

Describe an experience you've had with failure during *Eureka!* What actions would you take to avoid this failure in the future?

Advanced/ Advanced High
Ensure that students use evidence from their own experience, and also that of one of the inventors they studied.

ELPS 5.B

CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Introduce "Introspective Inventors."

Remember to pass in your *Inventor's Notebooks* so we can get those letters to the network. Let's wrap up this episode of the final Wheel of Invention challenge with a moment of "Introspective Inventors."

- Invite a student to come to the front of the room and "face the camera, for the audience at home." Ask two or three questions, which might include:

1. How do we learn from our failures? Give us an example of something you learned today.
2. How did your lab collaborate today? What did you do to come up with improvements?
3. What do you think are the most important things to remember in order to be a great inventor?

Sign-off

Please join us next time for another action-packed episode of *Eureka!* Until then, remember Judge Edison's words of wisdom: "Have a great idea. Have a lot of them."

After Class

- Read students' "Failure Wedge Challenge." Check that they have included specific examples of their own experiences and from one of the inventors they studied.

LESSON

8

Why We Invent—Identifying Challenges

PRIMARY FOCUS OF LESSON

Writing

Students will revise or complete writing challenges from previous lessons. **TEKS 4.11.B.ii**

Students will write two short, informative pieces describing their own invention idea, the problem it solves, including its purpose and function. **TEKS 4.11.A; TEKS 4.12.B; TEKS 4.13.A**

Speaking and Listening

Students will share their ideas about inventions through paired interviews, sharing their ideas, and taking notes. **TEKS 4.1.D**

FORMATIVE ASSESSMENT

Writing Make-Up Time	**Last Chance Wedge Make-Up and Extra Bonus Time!** Revise and complete any written previous assignments necessary to fulfill the requirements of the Quest. **TEKS 4.11.B.ii**
Activity Page 8.2	**What Problem Should My Invention Solve?/ Brainstorming** Identify and describe the problem their invention will address and provide criteria to support their choice. **TEKS 4.11.A; TEKS 4.12.B; TEKS 4.13.A**
Activity Page 8.4	**What Problem Should My Invention Solve?/ Brainstorming** Write a short explanation of their invention, including a list of materials, a description of how it works, and an illustration. **TEKS 4.11.A; TEKS 4.12.B**

TEKS 4.11.B.ii Develop drafts into a focused, structured, and coherent piece of writing by: developing an engaging idea with relevant details; **TEKS 4.11.A** Plan a first draft by selecting a genre for a particular topic, purpose, and audience using a range of strategies such as brainstorming, freewriting, and mapping; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central ideas and genre characteristics and craft; **TEKS 4.13.A** Generate and clarify questions on a topic for formal and informal inquiry; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities.

LESSON AT A GLANCE

<table>
<tr><th></th><th>Time</th><th>Materials</th></tr>
<tr><td colspan="3">Episode 8 (90 min.)</td></tr>
<tr><td>Introduction</td><td>5 min.</td><td rowspan="7">❏ Audio: Opening
❏ Wheels of Invention
❏ Light Bulb of Glory
❏ Failure Wedge
❏ Inventor's Notebooks
❏ Miscellaneous Wedges
❏ Wheels of Invention
❏ Video: Why We Invent (Digital Components)
❏ Video: Man on the Street (Digital Components)</td></tr>
<tr><td>Last Chance Wedge Make-Up</td><td>15 min.</td></tr>
<tr><td>Wrap Up Wheel of Invention</td><td>10 min.</td></tr>
<tr><td>An Inventing Opportunity</td><td>30 min.</td></tr>
<tr><td>What Should My Invention Solve?</td><td>15 min.</td></tr>
<tr><td>Brainstorming</td><td>10 min.</td></tr>
<tr><td>Closing: “Introspective Inventors”</td><td>5 min.</td></tr>
</table>

EPISODE OVERVIEW

Students will finish up any unfinished wedge-challenge writing and complete the Wheel of Invention. The judges will explain what brought them to inventing. Students will work independently and in pairs to identify and evaluate problems that can be addressed by inventing and then select a problem for their final invention.

ADVANCE PREPARATION

Note: This lesson requires a bit more preparation and customization than the previous episodes, but full preparation before you begin Episode 8 will help you for the remainder of the Quest.

Read

- Review students' failure wedge writing ("Letter to the Network") and determine which labs have earned their wedge.
- Review lesson and video scripts. Preview Episodes 9 and 10.

Customize

- Review *Inventor's Notebooks* from all the previous lessons, and identify any incomplete assignments or areas for improvement. Prepare individual supports for the Make-Up writing activity, so that students can address necessary improvements in this time.
- After reading Episodes 8, 9, and 10, determine the parameters and criteria for the Round 2 invention.
    - What criteria should students consider in choosing what problem to solve with their Round 2 invention (see What Problem Should My Invention Solve?)?
    - Will students create final inventions alone, in groups of two, or as a lab?
    - What will the final invention product be? A working invention, a non-working model, a written description, a diagram on paper?
    - How will they present the final product in Episode 10?
- If you wish to provide specific questions for today's brainstorming activity (8.3), write them on board or have them ready to distribute. These might include "What does your invention do?" and "How does it work?"
- Determine the format students will use for their final presentations. Possible ideas:

- Follow a science-fair model—lab. Members set up tables with their inventions and half the group stays with the inventions to present and answer questions, while the other half visits other labs.
- Invite parents or other teachers or staff to come to class and play the role of "network executives," checking up on the contestants or as Special Guest Judges.
- Have students participate in a "parade of invention." Each student looks into the "camera" and does a super-mini-pitch (name of invention plus slogan).
- Create an invention catalog with all the inventions included.

- The script assumes that all labs will have completed all their wedges. If this is not true, determine if those labs will be allowed to progress to Round 2, and if so, what the conditions will be.
- This script assumes students will create their own Round 2 inventions. If they will be working in groups, adjust the language accordingly.

Prop Master

- Test audio and video resources.
- Prepare to project the "Image of the Day."

Universal Access

- Review students' work in their *Inventor's Notebooks*. Identify where more work is needed for the Make-Up Time, and provide sentence frames and prompts to support students in revising and completing their work.
- Prepare sentence frames for Activity Page 8.2:
    - A problem I would like to solve is ___.
    - I am choosing to solve this problem because I believe ___.
    - Which of the criteria does this problem meet or address?
    - How is this problem (big/small/interesting/something you care about, etc.)
- Prepare sentence frames and guiding questions for Activity Page 8.4:
    - The problem my invention will address is ___.
    - The materials needed to build this invention are ___.
    - Questions might include: How will it ___? I am not certain how to ___. I need help with ___.

Start Lesson

Episode 8: Why We Invent

Identifying Challenges

90M

Primary Focus: Students will revise or complete writing challenges from previous lessons. **TEKS 4.11.B.ii**

Students will write two short, informative pieces describing their own invention idea, the problem it solves, including its purpose and function. **TEKS 4.11.A; TEKS 4.12.B; TEKS 4.13.A**

Students will share their ideas about inventions through paired interviews, sharing their ideas, and taking notes. **TEKS 4.1.D**

INTRODUCTION (5 MIN.)

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor—*where puppets pull the strings and "making it work" is only the beginning.*

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!*

Housekeeping

- Return *Inventor's Notebooks*. For those students who did not successfully complete the wedge writing, explain the process for making it up so that they, too, can earn their wedge.
- Collect any bonus inventor cards students made and award points for them.
- Assign a building manager for each lab for the episode.
- Award the "Light Bulb of Glory" to the leading lab.

TEKS 4.11.B.ii Develop drafts into a focused, structured, and coherent piece of writing by: developing an engaging idea with relevant details; **TEKS 4.11.A** Plan a first draft by selecting a genre for a particular topic, purpose, and audience using a range of strategies such as brainstorming, freewriting, and mapping; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central ideas and genre characteristics and craft; **TEKS 4.13.A** Generate and clarify questions on a topic for formal and informal inquiry; **TEKS 4.1.D** Work collaboratively with others to develop a plan of shared responsibilities.

Award FAILURE wedges.

The risk is ramping up here on *Eureka!* and the failures are going to start piling up today—failure wedges, that is! You took an imperfect invention and thought hard about why it wasn't perfect and worked hard to make it better. That's the secret to any invention.

Attach the wedge to your scorecard and bask in the glory!

All right, that's more than enough glory. Failure is great but it's not that great. On with the show!

LAST-CHANCE WEDGE MAKE-UP (15 MIN.)

Introduce wedge make-up time.

The great thing about invention, as we learned yesterday, is that there are almost always second chances. This is the moment for second chances in wedge attainment. Some of you have not yet earned all your wedges because your writing was not complete or fully acceptable. If you completed that writing last night, raise your hand and I will collect it and review it right now.

You have 15 minutes right now to wrap up the requirements for the Wheel of Invention. This is a time for collaboration. You may help your lab mates with their writing if they ask for help (you may not DO the writing for your lab mates!).

If your lab has collected all six wedges, you may use this time to complete additional inventor cards. This is the last chance to earn bonus points, so make it count!

Writing Make-Up Time

ENGLISH LANGUAGE LEARNERS

Writing

Beginning
Provide sentence frames and prompts to support students with any incomplete sections.

Intermediate
Provide prompts or ask for evidence from the text (when missing) to support students expand and lengthen their writing.

Advanced/ Advanced High
Point out any areas or ask for more explanation/ evidence to encourage deeper work from students.

ELPS 5.B; ELPS 5.F

Challenge

Allow students to give feedback explaining how the peer might improve their work.

Check for Understanding

Ensure that all students know which activity they should be working on during this period, and circulate to ensure that students stay focused on this task.

WRAP UP WHEEL OF INVENTION (10 MIN.)

Celebrate final Wheel of Invention.

As of this moment, these labs have all completed the Wheel of Invention: ___.

- If all labs have not completed the wheel, add "and the rest of the labs have a plan to complete it quickly."

Bask in the glory! I'll give you an extra thirty seconds, even, in honor of the achievement. And twenty bonus points. For each lab! Whoa!

Introduce Round 2.

This means that, miraculously, everyone is moving on to *Eureka!*: Round 2. In past years we've had to disqualify contestants for all sorts of reasons: insufficient research, disastrous collaboration, extreme rudeness to the judges.

But not this season! Take that, network—you said it couldn't be done, and here we are! This season is flawless, spectacular, outstanding!!!

(Listens in earpiece.) Oh, I'm being told not to jinx ourselves or antagonize the network. I'll downplay. This season, so far, is going just fine.

We spent seven awesome, exciting, crazy episodes on the Wheel of Invention in Round 1. How can Round 2 possibly top that?

By upping the risk and the challenge. Round 2 is where we take the training wheels off and let them fly! Round 2 is where it can all fall apart, or all come together.

Because in Round 2 you'll use all the skills you acquired in Round 1 to create your own invention. What are those skills, one more time? Remind me what each wedge represents? That's right—just call 'em out.

With those skills, and only those skills—well, and maybe a little help from me, the judges, and your fellow contestants—in Round 2 you will identify a problem or challenge you wish to solve with your invention.

Then you will invent something that addresses that challenge.

On the board, write:

1. Identify the problem.
2. Invent a solution.

Review definition of *invention* and provide Round 2 details.

That's Round 2, friends. Looks so simple, but so much can happen.

But before I let you get into trouble—who can remember when we talked about inventions wayyyy back in Episode 1? How did we define an invention?

» An invention is an object or process that someone MAKES that is NEW AND DIFFERENT and was created to DO SOMETHING.

Unlike in Round 1, here you will be inventing by yourself—but you are not alone. Collaboration is still in the mix. You are still working in your lab, it's just that your lab is now working on multiple inventions. You are each the building manager of your own project, but you can ask your lab mates for help. Round 2's inventions can be worth up to twenty points to your lab. Obviously, doing well can go a long way toward making your lab the winner of *Eureka! Student Inventor*.

Before there's an invention, there's a problem that needs an invention to solve it. There are a lot of problems in the world—big, small, and everything in between—and those problems can come from a lot of places.

Note: Round 2 can also be done in pairs, or in the lab group. If so, adjust the language accordingly.

Play video: Why We Invent.

- In the video, Jacques and Professor Carver explain how they were inspired to create some of their greatest inventions.

Discuss video and call out Wheel of Invention skills.

Where did our judges find their inspiration for their inventions?

» Possible responses: Jacques didn't have to look further than his own love of the ocean. Professor Carver found inspiration in the needs of his community.

The first step in this project is to identify the problem you want to solve through inventing. As we have seen already, the world of invention is vast and limitless.

Think back to last week: what skills from the Wheel of Invention do you think we can use to identify a problem to solve with your invention?

» Possible responses:
Research: Read and ask others about problems.
Failure: Think about instances when you've failed or things haven't worked.

The judges agree! Here on *Eureka! Student Inventor*, research is our favorite way to get started in identifying a problem to solve with an invention. In the first round, we were lucky enough to get expert research advice from other inventors. Today we'll ask ordinary (and not-so-ordinary) people about their lives as we research what problems need solving.

Check for Understanding

During the discussion, check that students understand how inventors draw on different sources of inspiration and that they understand the skills they learned in the Quest so far. Poll students about why RESEARCH is an important skill.

AN INVENTING OPPORTUNITY (30 MIN.)

Play video: Man on the Street.

Judges conduct *"man on the street"* interviews, asking people what they find frustrating, what slows them down, what problems they would like to see solved for themselves, and what problems need solving in their community.

Introduce interview activity.

That's a lot of ideas, but I'm sure you have things you care about personally, too! In a minute you'll pair off with one of your lab mates and, using the video as a model, interview each other to try to discover problems and opportunities that warrant the attention of inventors.

Brainstorm good questions to ask and write them on the board.

Some possible questions include:

1. When is a time you were frustrated this week at home? At school?
2. What is something you wish you could do faster?

3. What is something you find boring that you wish someone else would just do for you?

4. What is something you find fun that you would like to do more of?

5. What is something you saw someone else having trouble with today?

6. What is a problem you would like to tell the president about? The mayor of your town? The principal of your school?

- Have students pair off within their labs and interview each other using "Problem Research: Interviews" (Activity Page 8.1) in their *Inventor's Notebooks*.
    - First ask students to identify three of the questions that they find the most interesting.
    - Allow five minutes for students to answer the questions for themselves in writing.
    - Have students pair off to interview each other and write down their partner's answers to their questions.
    - Keep watch on the time. Halfway through the pair-share, remind students to switch and allow the other person to interview.

Activity Page 8.1

Check for Understanding

Circulate to make sure pairs are following the interview format, and writing down their partner's answers.

- If time allows, bring the class together and ask a couple of students to share an idea they heard during their interview.

Inventor's Notebook

ACTIVITY 8.1

Name: ____________________

Date: ____________________

PROBLEM RESEARCH: INTERVIEWS

Select three questions from the question bank. First interview yourself. Then interview one of your lab mates.

Question 1:

My answer:

Lab mate's answer:

Question 2:

My answer:

Lab mate's answer:

Question 3:

My answer:

Lab mate's answer:

WHAT SHOULD MY INVENTION SOLVE? (15 MIN.)

Establish criteria for choosing a problem.

As we saw from our judges, a strong invention begins with a clear idea of the problem you are solving. So, we need to focus on what problems you want to solve and WHY. Let's first establish some criteria you will use to choose your problem. Remember, you will be inventing a realistic solution to this problem. That means you cannot rely on magic! This is reality TV, not science fiction!

Pick-a-Problem Challenge

- As a class, decide the criteria for selecting the problems contestants will address, and write them on the board.

  Note: We suggest that you preselect a few criteria for selecting problems, based on your students, classroom resources, and priorities. Some possible criteria to select problems might include:

1. Do a lot of people deal with this problem? (Everyone brushes their teeth and could use an improved toothbrush. Fewer people have snakes for pets and need new snake toys.)
2. Is it a big or a small problem? (Spilling your cereal is annoying, but easy to clean up. Not knowing that something is poisonous is very dangerous!)
3. Is it an interesting problem? We're still trying to make good TV!
4. Is it a problem you care passionately about?
5. Is it a problem you think you can invent a solution to (maybe only a partial solution, of course) in three episodes?
6. If they will build: Is it something you can build a solution to with the resources available?

- Specify to students what they will be expected to produce in Round 2 and what resources they will have to produce it. Possibilities include:
    - a working model of their invention
    - a nonworking model
    - a large, detailed diagram
- As a class, read through the "Pick-a-Problem Challenge" (Activity 8.2) in the *Inventor's Notebook*, and to provide a model, ask a few students what they might answer.
- Direct students to complete the "Pick-a-Problem Challenge" individually.
- If time allows, have students share the problems they selected with their labs.

ENGLISH LANGUAGE LEARNERS

Exchanging Ideas

Beginning
Prompt the interview. Whose turn is it to ask questions? Which question are you asking? What are some problems you thought about during our discussion? Are you taking notes about ___'s answers?

Intermediate
Prompt interviews to keep the conversation moving: Have both of you shared your ideas? Which questions are left? What ideas are you getting from this conversation?

Advanced/ Advanced High
Check that both students are participating in the interview and taking turns.

ELPS 2.C; ELPS 3.E; ELPS 3.G

Activity Page 8.2

ACTIVITY 8.2

Name: ______________________

Date: ______________________

PICK A PROBLEM CHALLENGE

1. What problem will you solve with your invention?

____

____

____

2. Why did you choose that problem?

____

____

____

____

____

3. What criteria does it meet?

4. How does it meet those criteria?

BRAINSTORMING (10 MIN.)

Introduce "Inventing-from-Scratch Tips"

Now that you all know the problem you want to solve, it's time to start imagining your invention! So relax and let your creativity take over—inventing should be fun.

You should come up with at least two approaches to the problem.

There is always the danger of getting a little stuck when you are doing creative work, so Professor Carver has some tips for you in your *Inventor's Notebook*.

- Read "Inventing-from-Scratch Tips" (Activity Page 8.3).

Activity Page 8.3

Challenge

Have students turn and talk with a peer to discuss the two ideas they have for solving the problem.

ACTIVITY 8.3

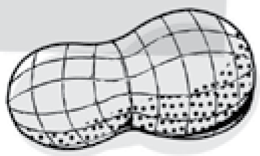
Introduction to Professor Carver's Inventing-from-scratch Tips:

Inventing is fun, but inventing is also hard work. Sometimes you have more ideas than you can write down. This note is not about those times.

This is for those days when you are stuck. We have all had those days. All two hundred uses for the peanut did not come to me in a burst of lightning inspiration from on high. Neither did all hundred-plus uses for the sweet potato! (Why does no one care about the sweet potato? Please, I beg of you, ask your cafeteria workers to see if they can provide you with some nutritious and delicious sweet potatoes!)

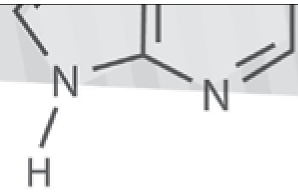
I know that it can be very scary to be brainstorming and find yourself out of ideas. When you are stuck, think back to Round 1.

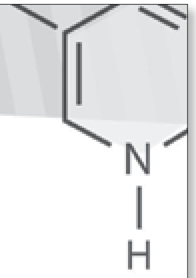
George Washington Carver



8.3

PROFESSOR CARVER'S
INVENTING-FROM-SCRATCH TIPS





- [ ] Think about the inventors you read about—where did their inspirations come from?

- [ ] Think about the inventions you studied and how invention breeds invention—is there an invention that already exists that could solve your problem if you built on it or changed it?

- [ ] Think about simple machines and give yourself a challenge: if you were going to solve your problem using one of the simple machines, how could you do it?

Transition to brainstorming.

> With those inspiring words, go do some brainstorming! I can't wait to see what you come up with.

Activity Page 8.4

- Have students open their *Inventor's Notebooks* to Activity Page 8.4 and complete the brainstorming activity.
- Remind students they have completed brainstorming throughout the Quest. Today's brainstorm is the most important, because it is for their own invention idea.
- Let students know they will have more time tomorrow to plan and document their invention. The objective now is to begin the process by getting a few ideas on the page.
    - In their brainstorming, encourage students to develop questions about the invention that they do not have answers for. Their labs can help with this later.

Note: You may want to ask students to answer a few set questions on their brainstorming worksheets this time, so the "judges" have something easier to read and respond to after class. Those questions could include:

1. What does your invention do?
2. How does it work?

Inventor's Notebook

ACTIVITY 8.4

Name: ______________________

Date: ______________________

INVENTION BRAINSTORMING!

Idea #: ______________ Date: __________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

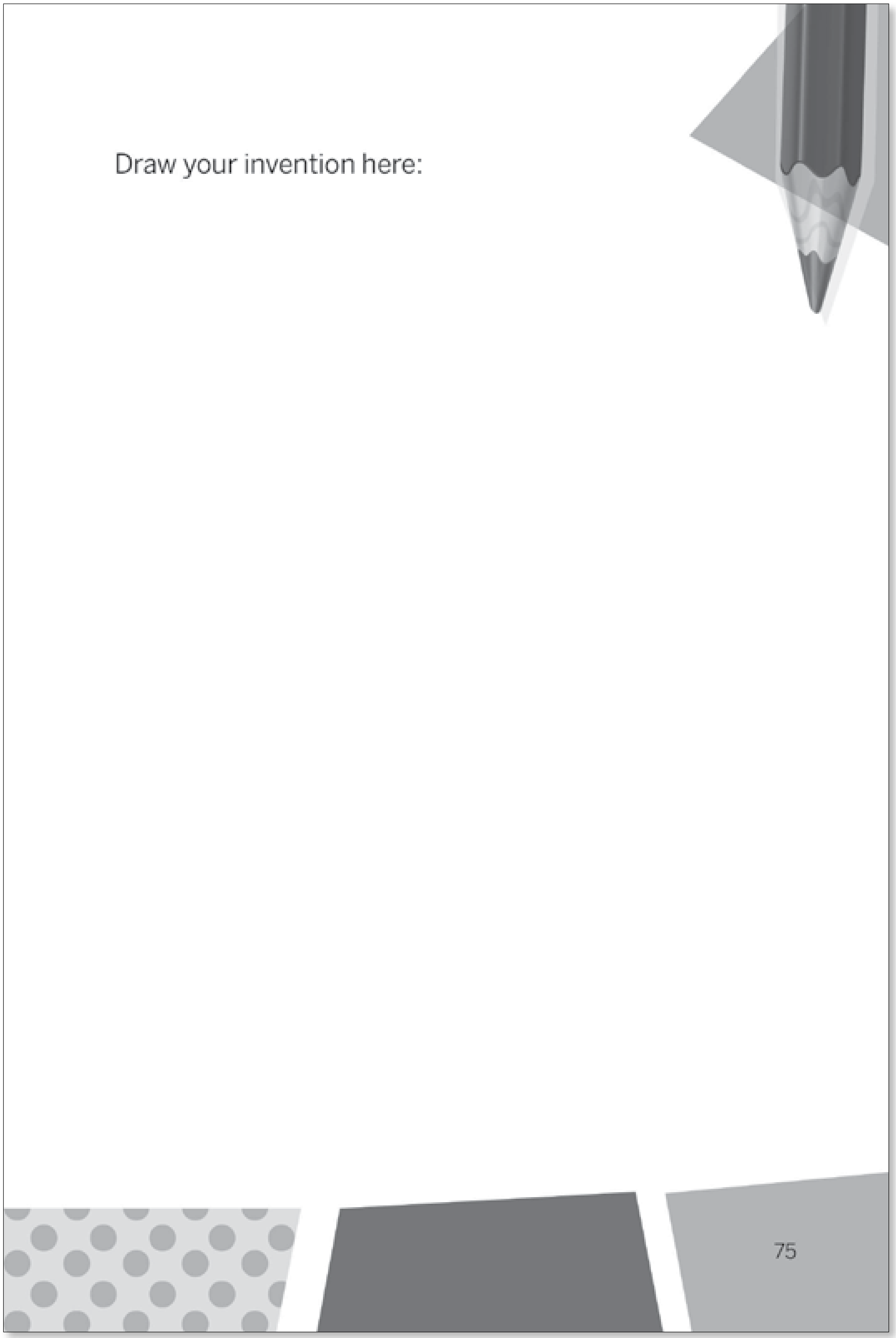
How does it work?

____

____

____

74



Draw your invention here:

75

ENGLISH LANGUAGE LEARNERS

Writing

Beginning
Provide sentence frames: A problem I would like to solve is ___. I am choosing to solve this problem because I believe ___.How is this problem ___(big/small/interesting /something you care about, etc.)?

Intermediate
Offer sentence frames. Help students address the criteria you have preselected.

Advanced/ Advanced High
Check that students understand the prompts and the criteria you are using the focus on problems. Prompt for longer answers and complete sentences.

ELPS 5.B; ELPS 5.G

Collect notebooks.

The judges have graciously agreed to take a look at your brainstorming tonight so you can make your inventions even better tomorrow. I will collect your *Inventor's Notebooks* now.

CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Introduce "Introspective Inventors."

We're coming to the end of the episode, so take the next two minutes to wrap up whatever you're working on.

It may be Round 2, but we're still interested in "Introspective Inventors." Do we have a volunteer for an interview for the viewers at home?

- Invite a student to come to the front of the room and "face the camera, for the audience at home." Ask two or three questions, which might include:

1. How is choosing a problem you want to solve different from solving a problem you're given?
2. What are you most excited about for tomorrow?

Sign-off

Please join us next time for another action-packed episode of *Eureka!*, and until then, remember Judge Edison's words of wisdom: "Have a great idea. Have a lot of them."

After Class

- Review Activity Page 8.4 brainstorming. Feedback from "the judges" in the form of comments made in the various judges' voices. This feedback will be very important for students to develop their inventions in the next lessons.

ENGLISH LANGUAGE LEARNERS

Writing

Beginning
Clarify specific questions for the Judges. Provide sentence frames: The problem my invention will address is ___. The materials needed to build this invention are ___. How will it ___? I am not certain how to ___.

Intermediate
Offer sentence frames. Encourage students to describe their invention, to consider thoughtful questions, and to draw an illustration.

Advanced/ Advanced High
Check that students understand the prompts. Offer support for longer answers and complete sentences.

ELPS 2.D; ELPS 5.B; ELPS 5.G

- Review and provide feedback on students' writing about the problems they want to solve. As you review Activity Page 8.4, consider how one or more of the judges might respond to the ideas students have come up with. Writing as one of the judges, prompt students to think about whether the solution they have identified really addresses the problem or whether they can successfully "pitch" it later on.

LESSON

9

Final Challenge Part 1—Invent!

PRIMARY FOCUS OF LESSON

Writing

Students will write a detailed explanation of their invention, including an argument for its importance. TEKS 4.12.C

Speaking and Listening

Students will listen to classmates, pose questions, and offer constructive feedback on their peers' inventions. TEKS 4.1.A; TEKS 4.13.A

Students will write, rehearse, and create illustrations or models for their final invention pitch. TEKS 4.9.F; TEKS 4.12.C; TEKS 4.13.H

Students will discuss and choose audio recordings to enhance their final presentations. TEKS 4.9.F

FORMATIVE ASSESSMENT

Activity Page 9.1	**Draft Invention** Write detailed descriptions of their invention, including arguments for its importance. TEKS 4.12.C
Activity Page 9.2	**Write Pitch: Writing Scripts** Write a script for their invention pitch. TEKS 4.12.C

TEKS 4.12.C Compose argumentative texts, including opinion essays, using genre characteristics and craft; **TEKS 4.1.A** Listen actively, ask relevant question to clarify information, and make pertinent comments; **TEKS 4.13.A** Generate and clarify questions on a topic for formal and informal inquiry; **TEKS 4.9.F** Recognize characteristics of multimodal and digital texts; **TEKS 4.13.H** Use an appropriate mode of delivery, whether written, oral, or multimodal, to present results.

LESSON AT A GLANCE

	Time	Materials
Episode 9 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ Light Bulb of Glory ❏ *Inventor's Notebook* ❏ building materials
Draft Invention	15 min.	
Lab Feedback	10 min.	
Model Building/Diagram Drawing	25 min.	
Pitch Review	5 min.	
Write Pitch	25 min.	
Closing: "Introspective Inventors"	5 min.	

EPISODE OVERVIEW

Students use their brainstorming notes from the previous day to draft their inventions, receive feedback from their peers, make revisions, and prepare for their final presentations.

ADVANCE PREPARATION

Read

- Review lesson script.
- Review students' brainstorming from Episode 8 in *Inventor's Notebooks* and offer feedback and improvement ideas for today.

Customize

- Using criteria you established for final inventions, review questions for today's "Lab Feedback" segment.
- Confirm the format you are using for your concluding presentations, which can be based on your time and resources. Possible formats include:
    1. Follow science-fair model—lab members set up tables with their inventions. Half the group stays with the inventions to present and answer questions, while the other half visits other labs.
    2. Invite parents or other teachers or staff to come to class and play the role of "network executives" checking up on the contestants.
    3. Have students participate in a "parade of invention"—each student looks into the "camera" and does a super-mini-pitch (name of invention plus slogan).
- Create an invention catalog with all the inventions included.
- Establish scoring for final inventions (see Model Building/Diagram Drawing for suggestions). We have provided a possible rubric for you to use or adapt in the lesson.
- Tailor your Pitch Review instructions to fit with the final presentation format you have chosen.

Prop Master

- Based on the problem criteria you established for final inventions in Episode 8, assemble building/craft materials to create final inventions and presentations.
- Test audio and video resources.

- Ensure students have access to equipment for recording audio.
- Prepare to project the "Image of the Day."

Universal Access

- Prepare sentence frames to support Activity Page 9.1:
    - The purpose of my invention is to ___.
    - It can be used by (who), in (where)?
    - It is the same size as a ___.
    - The materials needed to build this invention are: ___.
- Prepare sentence frames to support Activity Page 9.2:
    - My invention is called the ___.
    - It solves the problem of ___ by ___.
    - The way it works is ___.
    - It is an important invention because ___.
    - An example of a situation where this invention is needed is ___.
    - My slogan for the invention is "___."

Start Lesson

Episode 9: Final Challenge Part 1

Invent!

90M

Primary Focus: Students will write a detailed explanation of their invention, including an argument for its importance. **TEKS 4.12.C**

Students will listen to classmates, pose questions, and offer constructive feedback on their peers' inventions. **TEKS 4.1.A; TEKS 4.13.A**

Students will write, rehearse, and create illustrations or models for their final invention pitch. **TEKS 4.9.F; TEKS 4.12.C; TEKS 4.13.H**

Students will discuss and choose audio recordings to enhance their oral presentations. **TEKS 4.9.F**

INTRODUCTION (5 MIN.)

Play audio: Opening.

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor*—where puppets pull the strings and "making it work" is only the beginning.*

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!*

Housekeeping

- Return *Inventor's Notebooks*.
- Collect any bonus inventor cards students made and award points for them.
- Assign a building manager for each lab for the episode (if necessary).
- Award the "Light Bulb of Glory" to the leading lab.

TEKS 4.12.C Compose argumentative texts, including opinion essays, using genre characteristics and craft; **TEKS 4.1.A** Listen actively, ask relevant question to clarify information, and make pertinent comments; **TEKS 4.13.A** Generate and clarify questions on a topic for formal and informal inquiry; **TEKS 4.9.F** Recognize characteristics of multimodal and digital texts; **TEKS 4.13.H** Use an appropriate mode of delivery, whether written, oral, or multimodal, to present results.

Overview of Episode 9

Welcome to Episode 9. It's just you and me today, contestants—the judges were called to network headquarters to make a final plea for the show, but not before they looked at your brainstorming.

Yesterday you identified your problem and began to invent your solution, when you brainstormed individually. Today you INVENT some more, and prepare to share your inventions tomorrow. On the Wheel of Invention, we'll be drawing heavily on DOCUMENTATION and PITCHING, as well as on our old pal COLLABORATION, who is always with us.

Support

Have students review the definitions of invent, documentation, and collaboration.

DRAFT INVENTION (15 MIN.)

Introduce invention drafting.

Armed with your brainstorming, a fresh eye, and the Judges' Notes, it's time to make your invention more specific. Complete the draft of your Round 2 invention using your best documenting skills, so you can share your ideas with your lab.

Activity Page 9.1

- Have students open *Inventor's Notebooks* to "Draft Invention" (Activity Page 9.1) and complete the first part.

Inventor's Notebook

ACTIVITY 9.1

Name: ______________________________

Date: ______________________________

ROUND 2 INVENTION DRAFT

Draw a diagram of your draft and label as much of it as possible.

78

Draw your invention here:

79

Specs:

1. What does your invention do?

2. Who uses your invention? Where?

3. How big is your invention?

4. What materials are used to build your invention?

Lab feedback (wait to complete this until directed)

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ENGLISH LANGUAGE LEARNERS

Writing

Beginning

Provide sentence frames to support student writing: The purpose of my invention is ___. It can be used by (who), in (where)? It is the same size as a ___. The materials needed to build this invention are: ___.

Intermediate

Offer sentence frames. Help students understand the importance of describing how their invention works, who uses it, and how it would be constructed.

Advanced/ Advanced High

Check that students understand the prompt for details, specificity, and longer explanations.

ELPS 5.B; ELPS 5.G

LAB FEEDBACK (10 MIN.)

Introduce peer-feedback model.

> Now that you've drafted your invention, let's make full use of your lab mates. You'll share your drafts and get constructive criticism for your revision.

> What are some of the questions we might ask lab mates to help improve our inventions?

On the board, write:

- As a class, brainstorm good questions to ask lab mates. These will vary depending on the requirements you have established, but might include:
  1. What is unclear in my drawing?
  2. What is your favorite part of my invention?
- Have students share their drafts with lab members, and record their suggestions in Round 2 of the *Inventor's Notebook* page "Draft Invention" (Activity Page 9.1).

Check for Understanding

Circulate and observe the group lab feedback discussions. Make sure each student has a chance to share their invention, using their draft to support the discussion, and that other lab members are providing constructive feedback.

MODEL BUILDING/DIAGRAM DRAWING (25 MIN.)

Explain parameters of building and presenting in Round 2.

> You've shared your inventions with your lab mates and have some good feedback for revision. Now it's time to think about how you will share them with the judges and the TV audience tomorrow! First, of course, you'll need to create something that will allow them to see your invention.

- Remind students of the building requirements you have determined for the invention (i.e., models, diagrams, etc.).
- Remind students the format of the presentations (Possibilities are suggested in the Advanced Preparation section of this Teacher Guide.)
- Have the contestants build their models or create their large diagrams in preparation for Episode 10.

Check for Understanding

Circulate and ensure students are working on inventions. If students are stuck, ask questions or offer suggestions to help figure out the next step they can take.

PITCH REVIEW (5 MIN.)

On the board, write:

- Explain the scoring system that will be used to judge the presentations, and write the criteria on the board. These might include:

  1. organization of content
  2. explaining invention with clarity and detail
  3. demonstration of diagram/model
  4. presentation (voice, eye contact, enthusiasm)

  Note: We have provided a rubric you may use to evaluate the pitches, or you may adapt it for your classroom based on the format you choose for the pitches.

Check for Understanding

Ensure that students understand the format of the pitches, and the criteria they will be judged on. Invite a few students to review the format with the class, and allow students to ask clarifying questions about the format or judging criteria.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening
Exchanging Information/Ideas

Beginning
Prompt student conversation: Who is presenting their draft now? Can someone make a suggestion about how to make the drawing clearer? Can someone share your favorite part of this invention? Does someone else have another improvement idea to share?

Intermediate
Prompt student conversation: Has everyone shared their draft? What improvements can you suggest?

Advanced/ Advanced High
Ensure all students are participating, and if not, prompt nonspeaking students to participate.

ELPS 2.C; ELPS 3.E; ELPS 3.I

Judges' Rubric for Final Pitches

Judges' Rubric for Final Pitches (20 points maximum)				
	Exemplary (4-5 pts.)	**Strong (3 pts.)**	**Developing (2 pts.)**	**Beginning (0-1 pt.)**
Content Organization	Pitch has a clear beginning, middle, and end, including a strong slogan. Content is well organized.	Pitch is fairly organized, but lacks a strong intro or concluding slogan.	Organization of content is unclear. Lacks intro and conclusion.	Content is relayed without any organization or preparation.
Content: Purpose and Function of Invention	Provides a detailed explanation of the invention, the problem it addresses, how it works, why it is important, and includes a clear example.	Clearly explains the invention, the problem it addresses, how it works, and why it is important, with light details or examples.	Introduces the invention, problem it addresses, and sense of importance. Lacks details and examples.	Does not fully explain invention, and/or the problem it addresses, and/or why it is important. No supporting details or examples.
Demonstration of Model or Diagram	Pitch is supported by a clear diagram or fully-developed model. Student describes the purpose of this illustration clearly.	Pitch includes a clear diagram or model. Some details are missing, or pitch does not fully describe all components of the model/diagram.	Diagram or model lacks detail or clarity. Pitch does not clearly explain the diagram or model.	Diagram/model is missing or incomplete. Student is unable to explain the diagram.
Presentation Skills	Voice is always audible and clear. Constant eye contact. Student maintains a sense of confidence and enthusiasm.	Voice is mostly audible/clear. Some eye contact. Student seems moderately confident and enthusiastic.	Voice varies from audible/clear to occasional mumbling or dropped words. Eye contact is inconsistent. Student is hesitant, shy, or lacks enthusiasm.	Voice is unclear, mumbling. Student rarely makes eye contact. Little confidence or enthusiasm on display.

Review pitching.

> Now that you have an invention to share, how will you pitch it? Think back to your pitching wedge from last week. What are some of the things that make a good pitch? Remember the two things to think about—what you say and how you say it.

Review (and write on the board) the qualities of good and bad pitches and "Hedy Lamarr's Rules for Pitching."

	Good Pitch	**Bad Pitch**
What You Say (Content)	many facts, well organized, interesting, surprising, reasonably drawn conclusion based on facts	boring, scattered
How You Say It (Presentation)	good eye contact, easy to understand, loud enough, energy	monotone, mumbling, too quiet

- Read "Hedy Lamarr's Pitch Planner: Round 2" (*Inventor's Notebook*, Activity Page 9.2) together.

Note: Depending on the presentation format you have selected for Episode 10, you may wish to adapt these pitch-planning requirements. For the "science fair" model, students might prepare a whole pitch for visitors to their table. If students are working in larger groups and you have time, you might add the requirement for a skit or advertisement.

Explain that a good presentation or pitch involves a multimodal approach, or using different modes of communication. This means that the pitch could contain written, oral, digital, and audio materials. Help students brainstorm ways they could make their pitch multimodal—for example, using posters, charts, graphs, models, music, sound effects, video, photographs, and so on. **TEKS 4.9.F**

TEKS 4.9.F Recognize characteristics of multimodal and digital texts.

Challenge

Have students illustrate examples of good and bad pitches. For example, students might demonstrate speaking in a monotone as an example of a characteristic of a bad pitch.

Activity Page 9.2

ACTIVITY 9.2

Name: ______________________________

Date: ______________________________

HEDY LAMARR'S PITCH PLANNER: ROUND 2

1. The name of your invention:

____

2. What problem it solves:

____

____

____

3. How it works:

____

____

____

____

____

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4. Why is it an important invention? Include at least one example of a scenario in which your invention is needed.

5. A slogan for your invention—a catchy sentence that will grab your audience's attention and help people remember your invention:

WRITE PITCH (25 MIN.)

Start students on writing and rehearsing their pitches.

OK, inventors—go get ready to sell us on your inventions! And remember, your pitches will be judged not only on your content, but the strength of your presentations.

Also, remember that when you pitched your "lab name" invention, you included audio recordings. We started by brainstorming audio ideas for a light bulb pitch, and then you came up with some great audio for your own pitches. The judges were very impressed and would like you to include audio in your final presentations as well. It could be a song or background music, some sound effects, or even something original that your lab records. Just make sure it engages your audience and ties in to your invention. Okay, get busy.

- Have students write their pitches and practice them with their lab mates.
- Once they have written their pitches (Activity 9.2), students should rehearse presenting their inventions.
- A possible rehearsal format is to have students rehearse in pairs or in labs. Ask partners to watch the pitch and give feedback based on the judges' criteria you put on the board.
- Remind the labs that one member should be responsible for ensuring the group has access, as necessary, to digital or physical audio recordings that will be part of their Episode 10 presentations.

Note: When multiple students are rehearsing, it is all right if the classroom gets noisier and it may seem disorganized. By circulating, you can ensure students are on-task and encourage them to focus on their own presentations.

Check for Understanding

Ensure that students use some of this time to rehearse their pitches, in pairs or small groups. They should also practice presenting their models or illustrations. Encourage them to stand up and imagine they are speaking for the judges and the network executives. Encourage partners to provide feedback using the judges' criteria.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening

Presenting

Beginning
Provide supports: My invention is called ___. It solves the problem of ___ by ___. The way it works is ___. It is important because ___.

Intermediate
Support students to prepare their pitch, reminding them these are the notes they will use to help them.

Advanced/ Advanced High
Check that students understand the prompt for details, specificity, and longer explanations. Remind them to rehearse with you or each other.

ELPS 3.F; ELPS 3.I

CLOSING: "INTROSPECTIVE INVENTORS" (5 MIN.)

Introduce "Introspective Inventors."

This is really it. One more episode! I, for one, cannot wait to hear these pitches tomorrow!! Maybe excitement about the pitches will help distract me from worrying about what the network is going to say.

Let's have a final round of "Introspective Inventors," for old times' sake:

- Invite a student to come to the front of the room and "face the camera, for the audience at home." Ask two or three questions, which might include:

1. How did the earlier challenges on *Eureka!* help you today?
2. What was the best advice you received from someone else about your invention?
3. What are you most excited about for tomorrow?
4. Which Judge do you think will like your invention the best, and why?

Sign-off

Please join us next time for our FINAL action-packed episode of *Eureka! Student Inventor*. Until then, remember Judge Edison's words of wisdom: "Have a great idea. Have a lot of them."

EPISODE

10

Final Challenge Part 2—Pitch Your Invention!

PRIMARY FOCUS OF LESSON

Speaking and Listening

Students will present their invention, explaining how it addresses a problem and how it works, and supporting their pitch with a diagram or model demonstration. TEKS 4.1.C; TEKS 4.11.E; TEKS 4.13.H

Writing

Students will write a reflection on their experiences during this unit, including a description of their invention and reflection on a challenge they faced and overcame. TEKS 4.12.B; TEKS 4.13.E

FORMATIVE ASSESSMENT

Judges' Rubric for Invention Pitches	**Pitching, However You So Choose** Make a final presentation about their invention, evaluated with determined criteria. TEKS 4.1.C; TEKS 4.13.H
Activity Page 10.1	**Make Your Own Inventor Card** Describe and reflect on their experience with inventing. TEKS 4.12.B; TEKS 4.13.E

TEKS 4.1.C Express an opinion supported by accurate information, employing eye contact, speaking rate, volume, and enunciation, and the conventions of language to communicate ideas effectively; **TEKS 4.11.E** Publish written work for appropriate audiences; **TEKS 4.13.H** Use an appropriate mode of delivery whether written, oral, or multimodal, to present results; **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft; **TEKS 4.13.E** Demonstrate understanding of information gathered.

LESSON AT A GLANCE

	Time	Materials
Episode 10 (90 min.)		
Introduction	5 min.	❏ Audio: Opening ❏ building materials/models from yesterday ❏ *Inventor's Notebook* ❏ Judges' Rubric for Final Pitches ❏ Video: *Eureka Survives!* (Digital Components) ❏ Video: Dancing Judges ❏ Winners' certificates (Digital Components)
Review/Setup	10 min.	
Pitching, However You So Choose	50 min.	
Finale Video	5 min.	
Make Your Own Inventor Card	10 min.	
Grand Finale Festivities	10 min.	

EPISODE OVERVIEW

Students present their final inventions to the class, the winner of *Eureka!* is declared, and the future of the series is saved.

ADVANCE PREPARATION

Read

- Review lesson and video scripts.

Customize

- Make sure you have the rubrics you need to score final inventions, using criteria established in Episode 9. If you are sharing rubrics with students, prepare copies for them.

Note: The system we provide gives a maximum of 20 points per student. These can then be averaged amongst lab members, so the lab total is an average of the individuals, with a top score of 20.

- Set up classroom for final pitches.
- Determine how much time each student will have to pitch.
- Recruit additional audience members for final pitches, if applicable. They may play the role of Studio Executives, or Special Guest Judges.

Prop Master

- Print winners' certificates, available online.
- Test audio and video resources.
- Ensure students have access to equipment for playing audio.

Universal Access

- Prepare sentence frames for students' inventor cards:
    - My invention is called ___.
    - It can help people by ___.
    - A challenge I've had to overcome was ___.
    - As a result of this challenge, I learned how to ___.

Start Lesson

Episode 10: Final Challenge Part 2

Finale!

90M

Primary Focus: Students will present their invention, explaining how it addresses a problem and how it works, and supporting their pitch with a diagram or model demonstration. **TEKS 4.1.C; TEKS 4.11.E; TEKS 4.13.H**

Students will write a reflection on their experiences during this unit, including a description of their invention and reflection on a challenge they faced and overcame. **TEKS 4.12.B; TEKS 4.13.E**

INTRODUCTION (5 MIN.) **TEKS 4.11.E; TEKS 4.13.H**

Play audio: Opening

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has 10 episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better—as inventors. This is the world of the reality game show Eureka! Student Inventor*—where puppets pull the strings and "making it work" is only the beginning.*

"Last Time, on *Eureka!*"

- Ask one or two students to recap what happened last time on *Eureka!*

Welcome and update on show's status.

> Welcome to the episode we've all been waiting for. This could be the last time we do this, depending on how that meeting with the network went yesterday.
>
> What's that? I'm getting a call . . .

TEKS 4.1.C Express an opinion supported by accurate information, employing eye contact, speaking rate, volume, and enunciation, and the conventions of language to communicate ideas effectively; **TEKS 4.11.E** Publish written work for appropriate audiences; **TEKS 4.13.H** Use an appropriate mode of delivery whether written, oral, or multimodal, to present results: **TEKS 4.12.B** Compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft; **TEKS 4.13.E** Demonstrate understanding of information gathered.

Judges' Rubric for Invention Pitches

Support

Review the qualities of a good pitch, paying particular attention to things such as volume, intonation, and other elements beyond content.

ENGLISH LANGUAGE LEARNERS

Speaking and Listening

Presenting

Beginning

During the pitches, prompt students to include all aspects of the rubric. Ask, "What is your invention? What problem does it solve? How does it work? Why is it important? Can you share your model/diagram?"

Intermediate

During the pitches, provide light prompting to students to include all aspects of the rubric.

Advanced/ Advanced High

During the pitches, provide light prompting to students, to include all aspects of the rubric, as needed.

ELPS 3.H; ELPS 3.I

Inventors, I hate to put more pressure on you. But I just got word from the judges, who are en route. They are bringing the network executives WITH them. The judges swear they made a great case, but the producers want to see *Eureka!* live for themselves. These pitches will not only determine who goes home with the glory of winning *Eureka! Student Inventor*, they will also determine whether this show survives. Let's make it count!

REVIEW/SETUP (10 MIN.)

Note: Depending on how you decide to have students present their inventions, they might want to set up, do a final round of practice, etc., before they get started.

- Tell students how much time they have to present.
- Explain the criteria that the Judges will use to evaluate the pitches, based on what you have determined. You may choose to distribute the rubric provided in Episode 9, or post it on the board for students to see.

PITCHING, HOWEVER YOU SO CHOOSE (50 MIN.)

- Students present their inventions and invention pitches.
- As they present, complete the rubric you have chosen evaluating the presentation on your predetermined criteria.

FINALE VIDEO (5 MIN.)

Play video: *Eureka Survives!*

The judges congratulate all the contestants and joyfully announce the renewal of *Eureka! Student Inventor* for another season. George Washington Carver explains that, because students saved the show with their careful and clever inventing, he would like to use all of them as examples in the research portion of future seasons, so they should make themselves inventor cards.

Celebrate success and instruct students to create their own inventor cards.

> Congratulations!! There is no question—this season minted [number of students in your class] brand-new, high-quality inventors. You heard the man: You deserve your very own inventor cards. If you open your *Inventor's Notebook* to Activity Page 10.1, you can make them while the judges deliberate. They have a tough decision ahead of them, so it might take a minute.

MAKE YOUR OWN INVENTOR CARD (10 MIN.)

- Students make inventor cards about themselves, each complete with a drawing.
- While students are writing, tabulate the points and determine the winners.
- Tabulate the lab scores for Round 2.
- Total scores = Wheel of Invention + Bonus Points + Round 2

Challenge

Ask students to brainstorm inventing challenges that next season's inventors should tackle on *Eureka!*

Activity Page 10.1

ENGLISH LANGUAGE LEARNERS

Writing

Beginning
Provide sentence frames to support student writing: My invention is called ___. It can help people by ___. A challenge I've had to overcome was ___. As a result of this challenge, I learned how to ___."

Intermediate
Support with sentence frames or clarify the prompts. Encourage students to write a detailed explanation of their invention, and to write specifically about a challenge they faced.

Advanced/ Advanced High
Prompt for longer answers and more details.

ELPS 5.B; ELPS 5.G

Inventor's Notebook

ACTIVITY 10.1

Name: ____________________

Date: ____________________

MAKE YOUR OWN INVENTOR CARD

Draw a picture of yourself...

____

Name: ______________________

Birth date: ______________________

Birthplace: ______________________

Invention(s):

____

____

____

____

Describe a challenge that you overcame.

____

____

____

____

GRAND FINALE FESTIVITIES (10 MIN.)

Wrap up, introduce final presentation of winners

Ladies and gentlemen. Boys and girls. Student inventors. Every season we set out to avoid disaster. We did that, but your ingenuity and hard work did far, far more. As Monsieur Cousteau says, we have all been on the boat together. You have used all your creative muscles. You have worked together. You have faced failures undaunted. It has been my honor to serve as your host and guide.

That said, some of your ideas were particularly strong THIS time, and you did a great job of pitching them.

Note: You may choose to present labs or individuals with special awards for best exemplifying the skills of invention as represented by the Wheel of Invention.

- Announce lab scores for Round 2.
- Announce the winning lab of this season on *Eureka!*
- Present winning lab with certificates.

Play video: Dancing Judges.

Sign-off

Well, folks. All I can say is: wow. Wow. You saved our show, and, more importantly, you put serious thought into solving some truly important problems. I can say with confidence that you're all winners here—I know, I know—but you are. You're all inventors. And happily, this is where it begins, not where it ends. I get choked up just thinking about all the things you're going to make, all the ways in which you'll change the world.

So that’s it, my friends. That was this season’s stunning finale of *Eureka!*

Until next time: “Have a great idea. Have a lot of them.”

Grade 4 | Unit 2

Glossary

A

abscesses, n. inflammations caused by bacteria

agricultural, adj. relating to farming

airborne, adj. in flight

antibiotic, n. a medicine that kills or stops the growth of diseased cells

antiseptics, n. substances that prevent the growth of disease-causing microorganisms

aquatic, adj. relating to water

arguably, adv. able to be supported by a reasonable argument

avid, adj. eager or excited

B

baboon, n. a kind of monkey

bacteriologist, n. a scientist who studies microscopic organisms that often cause disease

bigwigs, n. important people

boils, n. a painful skin condition

botanist, n. a scientist who studies plants

botany, n. the scientific study of plants

C

charred, adj. burnt

contaminated, adj. harmful or unusable due to contact with something unclean

crop rotation, n. yearly switching of which crops are grown on a piece of land

cultures, n. growths of microorganisms in a nutrient medium

cylinder, n. an object with identical flat ends and a circular or oval section

D

deliberately, adv. on purpose

deter, v. discourage

diaphragm, n. a thin disk or piece of material that vibrates when producing or receiving sound waves

digress, v. get off the subject

dim, adj. not bright

drawbacks, n. disadvantages, problems

E

ecosystems, n. systems formed by the interaction of communities of organisms with their environments

English Channel, n. a body of water separating England and France

evaporate, v. change from a liquid state into a vapor

F

fertile, adj. capable of producing healthy plants

financiers, n. people who give inventors money to develop and sell their products, in return for a portion of the profits

frequency, n. the rate at which radio signals are transmitted

G

greasy spoons, n. slang for cheap and unsanitary restaurants

H

heed, v. pay attention to

humble, adj. not significant; modest

I

illumination, n. brightness

indifference, n. lack of interest

inspire, adj. give rise to, lead to

intricate, adj. detailed, complicated

inventory, n. a complete list

irk, v. bother, irritate

irritation, n. the state of being annoyed

isolated, adj. far away from other places, buildings, or people; remote

M

malfunctioning, adj. not working properly

manure, n. a substance made from animal poop that is spread on plants to help them grow

marketing, n. activities involved in advertising and selling a product

O

optimistic, adj. expecting a favorable outcome

organisms, n. living things

P

parchment, n. animal skin prepared for use as a writing surface

patent, v. get a government license giving an inventor the right to be the only one to manufacture and sell their invention for a certain period of time

pendulum, n. a weighted, swinging lever that regulates the speed of a clock

petri dishes, n. shallow, circular, transparent dishes with flat lids, used for the culturing of microorganisms

phonograph, n. a machine that reproduces sound by means of a needle in contact with a grooved rotating disk

player piano, n. a piano fitted with an apparatus enabling it to be played automatically

potential, n. qualities or abilities that may be developed and lead to future success

practical, adj. useful

prestigious, adj. highly respected

primates, n. a category of mammals that includes humans, monkeys, and apes

producers, n. people who supervise a television production

profit, n. (often financial) gain

Q

***quelle guigne*, interj.** French for "what bad luck!"

***quelle merveille*, interj.** French for "how marvelous!"

R

rehabilitation, n. recovery

revolutionary, adj. bringing about major change

S

self-sufficient, adj. able to take care of oneself

sharecroppers, n. farmers who had to give part of their crop away as rent

simians, n. monkeys

spearhead, v. lead

Stone Age, n. a period in the history of mankind marked by the use of tools and weapons made of stone

stylus, n. a pointed, pen-shaped instrument used to make an imprint on a surface

sundial, n. an instrument showing the time with the shadow of a pointer cast by the sun onto a plate marked with the hours of the day

synchronized, adj. occurring at the same time

T

take root, v. begin

telegraph, n. a machine that transmitted and received messages across great distances using electrical signals and wires. Messages were transmitted in codes that had to be received and translated by specially trained operators

tinker, v. to work at something

transmitter, n. a set of equipment used to generate and transmit electromagnetic waves carrying messages or signals, especially those of radio or television

***très magnifique*, adj.** French for "really wonderful"

U

upshot, n. result

V

vaccines, n. medicines to make people immune to diseases

Unit 2

		Correlation—Teacher's Guide
(1) Developing and sustaining foundational language skills: listening, speaking, discussion, and thinking—oral language. The student develops oral language through listening, speaking, and discussion. The student is expected to:		
TEKS 4.1.A	listen actively, ask relevant questions to clarify information, and make pertinent comments	U2: p. 16; U2: p. 19; U2: p. 90; U2: p. 94; U2: p. 146; U2: p. 149; U2: p. 222; U2: p. 225; U2: p. 258; U2: p. 261; U2: p. 306; U2: p. 310
TEKS 4.1.B	follow, restate, and give oral instructions that involve a series of related sequences of action	
TEKS 4.1.C	express an opinion supported by accurate information, employing eye contact, speaking rate, volume, and enunciation, and the conventions of language to communicate ideas effectively	U2: p. 146; U2: p. 149; U2: p. 324; U2: p. 327
TEKS 4.1.D	work collaboratively with others to develop a plan of shared responsibilities	U2: p. 16; U2: p. 19; U2: p. 170; U2: p. 174; U2: p. 222; U2: p. 225; U2: p. 278; U2: p. 282
(2) Developing and sustaining foundational language skills: listening, speaking, reading, writing, and thinking—beginning reading and writing. The student develops word structure knowledge through phonological awareness, print concepts, phonics, and morphology to communicate, decode, and spell. The student is expected to:		
(A) demonstrate and apply phonetic knowledge by:		
TEKS 4.2.A.i	decoding words with specific orthographic patterns and rules, including regular and irregular plurals	
TEKS 4.2.A.ii	decoding multisyllabic words with closed syllables, open syllables, VCe syllables, vowel teams, including digraphs and diphthongs, r-controlled syllables, and final stable syllables	
TEKS 4.2.A.iii	decoding words using advanced knowledge of syllable division patterns such as VV	
TEKS 4.2.A.iv	decoding words using knowledge of prefixes	
TEKS 4.2.A.v	decoding words using knowledge of suffixes, including how they can change base words such as dropping e, changing y to i, and doubling final consonants	
TEKS 4.2.A.vi	identifying and reading high-frequency words from a research-based list	
(B) demonstrate and apply spelling knowledge by:		
TEKS 4.2.B.i	spelling multisyllabic words with closed syllables, open syllables, VCe syllables, vowel teams, including digraphs and diphthongs, r-controlled syllables, and final stable syllables	
TEKS 4.2.B.ii	spelling homophones	
TEKS 4.2.B.iii	spelling multisyllabic words with multiple sound-spelling patterns	
TEKS 4.2.B.iv	spelling words using advanced knowledge of syllable division patterns	
TEKS 4.2.B.v	spelling words using knowledge of prefixes	

Unit 2

		Correlation—Teacher's Guide
TEKS 4.2.B.vi	spelling words using knowledge of suffixes, including how they can change base words such as dropping e, changing y to i, and doubling final consonants	
TEKS 4.2.C	write legibly in cursive to complete assignments	
(3) Developing and sustaining foundational language skills: listening, speaking, reading, writing, and thinking—vocabulary. The student uses newly acquired vocabulary expressively. The student is expected to:		
TEKS 4.3.A	use print or digital resources to determine meaning, syllabication, and pronunciation	
TEKS 4.3.B	use context within and beyond a sentence to determine the relevant meaning of unfamiliar words or multiple-meaning words	
TEKS 4.3.C	determine the meaning of and use words with affixes such as *mis-, sub-, -ment,* and *-ity/ty* and roots such as auto, graph, and meter	
TEKS 4.3.D	identify, use, and explain the meaning of homophones such as reign/rain	
(4) Developing and sustaining foundational language skills: listening, speaking, reading, writing, and thinking—fluency. The student reads grade-level text with fluency and comprehension. The student is expected to use appropriate fluency (rate, accuracy, and prosody) when reading grade-level text.		
TEKS 4.4	use appropriate fluency (rate, accuracy, and prosody) when reading grade-level text	
(5) Developing and sustaining foundational language skills: listening, speaking, reading, writing , and thinking—self-sustained reading. The student reads grade-appropriate texts independently. The student is expected to self-select text and read independently for a sustained period of time.		
TEKS 4.5	self-select text and read independently for a sustained period of time	
(6) Comprehension skills: listening, speaking, reading, writing, and thinking using multiple texts. The student uses metacognitive skills to both develop and deepen comprehension of increasingly complex texts. The student is expected to:		
TEKS 4.6.A	establish purpose for reading assigned and self-selected texts	
TEKS 4.6.B	generate questions about text before, during, and after reading to deepen understanding and gain information	
TEKS 4.6.C	make, correct, or confirm predictions using text features, characteristics of genre, and structures	
TEKS 4.6.D	create mental images to deepen understanding	
TEKS 4.6.E	make connections to personal experiences, ideas in other texts, and society	
TEKS 4.6.F	make inferences and use evidence to support understanding	
TEKS 4.6.G	evaluate details read to determine key ideas	U2: p. 16; U2: p. 19; U2: p. 56; U2: p. 61; U2: p. 90; U2: p. 94; U2: p. 170; U2: p. 174
TEKS 4.6.H	synthesize information to create new understanding	U2: p. 16; U2: p. 19; U2: p. 170; U2: p. 174

Unit 2		Correlation—Teacher's Guide
TEKS 4.6.I	monitor comprehension and make adjustments such as re-reading, using background knowledge, asking questions, and annotating when understanding breaks down	
(7) Response skills: listening, speaking, reading, writing, and thinking using multiple texts. The student responds to an increasingly challenging variety of sources that are read, heard, or viewed. The student is expected to:		
TEKS 4.7.A	describe personal connections to a variety of sources including self-selected texts	
TEKS 4.7.B	write responses that demonstrate understanding of texts, including comparing and contrasting ideas across a variety of sources	U2: p. 170; U2: p. 174
TEKS 4.7.C	use text evidence to support an appropriate response	U2: p. 56; U2: p. 61; U2: p. 90; U2: p. 94
TEKS 4.7.D	retell, paraphrase or summarize texts in ways that maintain meaning and logical order	U2: p. 56; U2: p. 61
TEKS 4.7.E	interact with sources in meaningful ways such as notetaking, annotating, freewriting, or illustrating	U2: p. 56; U2: p. 61; U2: p. 146; U2: p. 149
TEKS 4.7.F	Respond using newly acquired vocabulary as appropriate	U2: p. 90; U2: p. 94
TEKS 4.7.G	discuss specific ideas in the text that are important to the meaning	
(8) Multiple genres: listening, speaking, reading, writing, and thinking using multiple texts—literary elements. The student recognizes and analyzes literary elements within and across increasingly complex traditional, contemporary, classical, and diverse literary texts. The student is expected to:		
TEKS 4.8.A	infer basic themes supported by text evidence	
TEKS 4.8.B	explain the interactions of the characters and the changes they undergo	
TEKS 4.8.C	analyze plot elements, including the rising action, climax, falling action, and resolution	
TEKS 4.8.D	explain the influence of the setting, including historical and cultural settings, on the plot	
(9) Multiple genres: listening, speaking, reading, writing, and thinking using multiple texts—genres. The student recognizes and analyzes genre-specific characteristics, structures, and purposes within and across increasingly complex traditional, contemporary, classical, and diverse texts. The student is expected to:		
TEKS 4.9.A	demonstrate knowledge of distinguishing characteristics of well-known children's literature such as folktales, fables, legends, myths, and tall tales	
TEKS 4.9.B	explain figurative language such as simile, metaphor, and personification that the poet uses to create images	
TEKS 4.9.C	explain structure in drama such as character tags, acts, scenes, and stage directions	
(D) recognize characteristics and structures of informational text, including:		
TEKS 4.9.D.i	the central idea with supporting evidence	

Unit 2

		Correlation—Teacher's Guide
TEKS 4.9.D.ii	features such as pronunciation guides and diagrams to support understanding	
TEKS 4.9.D.iii	organizational patterns such as compare and contrast	U2: p. 170; U2: p. 174
(E) recognize characteristics and structures of argumentative text by:		
TEKS 4.9.E.i	identifying the claim	
TEKS 4.9.E.ii	explaining how the author has used facts for an argument	
TEKS 4.9.E.iii	identifying the intended audience or reader	
TEKS 4.9.F	recognize characteristics of multimodal and digital texts	U2: p. 306; U2: p. 310; U2: p. 319
(10) Author's purpose and craft: listening, speaking, reading, writing, and thinking using multiple texts. The student uses critical inquiry to analyze the authors' choices and how they influence and communicate meaning within a variety of texts. The student analyzes and applies author's craft purposefully in order to develop their own products and performances. The student is expected to:		
TEKS 4.10.A	explain the author's purpose and message within a text	
TEKS 4.10.B	explain how the use of text structure contributes to the author's purpose	U2: p. 170; U2: p. 174
TEKS 4.10.C	analyze the author's use of print and graphic features to achieve specific purposes	
TEKS 4.10.D	describe how the author's use of imagery, literal and figurative language such as simile and metaphor, and sound devices such as alliteration and assonance achieves specific purposes	
TEKS 4.10.E	identify and understand the use of literary devices, including first- or third-person point of view;	
TEKS 4.10.F	discuss how the author's use of language contributes to voice	
TEKS 4.10.G	identify and explain the use of anecdote	
(11) Composition: listening, speaking, reading, writing, and thinking using multiple texts—writing process. The student uses the writing process recursively to compose multiple texts that are legible and uses appropriate conventions. The student is expected to:		
TEKS 4.11.A	plan a first draft by selecting a genre for a particular topic, purpose, and audience using a range of strategies such as brainstorming, freewriting, and mapping	U2: p. 222; U2: p. 225; U2: p. 278; U2: p. 282
(B) develop drafts into a focused, structured, and coherent piece of writing by:		
TEKS 4.11.B.i	organizing with purposeful structure, including an introduction, transitions, and a conclusion	
TEKS 4.11.B.ii	developing an engaging idea with relevant details	U2: p. 278; U2: p. 282
TEKS 4.11.C	revise drafts to improve sentence structure and word choice by adding, deleting, combining, and rearranging ideas for coherence and clarity	

Unit 2		Correlation—Teacher's Guide
(D) edit drafts using standard English conventions, including:		
TEKS 4.11.D.i	complete simple and compound sentences with subject-verb agreement and avoidance of splices, run-ons, and fragments	
TEKS 4.11.D.ii	past tense of irregular verbs	
TEKS 4.11.D.iii	singular, plural, common, and proper nouns	
TEKS 4.11.D.iv	adjectives, including their comparative and superlative forms	
TEKS 4.11.D.v	adverbs that convey frequency and adverbs that convey degree	
TEKS 4.11.D.vi	prepositions and prepositional phrases	
TEKS 4.11.D.vii	pronouns, including reflexive cases	
TEKS 4.11.D.viii	coordinating conjunctions to form compound subjects, predicates, and sentences	
TEKS 4.11.D.ix	capitalization of historical periods, events and documents; titles of books; stories and essays; and languages, races, and nationalities	
TEKS 4.11.D.x	punctuation marks including apostrophes in possessives, commas in compound sentences, and quotation marks in dialogue	
TEKS 4.11.D.xi	correct spelling of words with gradeappropriate orthographic patterns and rules and high-frequency words	
TEKS 4.11.E	publish written work for appropriate audiences	U2: p. 324; U2: p. 327
(12) Composition: listening, speaking, reading, writing, and thinking using multiple texts—genres. The student uses genre characteristics and craft to compose multiple texts that are meaningful. The student is expected to:		
TEKS 4.12.A	compose literary texts such as personal narratives and poetry using genre characteristics and craft	U2: p. 146; U2: p. 149
TEKS 4.12.B	compose informational texts, including brief compositions that convey information about a topic, using a clear central idea and genre characteristics and craft	U2: p. 170; U2: p. 174; U2: p. 222; U2: p. 225; U2: p. 278; U2: p. 282; U2: p. 324; U2: p. 327
TEKS 4.12.C	compose argumentative texts, including opinion essays, using genre characteristics and craft	U2: p. 90; U2: p. 94; U2: p. 258; U2: p. 261; U2: p. 306; U2: p. 310
TEKS 4.12.D	compose correspondence that requests information	U2: p. 16; U2: p. 19
(13) Inquiry and research: listening, speaking, reading, writing, and thinking using multiple texts. The student engages in both short-term and sustained recursive inquiry processes for a variety of purposes. The student is expected to:		
TEKS 4.13.A	generate and clarify questions on a topic for formal and informal inquiry	U2: p. 56; U2: p. 61; U2: p. 62; U2: p. 69; U2: p. 278; U2: p. 282; U2: p. 306
TEKS 4.13.B	develop and follow a research plan with adult assistance	
TEKS 4.13.C	identify and gather relevant information from a variety of sources	U2: p. 56; U2: p. 61; U2: p. 258; U2: p. 261

Unit 2

		Correlation—Teacher's Guide
TEKS 4.13.D	Identify primary and secondary sources	
TEKS 4.13.E	demonstrate understanding of information gathered	U2: p. 324; U2: p. 327
TEKS 4.13.F	recognize the difference between paraphrasing and plagiarism when using source materials	
TEKS 4.13.G	develop a bibliography	
TEKS 4.13.H	use an appropriate mode of delivery, whether written, oral, or multimodal, to present results	U2: p. 90; U2: p. 94; U2: p. 146; U2: p. 149; U2: p. 306; U2: p 310; U2: p. 324; U2: p. 327

Unit 2		Correlation—Teacher's Guide
(1) Cross-curricular second language acquisition/learning strategies. The ELL uses language learning strategies to develop an awareness of their own learning processes in all content areas. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:		
ELPS 1.A	use prior knowledge and experiences to understand meanings in English	U2: p. 30
ELPS 1.B	monitor oral and written language production and employ self-corrective techniques or other resources	U2: p. 23, U2: p. 48
ELPS 1.C	use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary	U2: p. 48, U2: p. 101
ELPS 1.D	speak using learning strategies such as requesting assistance, employing non-verbal cues, and using synonyms and circumlocution (conveying ideas by defining or describing when exact English words are not known)	
ELPS 1.E	internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment	U2: p. 23; U2: p. 236
ELPS 1.F	use accessible language and learn new and essential language in the process	U2: p. 30, U2: p. 48
ELPS 1.G	demonstrate an increasing ability to distinguish between formal and informal English and an increasing knowledge of when to use each one commensurate with grade-level learning expectations	
ELPS 1.H	develop and expand repertoire of learning strategies such as reasoning inductively or deductively, looking for patterns in language, and analyzing sayings and expressions commensurate with grade-level learning expectations	
(2) Cross-curricular second language acquisition/listening. The ELL listens to a variety of speakers including teachers, peers, and electronic media to gain an increasing level of comprehension of newly acquired language in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in listening. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:		
ELPS 2.A	distinguish sounds and intonation patterns of English with increasing ease	
ELPS 2.B	recognize elements of the English sound system in newly acquired vocabulary such as long and short vowels, silent letters, and consonant clusters	
ELPS 2.C	learn new language structures, expressions, and basic and academic vocabulary heard during classroom instruction and interactions	U2: p. 23, U2: p. 47, U2: p. 144, U2: p. 151, U2: p. 159, U2: p. 163, U2: p. 247, U2: p. 269, U2: p. 294, U2: p. 317

Unit 2

		Correlation—Teacher's Guide
ELPS 2.D	monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed	U2: p. 159, U2: p. 304
ELPS 2.E	use visual, contextual, and linguistic support to enhance and confirm understanding of increasingly complex and elaborated spoken language	
ELPS 2.F	listen to and derive meaning from a variety of media such as audio tape, video, DVD, and CD ROM to build and reinforce concept and language attainment	U2: p. 64; U2: p. 144
ELPS 2.G	understand the general meaning, main points, and important details of spoken language ranging from situations in which topics, language, and contexts are familiar to unfamiliar	U2: p. 144
ELPS 2.H	understand implicit ideas and information in increasingly complex spoken language commensurate with grade-level learning expectations	
ELPS 2.I	demonstrate listening comprehension of increasingly complex spoken English by following directions, retelling or summarizing spoken messages, responding to questions and requests, collaborating with peers, and taking notes commensurate with content and grade-level needs	U2: p. 163, U2: p. 248
(3) Cross-curricular second language acquisition/speaking. The ELL speaks in a variety of modes for a variety of purposes with an awareness of different language registers (formal/informal) using vocabulary with increasing fluency and accuracy in language arts and all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in speaking. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. The student is expected to:		
ELPS 3.A	practice producing sounds of newly acquired vocabulary such as long and short vowels, silent letters, and consonant clusters to pronounce English words in a manner that is increasingly comprehensible	
ELPS 3.B	expand and internalize initial English vocabulary by learning and using high-frequency English words necessary for identifying and describing people, places, and objects, by retelling simple stories and basic information represented or supported by pictures, and by learning and using routine language needed for classroom communication	U2: p. 47, U2: p. 236, U2: p. 239
ELPS 3.C	speak using a variety of grammatical structures, sentence lengths, sentence types, and connecting words with increasing accuracy and ease as more English is acquired	
ELPS 3.D	speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency	U2: p. 23, U2: p. 30, U2: p. 144
ELPS 3.E	share information in cooperative learning interactions	U2: p. 47, U2: p. 163, U2: p. 247, U2: p. 269, U2: p. 294, U2: p. 317

Unit 2

		Correlation—Teacher's Guide
ELPS 3.F	ask and give information ranging from using a very limited bank of high-frequency, high-need, concrete vocabulary, including key words and expressions needed for basic communication in academic and social contexts, to using abstract and content-based vocabulary during extended speaking assignments	U2: p. 151, U2: p. 159, U2: p. 322
ELPS 3.G	express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and gradeappropriate academic topics	U2: p. 48, U2: p. 294
ELPS 3.H	narrate, describe, and explain with increasing specificity and detail as more English is acquired	U2: p. 328
ELPS 3.I	adapt spoken language appropriately for formal and informal purposes	U2: p. 317; U2: p. 322; U2: p. 328
ELPS 3.J	respond orally to information presented in a wide variety of print, electronic, audio, and visual media to build and reinforce concept and language attainment	U2: p. 64; U2: p. 144
(4) Cross-curricular second language acquisition/reading. The ELL reads a variety of texts for a variety of purposes with an increasing level of comprehension in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in reading. In order for the ELL to meet grade-level learning expectations across the foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For kindergarten and grade 1, certain of these student expectations apply to text read aloud for students not yet at the stage of decoding written text. The student is expected to:		
ELPS 4.A	learn relationships between sounds and letters of the English language and decode (sound out) words using a combination of skills such as recognizing sound-letter relationships and identifying cognates, affixes, roots, and base words	
ELPS 4.B	recognize directionality of English reading such as left to right and top to bottom	
ELPS 4.C	develop basic sight vocabulary, derive meaning of environmental print, and comprehend English vocabulary and language structures used routinely in written classroom materials	U2: p. 48
ELPS 4.D	use prereading supports such as graphic organizers, illustrations, and pretaught topic-related vocabulary and other prereading activities to enhance comprehension of written text	U2: p. 108, U2: p. 182
ELPS 4.E	read linguistically accommodated content area material with a decreasing need for linguistic accommodations as more English is learned	

Unit 2

		Correlation—Teacher's Guide
ELPS 4.F	use visual and contextual support and support from peers and teachers to read grade-appropriate content area text, enhance and confirm understanding, and develop vocabulary, grasp of language structures, and background knowledge needed to comprehend increasingly challenging language	U2: p. 182, U2: p. 239
ELPS 4.G	demonstrate comprehension of increasingly complex English by participating in shared reading, retelling or summarizing material, responding to questions, and taking notes commensurate with content area and grade level needs	U2: p. 40, U2: p. 48, U2: p. 64, U2: p. 67, U2: p. 85, U2: p. 96, U2: p. 177
ELPS 4.H	read silently with increasing ease and comprehension for longer periods	
ELPS 4.I	demonstrate English comprehension and expand reading skills by employing basic reading skills such as demonstrating understanding of supporting ideas and details in text and graphic sources, summarizing text, and distinguishing key ideas from details commensurate with content area needs	U2: p. 85
ELPS 4.J	demonstrate English comprehension and expand reading skills by employing inferential skills such as predicting, making connections between ideas, drawing inferences and conclusions from text and graphic sources, and finding supporting text evidence commensurate with content area needs	
ELPS 4.K	demonstrate English comprehension and expand reading skills by employing analytical skills such as evaluating written information and performing critical analyses commensurate with content area and grade-level needs	U2: p. 40
(5) Cross-curricular second language acquisition/writing. The ELL writes in a variety of forms with increasing accuracy to effectively address a specific purpose and audience in all content areas. ELLs may be at the beginning, intermediate, advanced, or advanced high stage of English language acquisition in writing. In order for the ELL to meet grade-level learning expectations across foundation and enrichment curriculum, all instruction delivered in English must be linguistically accommodated (communicated, sequenced, and scaffolded) commensurate with the student's level of English language proficiency. For kindergarten and grade 1, certain of these student expectations do not apply until the student has reached the stage of generating original written text using a standard writing system. The student is expected to:		
ELPS 5.A	learn relationships between sounds and letters of the English language to represent sounds when writing in English	
ELPS 5.B	write using newly acquired basic vocabulary and content-based grade-level vocabulary	U2: p. 48, U2: p. 67, U2: p. 69, U2: p. 101, U2: p. 151, U2: p. 239, U2: p. 248, U2: p. 276, U2: p. 283, U2: p. 303, U2: p. 304, U2: p. 316, U2: p. 329
ELPS 5.C	spell familiar English words with increasing accuracy, and employ English spelling patterns and rules with increasing accuracy as more English is acquired	
ELPS 5.D	edit writing for standard grammar and usage, including subject-verb agreement, pronoun agreement, and appropriate verb tenses commensurate with grade-level expectations as more English is acquired	

Unit 2

		Correlation—Teacher's Guide
ELPS 5.E	employ increasingly complex grammatical structures in content area writing commensurate with grade level expectations such as (i) using correct verbs, tenses, and pronouns/antecedents; (ii) using possessive case (apostrophe -s) correctly; and, (iii) using negatives and contractions correctly	
ELPS 5.F	write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired	U2: p. 48, U2: p. 283
ELPS 5.G	narrate, describe, and explain with increasing specificity and detail to fulfill content area writing needs as more English is acquired	U2: p. 211, U2: p. 236, U2: p. 248, U2: p. 303, U2: p. 304, U2: p. 316, U2: p. 329

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LECTOESCRITURA EN ESPAÑOL

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TEXAS
ELEMENTARY LITERACY PROGRAM

Grade 4 | **Unit 2** | Teacher Guide

Eureka! The Art of Invention

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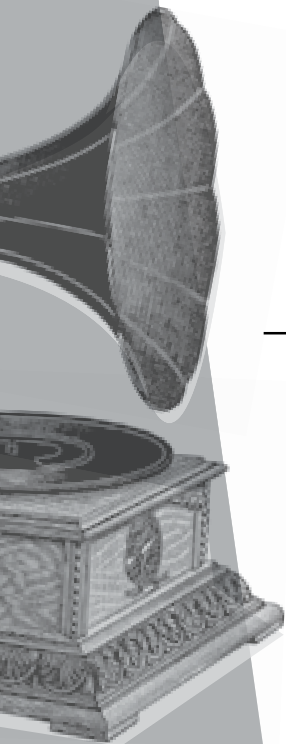
TEXAS
ELEMENTARY LITERACY PROGRAM

ENGLISH

Grade 4

Unit 2 | Activity Book

Eureka! The Art of Invention



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Grade 4, Unit 2,
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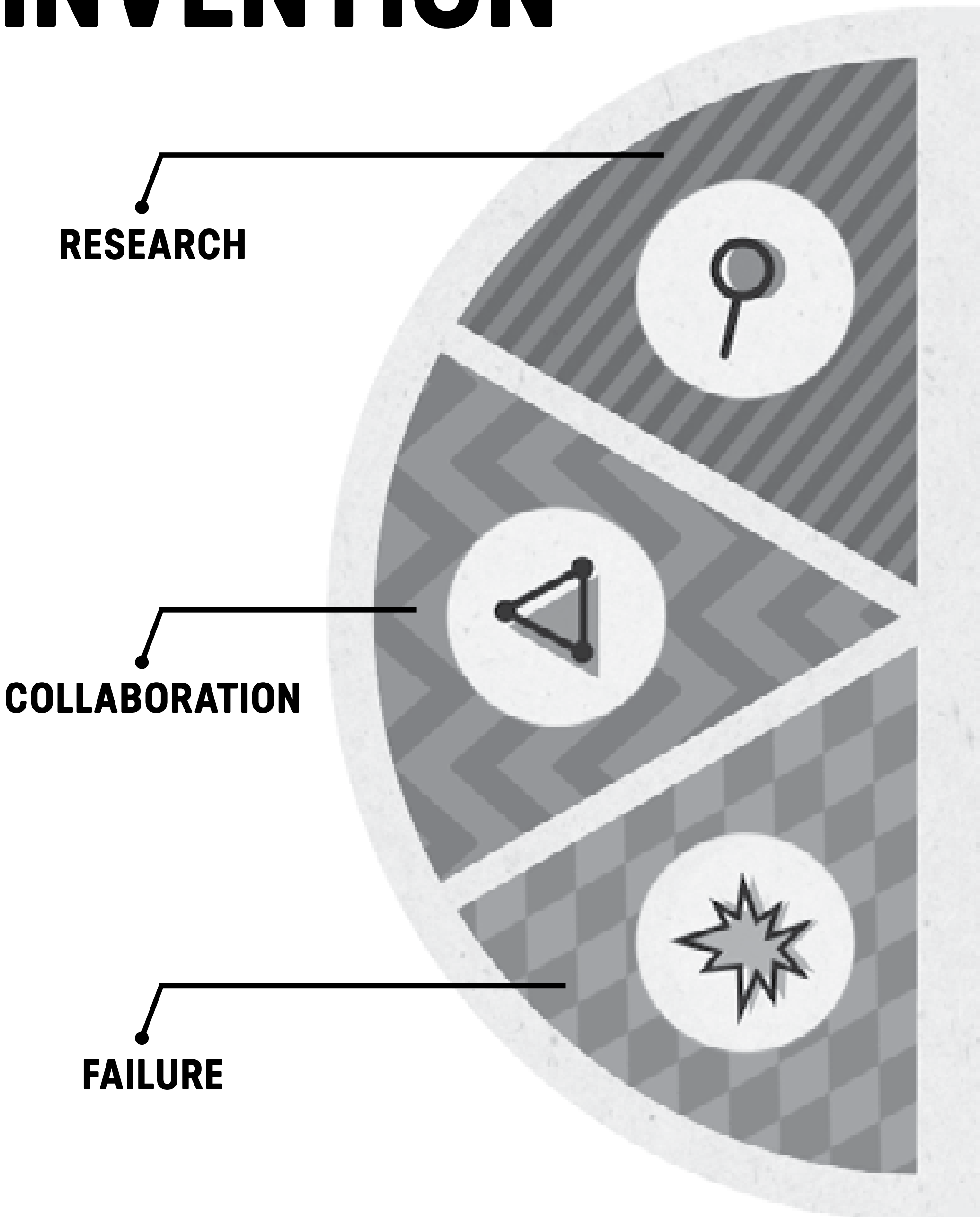
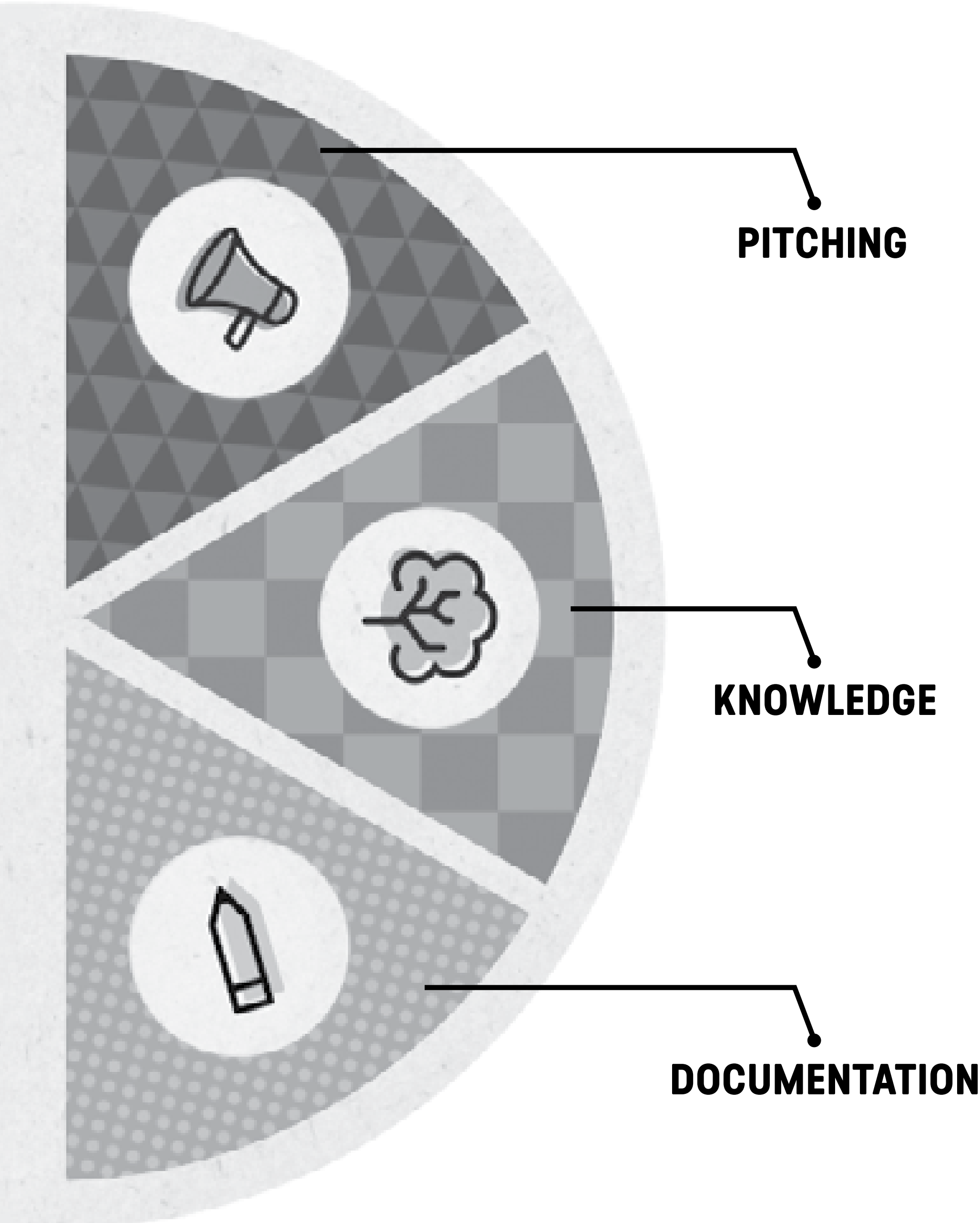
Contents

INVENTOR'S NOTEBOOK

Eureka! The Art of Invention

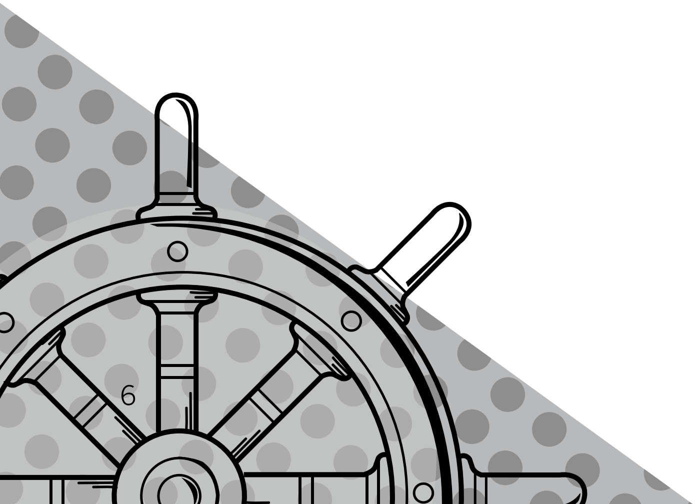
WHEEL OF
INVENTION




PITCHING
KNOWLEDGE
DOCUMENTATION

JACQUES'S RULES FOR COLLABORATION

- ☐ Take turns talking and listening.
- ☐ Stay on task.
- ☐ Ask good questions.
- ☐ Make suggestions in a positive, constructive way.
- ☐ Consider everyone's ideas.
- ☐ Everyone contributes. Help others and ask for help when you need it.



ACTIVITY 1.2

Name: ____________________

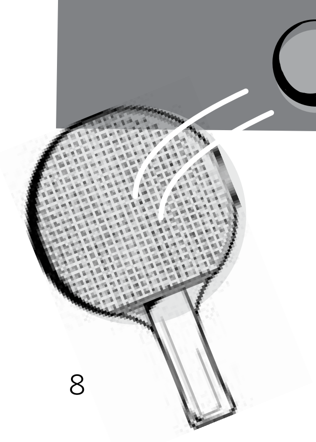
Date: ____________________

! JACQUES'S COLLABORATION BUILDING CHALLENGE

Devise a way to pick up a standard table tennis ball from the table, pass it around among the group (each lab member must be in control of it for three seconds), and then put it in the basket.

- Do not touch it with your hands. That includes covering your hands with any kind of glove-like item!
- Do not drop it.
- You may use up to two pencils, ten pieces of tissue, and a box of rubber bands.

You may use trial and error and test your experiment or components of your experiment as you build. Keep your table tennis ball under control at all times!!



Notes on group work:

You will work in your lab to complete this building challenge. In order to be successful, you will need to work together! Ensure that all lab members are given an opportunity to express their opinion and that everyone is contributing to the process. Listen carefully to what the other members of your group have to say. Their ideas may help you come up with a new idea of your own.

For this challenge, one team member will be assigned the role of building manager.

The building manager leads the decision-making process. This does not mean that the building manager has to do all of the work, or that the group uses all of the building manager's ideas! But sometimes, when a group has many ideas, it can be hard to decide which one to try first. The building manager should listen to the lab and help make that decision. They can call for a vote, or, if there's a tie, break the tie. If there are several tasks to be accomplished at the same time, the building manager can assign them. If you don't know what you should be doing to help, ask the building manager.

ACTIVITY 1.3

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ______________________ Date: ______________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

Draw your invention here:

ACTIVITY 1.3

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ______________________ Date: ____________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

Draw your invention here:

Name: ____________________

Date: ____________________

COLLABORATION WEDGE CHALLENGE: LETTER TO JACQUES

Think back on the group work rules that Jacques introduced and that we addressed as a class in the "Learn from Last Season" transcript and the building prompt.

Prove to Jacques that you were paying attention. Pick one rule and write him a letter explaining how you used that rule during the building activity.

Dear Jacques,

I believe the most important rule for collaboration is:

If you ignore this rule:

I used this rule during the building activity when:

Another one of my lab mates used this rule when:

Sincerely,

ACTIVITY 3.1

Name: ______________________

Date: ______________________

EDISON'S INVENTION EVIDENCE

Invention: Light Bulb

What this invention does:

What came before this invention:

How did this invention change things? Give two examples and include quotes from the article as evidence.

Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

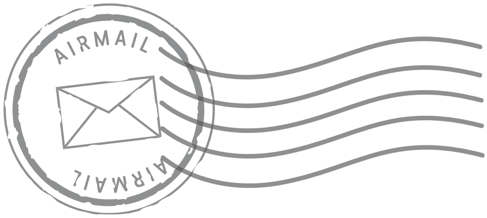
Name: ______________________________

Date: ______________________________

RESEARCH WEDGE CHALLENGE: LETTER TO MR. EDISON

Write a letter to Thomas Edison extolling the virtues of the light bulb.

Your letter should be about two paragraphs long. That means you might not have time to cover all the arguments and evidence you gathered earlier, so choose your material judiciously. Think about the story of the light bulb you want to tell. As you develop your letter, you may also want to think about information you learned about Mr. Edison's personality and life from his inventor card.



Here's an opening to get you started:

Dear Mr. Edison,

Eureka! Student Inventor could not possibly succeed without you as a judge. What show about invention can be taken seriously if it doesn't include the inventor of the light bulb, one of the greatest inventions of all time?

The light bulb is a truly great invention because:

Sincerely,

ACTIVITY 3.3

Name: ______________________________

Date: ______________________________

EDISON'S INVENTION EVIDENCE

Invention: ______________________________

1. What this invention does:

____

____

____

____

2. What came before this invention:

____

____

____

____

____

3. How did this invention change things? Give two examples and include quotes from the article as evidence:

4. Imagine the world if this invention had never existed. Describe one situation in modern life that would be very different.

3.4

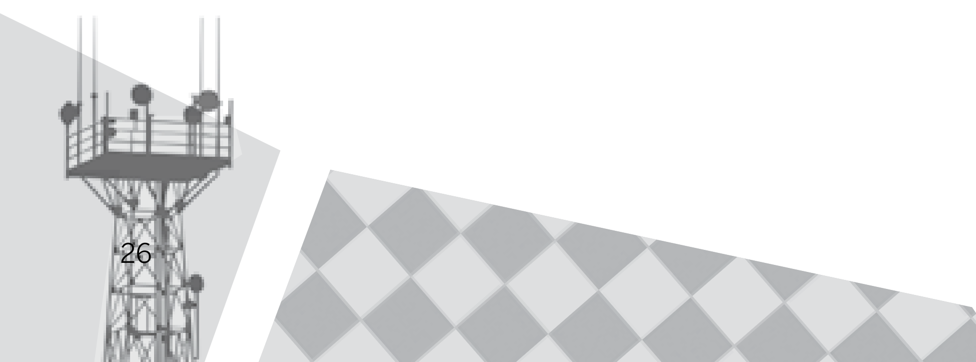
HEDY LAMARR'S RULES FOR PITCHING

WHAT YOU SAY:

- [ ] Be focused on your topic.
- [ ] Be specific.
- [ ] Be interesting.

HOW YOU SAY IT:

- [ ] Make eye contact. (Look at your audience!)
- [ ] Show energy and passion.
- [ ] Watch your volume and speed.




VARIABLE FREQUENCY CARRIER OSCILLATOR
MODULATOR

ACTIVITY 4.1

Name: ______________________________

Date: ______________________________

HEDY LAMARR'S SAMPLE PITCH PLANNER

Using the evidence you pulled for "Edison's Invention Evidence," plan the pitch your lab will present for your invention. This pitch will explain why your invention deserves to be on the back cover of Edison's new book! All members of your lab should participate in the pitch.

Introduction (15–30 sec.):

1. The name of your invention:

____

2. The date (approximate is OK) of your invention:

____

3. A sentence briefly explaining how it was invented:

____

____

____

____

4. A sentence explaining how it improved life:

5. Your slogan—a catchy sentence that will grab your audience's attention (the slogan can be the one you created in Episode 1, or you can revise it):

Skit (1–2 min.):

1. Create a skit to demonstrate the importance of your invention. Choose one of the following ideas for your skit:
   - Demonstrate how people lived before and after your invention was invented.

     OR

   - Interview the inventor.

Characters:

Setting:

Summary (what happens in your skit):

Conclusion (15 sec.):

1. Sign off with your slogan.

Name: ______________________

Date: ______________________

HEDY LAMARR'S PITCH PLANNER

Using the evidence you pulled for "Edison's Invention Evidence," plan the pitch your lab will present for your invention. This pitch will explain why your invention deserves to be on the back cover of Edison's new book! All members of your lab should participate in the pitch.

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4. A sentence explaining how it improved life:

____

____

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   - Demonstrate how people lived before and after your invention was invented.

     OR

   - Interview the inventor.

Characters:

Setting:

Summary (what happens in your skit):

Conclusion (15 sec.):

1. Sign off with your slogan.

Name: ______________________________

Date: ______________________________

HEDY LAMARR'S NOTES FOR KNOWLEDGE

Invention:	What is it used for?

Why is it important?
1.
2.
1.
2.
1.
2.
1.
2.
1.
2.
1.
2.

ACTIVITY 5.1

Name: ______________________________

Date: ______________________________

SIMPLE MACHINE DANCE PARTY CHALLENGE

Simple Machine: ______________________________

1. List an invention from the article that uses this simple machine:

____

2. List another invention, not in the article, that uses this simple machine:

____

3. Find three descriptions of action or movement from the article that refer to the simple machine:

____

____

____

____

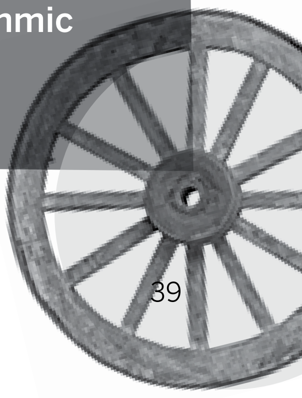
____

____

4. In your own words, simply describe how this simple machine works:

Now, with your group, prepare a short dance or movement that demonstrates how this simple machine works.

- Your dance must last 30 seconds.
- All members of your lab must participate!
- You can all do the same movement, or you can do different movements.
- Feel free to create musical or rhythmic accompaniment.



ACTIVITY 5.2

Name: ______________________________

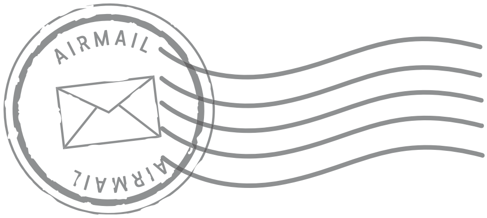
Date: ______________________________

KNOWLEDGE WEDGE CHALLENGE: LETTER TO MI-SHELL

Mi-Shell needs to get from his terrarium in the *Eureka!* production office in Brooklyn to the network headquarters in midtown Manhattan (about eight miles away), while transporting two dozen cookies and a message of friendship and respect to save the show.

He may use ANY of the simple machines or inventions you have learned about so far, and you should encourage him to be creative, so he will impress the executives! He must use one simple machine and one additional invention we have studied (it can be another simple machine, but doesn't have to be) to make his journey easier. He can use inventions to ask people for help, and he can build his own inventions as long as they include the ones we have studied.

Please write him a letter to help him achieve his task.



Dear Mi-Shell,

Thank you for agreeing to deliver cookies to the network and save the show! You should use

______________________ and ______________________

(a simple machine) (a second invention)

to make your journey easier.

Here is how you should do it:

____

____

____

____

____

____

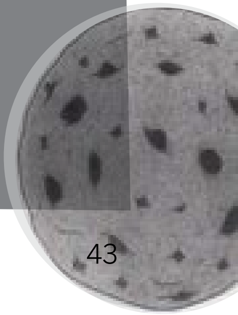
____

____

Sincerely,

Checklist:

- ☐ Does your letter include a simple machine?
- ☐ Does your letter include another invention?
- ☐ Does your letter explain how Mi-Shell should transport the cookies?
- ☐ Does your letter explain how Mi-Shell should travel?



ACTIVITY 6.1

Name: ______________________________

Date: ______________________________

HOW MANY WAYS CAN YOU SOLVE IT?

Round 1	Round 2

Round 3	Round 4

ACTIVITY 6.2

Name: ______

Date: ______

PROFESSOR CARVER'S GUIDE TO DOCUMENTING MATERIALS

Name of object: Pencil

Description of object
Sight:
Touch:
Smell:
Sound:

What is the object usually used for?

What else can you do with it?

Name: ______________________________

Date: ______________________________

PROFESSOR CARVER'S GUIDE TO DOCUMENTING MATERIALS

Name of object: ______________________________

Description of object
Sight:
Touch:
Smell:
Sound:

What is the object usually used for?

What else can you do with it?

ACTIVITY 6.4

Name: ______________________________

Date: ______________________________

PROFESSOR CARVER'S DOCUMENTATION BUILDING CHALLENGE

Building prompt:

You are building an invention the judges can use to throw out trash!

Challenge requirements:

- ☐ The trash can is two feet away.
- ☐ The user is sitting down.
- ☐ You can use anything in the building materials box.
- ☐ You cannot just throw the trash.
- ☐ Your invention must work 75% of the time.

You may practice using your invention and make changes to it as time allows. You are allowed to get out of your seat to build!

Notes on group work:

You will work in a group to complete this building challenge. In order to be successful, you will need to work together! Be sure that everyone is given an opportunity to express their opinion, and that everyone is contributing to the process. Listen carefully to what the other members of your group have to say. Their ideas may help you come up with a new idea of your own.

One member of your lab will be assigned to be the building manager.

The building manager leads the decision-making process. This does not mean that the building manager has to do all of the work, or that the group uses all of the building manager's ideas! But sometimes, when a group has many ideas, it can be hard to decide which one to try first. The building manager should listen to the lab and help make that decision. They can call for a vote, or, if there's a tie, break the tie. If there are several tasks to be accomplished at the same time, the building manager can assign them. If you don't know what you should be doing to help, ask the building manager.

ACTIVITY 6.5

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ____________________ Date: ____________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

Draw your invention here:

ACTIVITY 6.5

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ______________________ Date: ______________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

Draw your invention here:

ACTIVITY 6.6

Name: ______________________________

Date: ______________________________

DOCUMENTATION WEDGE CHALLENGE

1. On the next page, label a diagram for the judges so they can use your clever design in their office-cleaning project.

2. List of materials used:

____

____

____

____

____

____

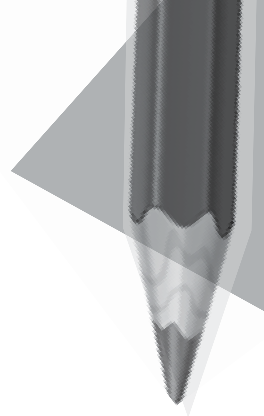
____

3. Write three sentences explaining how you made your invention.

Draw and label your invention here:

Labeled Diagram of Invention:

- [ ] Indicate what materials are used in various parts of your invention.
- [ ] Draw a star where the trash is placed.



☐ Label the parts of your invention. (handle, basket, slingshot, ramp—whatever you've included).

☐ Draw an arrow that shows us where the trash goes when the invention is being used.

Name: ______________________

Date: ______________________

EDISON'S INVENTION EVALUATION

Check two areas where you think your invention failed/ could be improved:

- ☐ **Accuracy**
- ☐ **Easy to build**
- ☐ **Easy to use**
- ☐ **Sturdiness** (how long your invention will last before it falls apart)
- ☐ **Flexibility** (how well your invention could handle ANY trash, not just a wad of paper)

How would you revise your invention to improve it in the areas you checked?

Name: ____________________

Date: ____________________

FAILURE WEDGE CHALLENGE: LETTER TO NETWORK EXECUTIVES

Write a letter to the network explaining how failure can be a useful tool in invention.

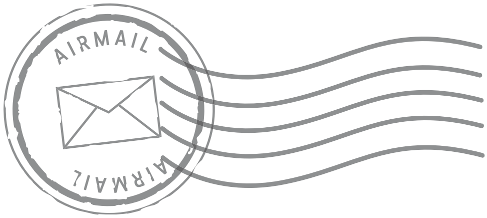
Give two examples of failure in your letter.

First, give an example of a failure you've experienced during the Quest so far. It can be a building failure, a collaboration failure, or any other kind of failure.

1. Explain how you failed.
2. Explain how you would change your actions in the future.

Second, give an example of an inventor's failure you learned about during the Quest from inventor cards or other reading.

3. Explain how the inventor failed.
4. Explain what they learned from that failure.



Dear network executives,

Don't cancel Eureka! Student Inventor just because last season was a failure! On the program this year, we have learned that failure is an important tool in invention. The judges and our host have used their failures from last season to learn how to make the show better. Learning from failure works!

This season I learned by failing. Here's how:

I also learned about ______________________________,

a famous inventor who failed, too.

Save Eureka! Let us fail some more!

Sincerely,

Name: ______________________

Date: ______________________

PROBLEM RESEARCH: INTERVIEWS

Select three questions from the question bank. First interview yourself. Then interview one of your lab mates.

Question 1:

My answer:

Lab mate's answer:

Question 2:

My answer:

Lab mate's answer:

Question 3:

My answer:

Lab mate's answer:

ACTIVITY 8.2

Name: ______________________

Date: ______________________

PICK A PROBLEM CHALLENGE

1. What problem will you solve with your invention?

____

____

____

2. Why did you choose that problem?

____

____

____

____

____

3. What criteria does it meet?

4. How does it meet those criteria?

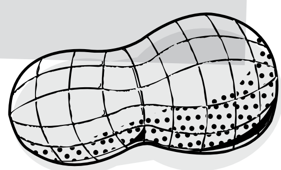
Introduction to Professor Carver's Inventing-from-scratch Tips:

Inventing is fun, but inventing is also hard work. Sometimes you have more ideas than you can write down. This note is not about those times.

This is for those days when you are stuck. We have all had those days. All two hundred uses for the peanut did not come to me in a burst of lightning inspiration from on high. Neither did all hundred-plus uses for the sweet potato! (Why does no one care about the sweet potato? Please, I beg of you, ask your cafeteria workers to see if they can provide you with some nutritious and delicious sweet potatoes!)

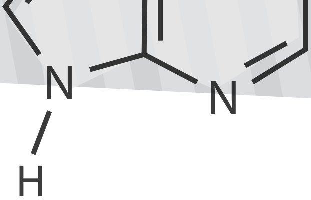
I know that it can be very scary to be brainstorming and find yourself out of ideas. When you are stuck, think back to Round 1.

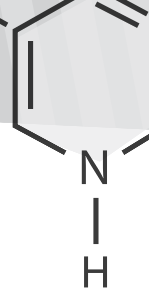
George Washington Carver



8.3

PROFESSOR CARVER'S
INVENTING-FROM-SCRATCH TIPS

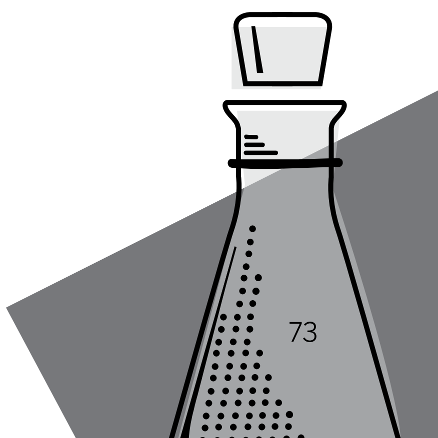




- [ ] **Think about the inventors you read about—where did their inspirations come from?**

- [ ] **Think about the inventions you studied and how invention breeds invention—is there an invention that already exists that could solve your problem if you built on it or changed it?**

- [ ] **Think about simple machines and give yourself a challenge: if you were going to solve your problem using one of the simple machines, how could you do it?**



ACTIVITY 8.4

Name: ______________________________

Date: ______________________________

INVENTION BRAINSTORMING!

Idea #: ______________________ Date: ____________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

Draw your invention here:

ACTIVITY 8.4

Name: ____________________

Date: ____________________

INVENTION BRAINSTORMING!

Idea #: ____________________ Date: ____________

Invention problem:

____

Materials:

____

____

____

Questions:

____

____

____

How does it work?

____

____

____

Draw your invention here:

ACTIVITY 9.1

Name: ______________________________

Date: ______________________________

ROUND 2 INVENTION DRAFT

Draw a diagram of your draft and label as much of it as possible.

Draw your invention here:

Specs:

1. What does your invention do?

2. Who uses your invention? Where?

3. How big is your invention?

4. What materials are used to build your invention?

Lab feedback (wait to complete this until directed)

ACTIVITY 9.2

Name: ______________________________

Date: ______________________________

HEDY LAMARR'S PITCH PLANNER: ROUND 2

1. The name of your invention:

____

2. What problem it solves:

____

____

____

3. How it works:

____

____

____

____

____

4. Why is it an important invention? Include at least one example of a scenario in which your invention is needed.

5. A slogan for your invention—a catchy sentence that will grab your audience's attention and help people remember your invention:

ACTIVITY 10.1

Name: ____________________

Date: ____________________

MAKE YOUR OWN INVENTOR CARD

Draw a picture of yourself...

____

Name: ______________________________

Birth date: ______________________________

Birthplace: ______________________________

Invention(s):

____

____

____

____

Describe a challenge that you overcame.

____

____

____

____

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Eureka! The Art of Invention

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ENGLISH

Grade 4

Unit 2 | Reader

Eureka! Files

GRADE 4 UNIT 2

EUREKA! FILES

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Contents

EUREKA! FILES

Eureka! The Art of Invention

Introduction

Welcome to the *Eureka! Files*.

As a contestant on *Eureka! Student Inventor* you are entitled to one (1) copy of the *Eureka! Files*. Guard it carefully. We've seen what inventing without any reading can look like and it's not pretty. You will need to refer to these articles throughout the Quest. You will not be able to complete the Wheel of Invention without them.

In this collection you will find:

- a carefully preserved transcript from an episode from last season that the network would just as soon forget
- uncensored, frank articles about your judges
- notes from experienced inventors
- information about inventions
- challenging vocabulary is in bold and defined in the glossary at the back.

These documents are only the beginning—remember that you can earn bonus points for reading and creating inventor cards for additional inventors. There are no rules against extra research in this Quest.

Good luck, contestants!

CAST LIST

Contestants:

Sam
Laura
Tyler
Maria
Alex

Other Characters:

Narrator
Host

Learn From Last Season: Bad Collaboration

Narrator: We are about to watch one of last season's building activities. Here students attempt to dip a paintbrush in a cup of red paint and then paint a red *X* on a piece of paper without any person touching the paintbrush directly. The contestants have just begun …

Sam: OK, OK, OK, I have such a good idea. We're gonna get everyone to stand in a line and I'm gonna tie a string around my wrist and attach the paintbrush to the string and then we're gonna tie everyone's wrists together, and—

Laura: Wait, I don't understand how that's gonna—

Sam: And then everyone will stand close together and there will be, like, a countdown and when we all swing our arms we'll launch the paintbrush into the paint—

Tyler: Oh, I have an idea! Let's just all make a pyramid with the paintbrush at the top—

Maria: You guys are being stupid.

Laura: I didn't even say anything!

Maria: This is stupid. I say we forget the paintbrush and just put the paint in our mouths and then spit it onto the paper—

Alex: Oh! That reminds me of this really funny thing that happened at lunch yesterday! I was opening my milk, and I squeezed the box as I was opening it and there was this spurt of milk in my eye, but it was really funny. What's for lunch today?

Laura: I think it might be pizza day. Because it's Tuesday.

Maria: No, no, pizza is Friday. Tuesday is tacos.

Sam: We're gonna tie our wrists together!

Tyler: I don't think putting paint in our mouths is a good idea. Did anyone hear me about the pyramid?

Maria: I'm putting the paint in my mouth right now. Ew—gross, it tastes foul.

Narrator: Maria starts to cough and can't stop coughing.

Host: What's going on over here??

Narrator: The host listens in [their] earpiece.

Host: OK, I'm being told . . . the **producers** are saying that you cannot ingest the paint. That was not a good idea. It's toxic. It's poisonous.

Narrator: Everyone looks at Maria. She is turning blue.

Host: We have to get her to the doctor, right now.

Laura: Does that mean we lose?

Thomas Edison

Grouchy inventor Thomas Edison returns to anchor the panel of judges on *Eureka! Student Inventor*

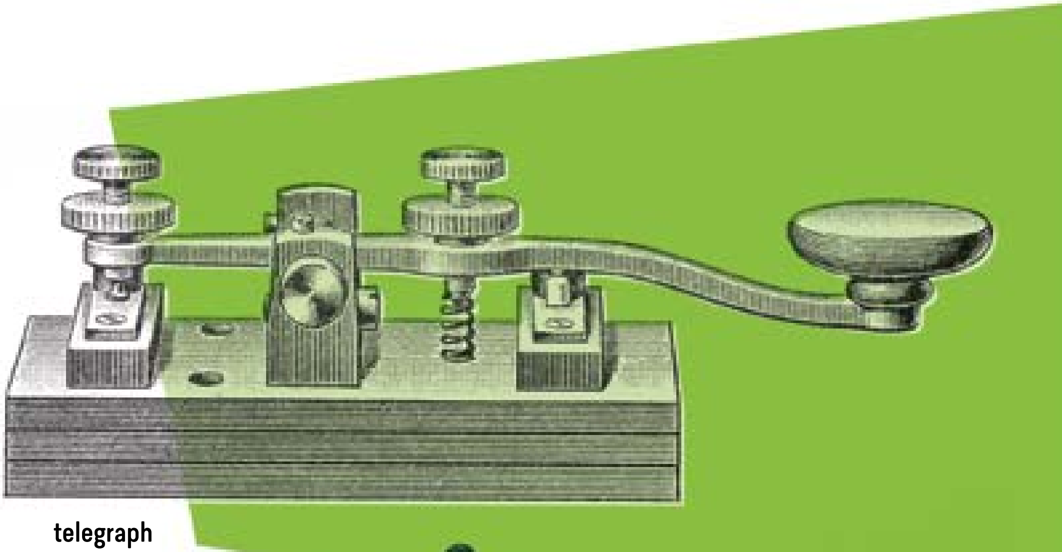
Producers are relieved to have Thomas Edison back on the judging panel this season on *Eureka!* Without a big name like his, they were concerned that even fewer people would tune in. For everyone's sake, the producers hope that this season's contestants pay Edison the respect he feels he deserves.

After all, many claim that Thomas Alva Edison is the most successful American inventor of all time. He **patented** over a thousand inventions in the United States. He had **humble** beginnings, however. Born on February 11, 1847, in Milan, Ohio, he was the last of seven children. His family was poor and his education consisted mainly of being homeschooled and reading his father's books. He got his first job when he was twelve years old, selling newspapers on the Grand Trunk Railroad. In his time off, he read in the public library and conducted chemistry experiments in the baggage cars. One of his experiments set the train on fire, but Edison wasn't **deterred**. Even then, he knew that you often have to figure out the wrong way to do something before you can find the right way.

One day he rescued a child from the path of a moving train, and the boy's father, who was trained to operate a **telegraph**, offerred him lessons in telegraphy. He soon became a telegraph operator and before long was inventing remarkable improvements to the telegraph that got the attention of **financiers**. With their support, he opened a laboratory in Menlo Park, New Jersey.

His lab was the first of its kind. It was a busy place where experts collaborated, working on multiple inventions at the same time. Research and **marketing** happened under one roof. In this idea-rich environment, Edison invented the **phonograph**—the first device for recording sound!—and the incandescent light bulb, his most famous invention.

By the time he died, in 1931, Edison had patented an astounding 1,093 inventions in the United States, and more abroad. These also include the Kinetoscope (which launched the movie industry), the microphone, the rechargeable battery, and a cement manufacturing process. Edison believes this list cements his place in history.



telegraph

phonograph

Jacques Cousteau

Lover of croissants and aquatic life, seafaring Frenchman Jacques Cousteau returns to *Eureka!'s* judging panel

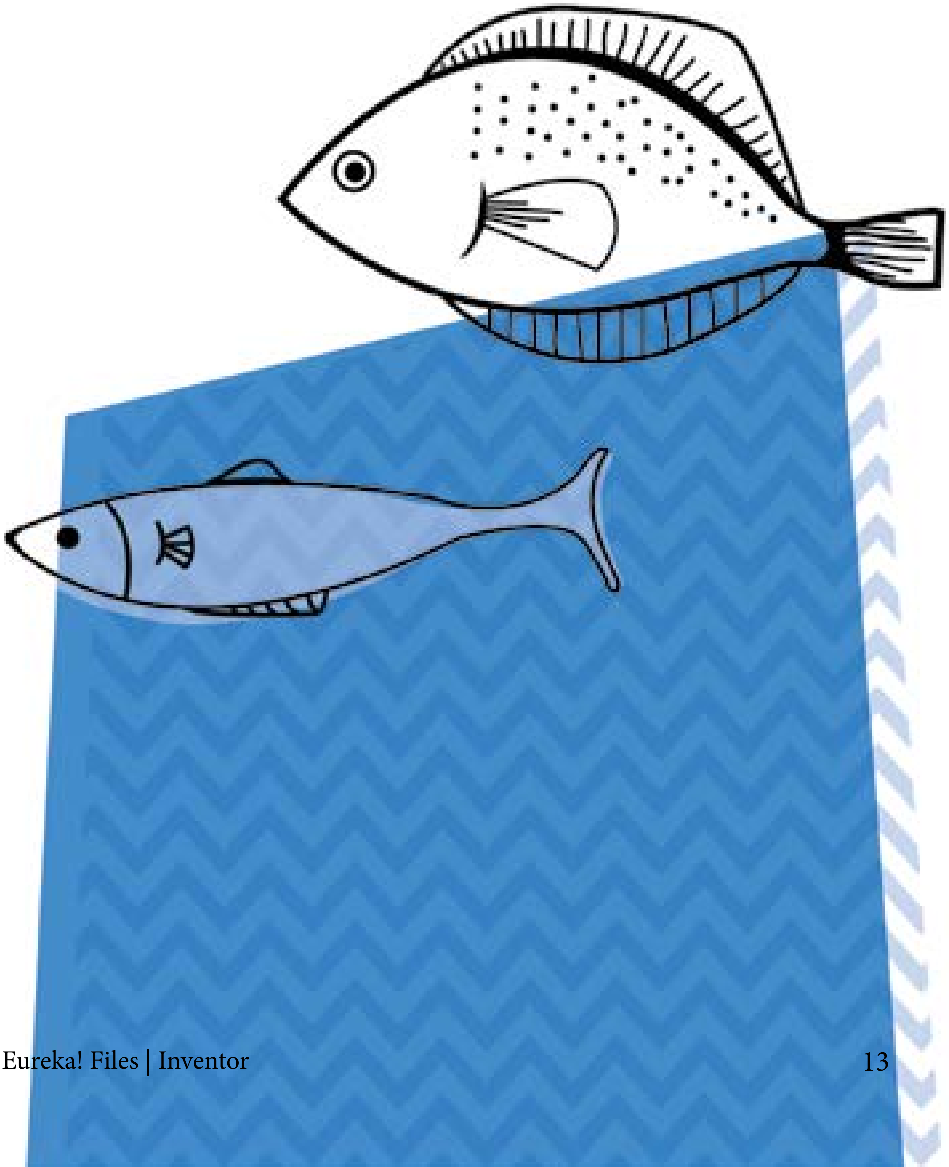
Producers are frustrated that Jacques Cousteau has returned this season as a judge on *Eureka!*, despite the fact that he was not invited back after the mess he caused last season. Jacques, however, is thrilled to be on the panel, and claims that this will be *Eureka!*'s most exciting season ever!

Jacques Cousteau likes excitement. Born on June 11, 1910, in the small town of Saint-André-de-Cubzac, France, Cousteau was a curious child. Although not a good student, he was always building things and taking things apart to see how they worked. At age twenty-six he was in a terrible car accident that required months of **rehabilitation**. Armed with a pair of goggles, he began swimming daily in the sea. He quickly realized that he wanted to be able to explore the ocean, but to do so he would need better equipment for breathing under water. So he decided to try inventing it.

Cousteau and his inventing partner developed the Aqua-Lung, which allowed people to stay under water while breathing from air cylinders (small tanks that can hold hours' worth of air). This advance opened human eyes to **aquatic** life in a new way, and also allowed for undersea rescues and recoveries that would have been impossible before.

Cousteau also helped invent a deepwater camera. (As an **avid** undersea explorer he wanted to share with the world what he experienced in person.) He increased interest in underwater archeology by **spearheading** the exploration of a famous Roman shipwreck. He went on to lead many more explorations, to write books, and to make films about his voyages and about ocean life. His television series, *The Undersea World of Jacques Cousteau*, was so popular it ran for eight years (a distant hope for *Eureka!*).

Jacques died at the age of eighty-seven in Paris, on land. But he was most himself when he was at sea. He once said, "From birth, man carries the weight of gravity on his shoulders. He is bolted to earth. But man has only to sink beneath the surface and he is free."



George Washington Carver

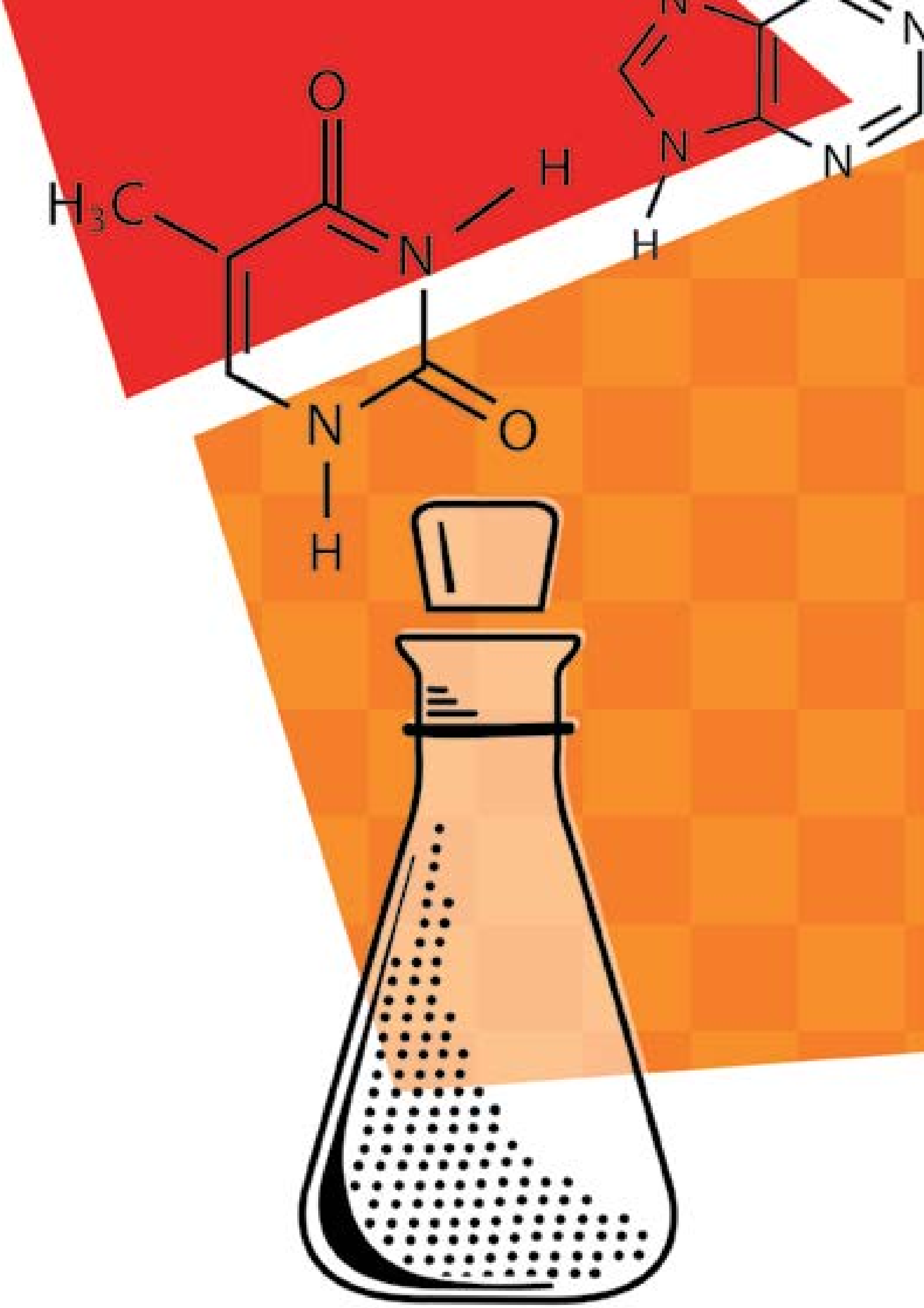
Peanut expert George Washington Carver joins *Eureka!* as judge, brings love of plants, general human kindness to program

Producers are pleased to announce that well-known inventor, professor, and all-around good guy George Washington Carver has joined the cast of *Eureka!* Carver brings to the judging panel a love of research, a deep knowledge of plant life and **agricultural** inventions, and a much-needed friendly and **optimistic** perspective.

A biography of George Washington Carver might as well also be a biography of the peanut. And the sweet potato. Carver **arguably** devoted more time, care, and love to these two crops—finding over 400 new uses for them—than any person devoted to plant life before or since. The road to **botany**-based greatness wasn't easy, however. Carver was born into slavery in Diamond, Missouri, around January 1864 (he wasn't sure of his exact birth date). He could not enroll at the first college to which he'd been admitted because of his race. When he finally started college in 1890, he studied painting and drawing (and piano!) because his school, Simpson College in Iowa, did not have a science program. But these studies led him back to science and nature when an instructor was impressed by his pictures of plants. The instructor pointed Carver toward Iowa State Agricultural College's botany program, where he was the first black student.

This is where his unlikely career **took root**. He was a talented **botanist** and was soon hired to lead the **prestigious** Tuskegee Institute's agricultural department. While at Tuskegee, Carver set out to help struggling farmers and **sharecroppers** in the South. He worked hard to get the latest information about farming methods to them, even in remote locations, to help them remain **self-sufficient**. Until this time farmers in the South had produced mostly cotton. Carver helped to introduce many more cash crops—crops that could be sold for money. He also instructed farmers to grow crops that broke down the soil, such as cotton one year, and then the next year to grow crops that improved the quality of the soil, such as peanuts, sweet potatoes, peas, and soybeans. This method of **crop rotation** kept the soil rich and **fertile**.

Carver became an inventor when he turned his attention to finding new uses for some of these new crops. He developed countless paints, dyes, and plastics made from peanuts, sweet potatoes, pecans, and soybeans. And, of course, he is often credited with inventing (or at least popularizing) peanut butter! When asked why he didn't try to make a personal **profit** from his inventions, he said, "God gave them to me. How can I sell them to someone else?"



Hedy Lamarr

Brainy beauty Hedy Lamarr reluctantly agrees to judge season two of *Eureka!*, citing boredom and a salary that will help pay for her guilty pleasure: strudel

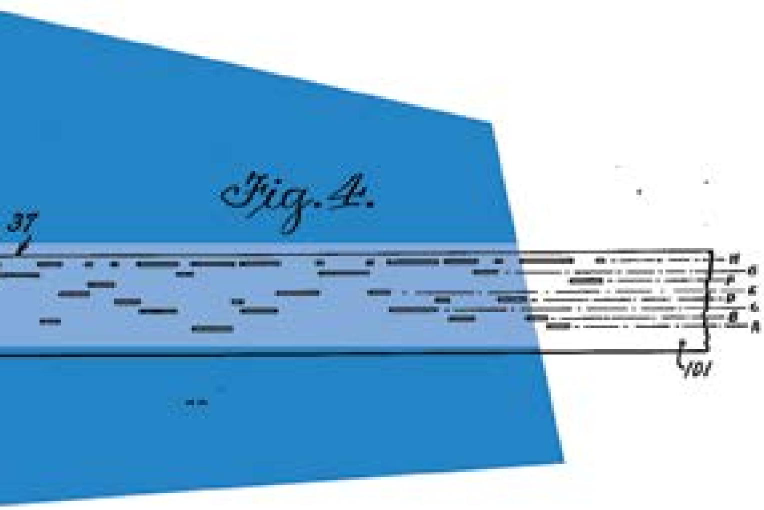
Producers are reportedly “OK” with Hedy Lamarr rejoining *Eureka!* as a judge. For her part, Ms. Lamarr claims “**indifference**” about returning to the panel. Her hopes for the student contestants include that they don’t give her a head cold, or lice.

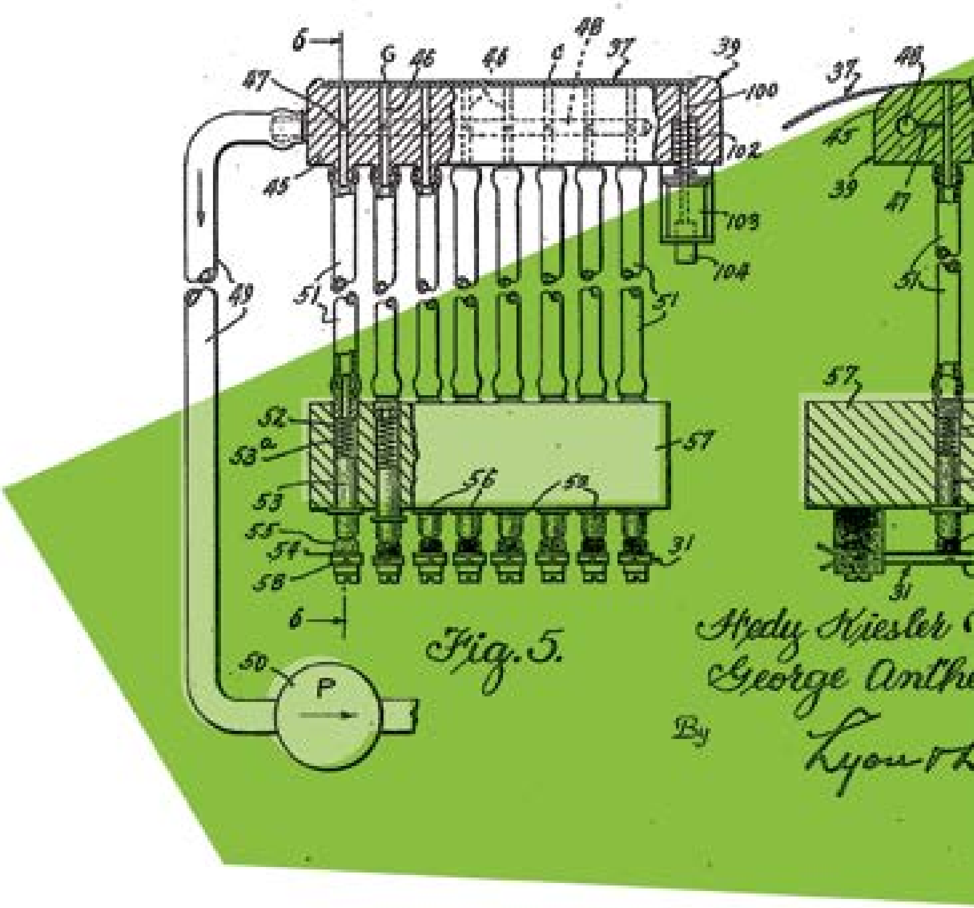
Born on November 9, 1914, as Hedwig Eva Maria Kiesler, to Jewish parents in Vienna, Austria, Hedy Lamarr changed her name in the early 1940s and became a movie star known for her stunning looks. But there was more to Hedy Lamarr than starring roles in popular Hollywood films, great beauty, and six marriages. She was also an avid inventor.

Her inventing began out of a need to entertain herself. She disliked Hollywood parties, so she had free time. She dedicated a room in her house entirely to inventing. Some of the things she developed there were everyday items (a better traffic signal, an improved Kleenex box—neither of which succeeded). But some of her other inventions were advanced technologies. She is best

known as an inventor for coming up with ***frequency** hopping*, the concept of changing the frequencies of the radio signals steering a torpedo so that an enemy would not be able to block them. She and her friend and inventing partner, a composer named George Antheil, stumbled on the idea when discussing a piece of music he'd composed that made use of **synchronized player pianos**. The two hoped to help America in World War II with their idea. It was acquired by the US Navy, but the navy never found a way to use it. It took twenty more years for the idea to be put to use, a major disappointment to Lamarr. Today a more advanced version of frequency hopping is used in wireless phones, GPS—anything that makes use of Wi-Fi.

Lamarr never profited from the idea and she was rarely appreciated for her brilliant mind. This oversight **irked** her to no end and certainly contributes to her sometimes, shall we say, "quick-tempered" responses on *Eureka!*





Lamarr's patent sketches

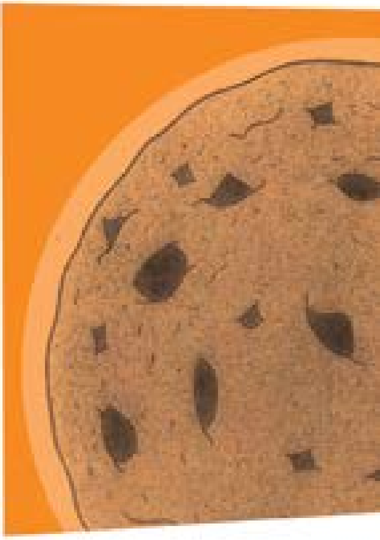
Ruth Wakefield

Good day, children. I am Ruth Graves Wakefield, and I am so very pleased to have the opportunity to clear up some disappointing untruths that people have written over the years about me and the invention of the chocolate-chip cookie.

I was born June 17, 1903, in East Walpole, Massachusetts. Articles about me almost always get that right, at least. But then the stories people tell! Here are some of the false stories that exist about me on the Internet. Some have claimed that the invention of America's favorite cookie was an accident. They say I ran out of nuts and, in a panic, chopped up a Hershey bar to throw into the cookie dough. It's utter nonsense! I kept a strict **inventory** of my food pantries' contents, and would certainly have noted an absence of pecans, cashews, or our own Professor Carver's peanuts prior to the dinner rush. I have also read that I mistakenly spilled chocolate chunks into cookie dough after being startled by a **malfunctioning** mixer. Having spent most of my life in kitchens—including my college years, during which I studied the household arts—I assure you that my response to a broken appliance would have been mild **irritation** followed by a call to the repairman.

Here is the truth about my cookie. It may not be the most thrilling story in the world, but I can't concern myself with that. In 1930 my husband Kenneth and I opened a restaurant near Boston called the Toll House Inn. The Inn was my pride and joy, and I took its operation very seriously. Some have suggested I was a bit of a tyrant with the staff, and I don't deny it. If a waitress wasn't able to fold a napkin exactly right, I would suggest that perhaps her skills were better suited to one of those "**greasy spoons**." Yes, I wanted my restaurant to be the best, and I'm fairly certain that's no crime. Therefore I was always trying to come up with new dishes and desserts to attract more business. So I set out, *quite* ***deliberately***, to invent a new cookie. And, after some trial and error with different ingredients, I created the chocolate-chip cookie in 1938 by improving a butterscotch cookie already on the menu. That's all there is to it.

And while I know quite well that my cookie did not change the course of history, I'll leave you with this question. If you were stranded on a desert island, which would you prefer to have with you—a box of light bulbs or a box of chocolate-chip cookies?



LIGHTBULB

The Light Bulb

BEFORE THE LIGHT BULB: Life in the Dark

For most of human history, people got up at sunrise and didn't do much after sunset because there wasn't much light indoors and traveling in the dark was dangerous—people could easily get lost or fall and hurt themselves.

Of course people lit their homes before the light bulb, but there were lots of **drawbacks** to these early sources of light. Candles, for example, didn't give off much light. Wood fires took a lot of effort to build and gave off unwanted heat when the weather was warm. Some species of whales almost became extinct because the oil in their blubber was used as fuel for oil lamps. Accidental fires were a problem with all of these light sources and with the gas lamps that became popular in the nineteenth century.

INVENTING THE LIGHT BULB: Edison's Innovation

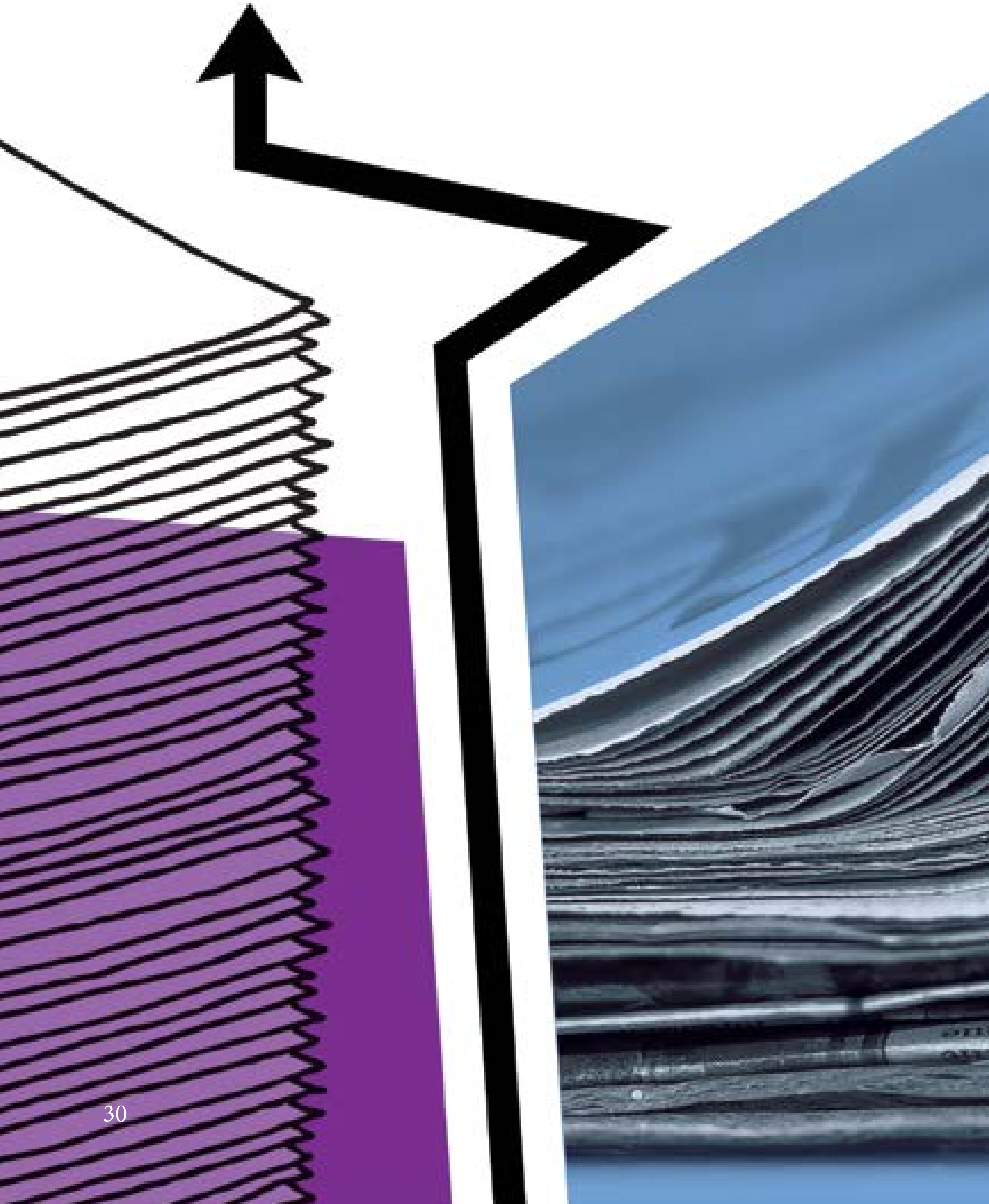
Electric lights existed before Thomas Edison's light bulb, but they were expensive and unreliable, and the lighting was very **dim**. One reason is that early inventors could not come up with a proper filament, which is the tiny wire that runs through the center of a light bulb. When the filament heats up, it glows, which is the source of the bulb's light. Before Edison, inventors made filaments from metals that would catch fire at the slightest heat. As a result the bulbs burned out very quickly, or the filament would burn so hot that the bulb would explode. Starting in 1878, Edison experimented for two years before he came up with a **charred** bamboo filament that provided 1,200 hours of **illumination**.

HOW THE LIGHT BULB CHANGED THINGS: The Impact

As a smart businessman, Edison realized the **potential** in selling both light bulbs and electricity. He quickly started a company to supply electricity to customers, and in 1882 his first power station lit up fifty-nine homes in New York City.

Almost every part of our lives has been affected by electric light. Think about all the things people do before sunrise or after sunset that would not have been possible before the light bulb. Today, factories that would have shut down at night can run around the clock because of the light bulb. The headlights on all sorts of vehicles, including ambulances and fire engines, allow for safe travel after dark. And nighttime activities that we take for granted, from sleepovers to concerts to reading in bed, would be more difficult or impossible without electric light. The light bulb also led to lots of other inventions, because once electric outlets were installed in homes, many inventors realized that things other than lamps could be plugged into these outlets. They then got busy inventing all sorts of home appliances—like the toaster, dishwasher, and electric fan—that make our lives easier and more comfortable.

PAPER



Paper

BEFORE PAPER: A Record-Keeping Nightmare

Throughout most of history, only a very small amount of human knowledge was ever written down. Most knowledge was communicated through spoken words. This meant that what a person knew was limited to what they could remember. One reason for this is that writing was very inconvenient. The writing surface made from the papyrus plant in ancient Egypt was extremely fragile. In other parts of the world people wrote on vellum, a **parchment** made from animal skin. But vellum was expensive and time-consuming to produce.

Almost two thousand years ago, around the year 105, a man named Cai Lun was keeping official government records for the Chinese Emperor He of Han. At that time in China people wrote on silk, which was very expensive, or on scrolls of bamboo, which were very heavy and difficult to manufacture. Cai Lun was frustrated with those choices and believed he could come up with a better option—a writing surface that was light, cheap, and easy to make.

INVENTING PAPER: The First Paper

Cai Lun experimented with lots of different materials and methods before discovering his winning formula: He mixed tree bark, old cloth, and discarded pieces of rope and fishing nets in a big kettle of boiling water. As the water **evaporated**, he mashed up the mush that was left into a paste, which he then set to dry on screens in thin layers. As they dried, these layers of Cai Lun's strange mixture hardened into the first sheets of paper! Cai Lun's lightweight invention made writing, transporting, and storing records much easier. Emperor He was very pleased. He rewarded Cai Lun with great wealth. Neither of them could have predicted that a few hundred years later the Chinese would find two new uses for Cai Lun's invention that would become hugely popular: paper money and toilet paper.

HOW PAPER CHANGED THINGS: Portable Knowledge

Cai Lun's invention changed civilization. People could now spread knowledge of science, literature, and art over great distances by carrying paper documents with them when they traveled. Paper also helped people communicate across hundreds and even thousands of years because stories, poems, artwork, and history could now be recorded, stored, and copied over generations. By allowing political thinkers to share their ideas with many people, paper also toppled mighty kings and brought about great revolutions. For example, Tom Paine's *Common Sense*, a pamphlet that **inspired** the American Revolution, would not have been read up and down the thirteen colonies had it not been printed on paper. Paper is also used for fun—coloring books, comics, crosswords, and novels would not exist without paper! Through the spread of books, paper has enabled billions of people to learn to read, receive an education, and read for pleasure.

AIRPLANE

The Airplane

Leonardo's Flying Machines

Leonardo da Vinci (1452–1519), the famous artist who painted the *Mona Lisa*, was also a brilliant inventor. About four hundred years before the Wright Brothers' first flight, he was writing and sketching his ideas for man-powered flying machines. After carefully studying the way birds and bats fly, da Vinci drew plans for a human-powered flying machine with giant flapping wings. He also sketched ideas for a helicopter. The technology for this kind of flight didn't exist during his life, so his ideas were ahead of their time.

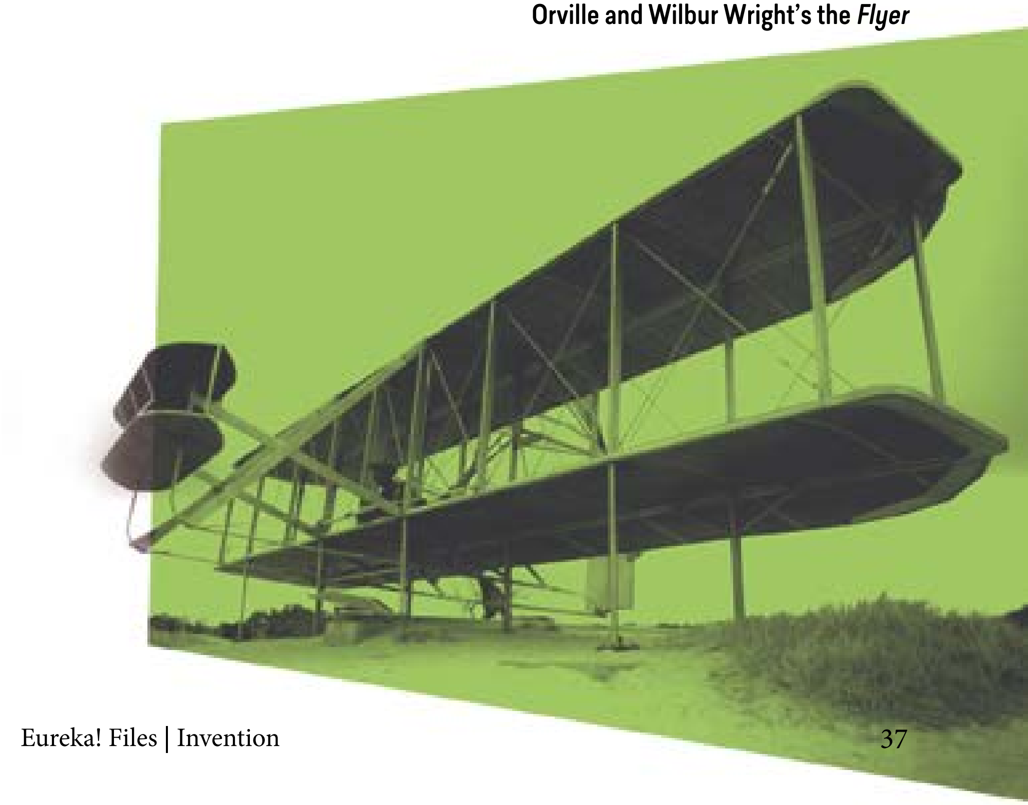
BEFORE THE AIRPLANE: Flights before the Wrights

Human beings first flew in the year 1783 in a hot-air balloon, but people wanted to do more than float in the sky. In the 1800s, a German man named Otto Lilienthal made over two thousand flights in gliders, motorless aircraft that ride air currents as a bird does in between flapping its wings. As new and more powerful engines were developed, lots of inventors attached them to aircraft frames and tried to fly. They failed because they didn't understand that successful flight requires a pilot to carefully balance and control the aircraft.

INVENTING THE AIRPLANE:
The Wright Brothers Take Control

Orville and Wilbur Wright understood the importance of control. That's why they practiced flying and steering gliders for two years before building the *Flyer*, their first motorized plane. They succeeded in keeping the *Flyer* **airborne** at Kitty Hawk, North Carolina, in 1903 because they had installed controls to keep the plane balanced and steady. Afterward they continued experimenting for two more years, eventually building the *Flyer III*. That plane had improved controls to adjust its pitch (lifting the nose or tail), roll (tilting from side to side), and yaw (steering right or left). These controls are still found on airplanes today. They help planes take off, fly, and land much more safely, especially in bad weather or high winds.

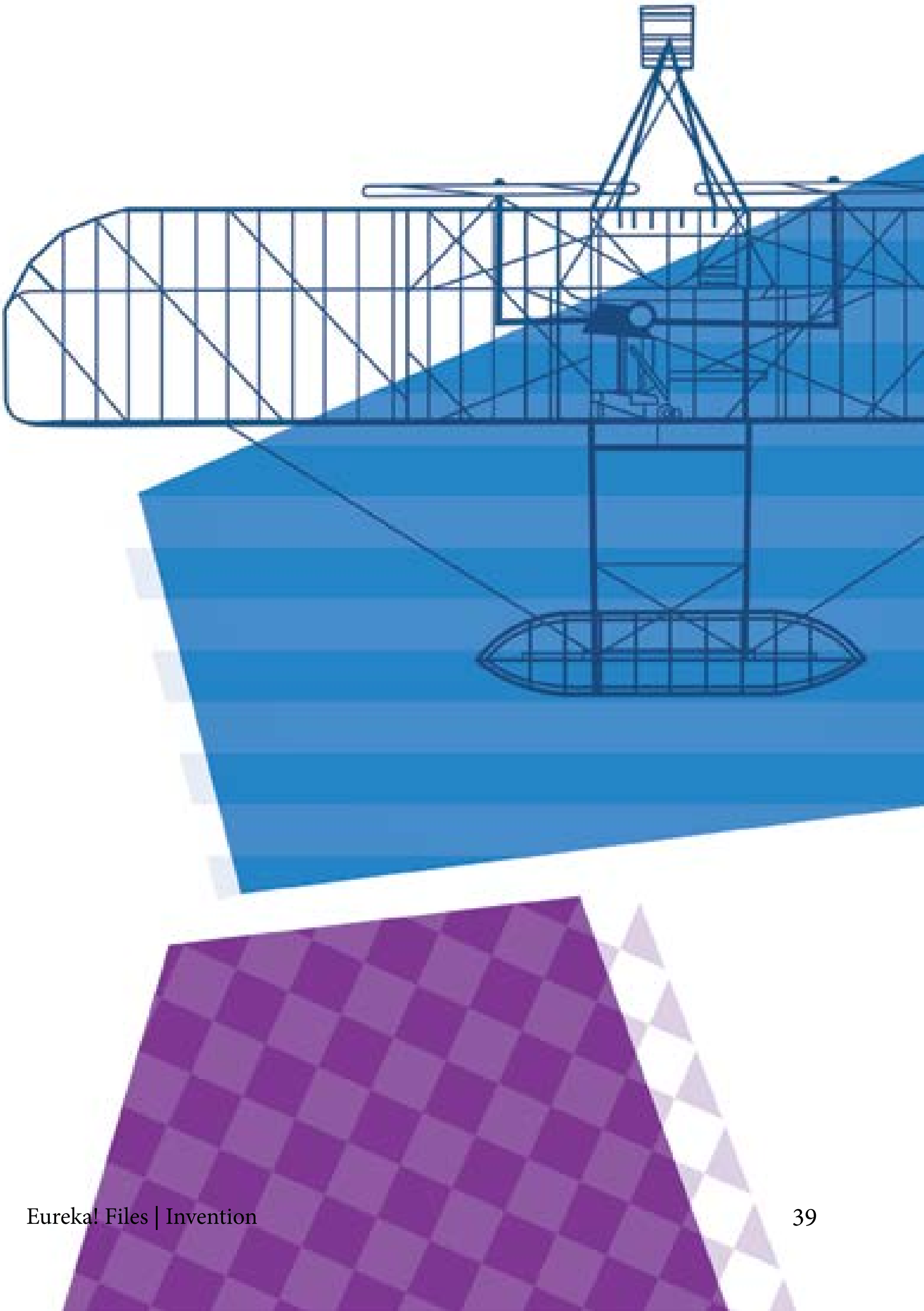
Orville and Wilbur Wright's the *Flyer*



HOW THE AIRPLANE CHANGED THINGS: The Sky's the Limit

It wasn't long before people saw the potential of the Wright Brothers' invention. Planes began carrying mail in 1911. In 1914, at the start of World War I, France and Germany used airplanes for military purposes for the first time, permanently changing how wars are fought. That same year a businessman in Florida started the very first airline, charging passengers five dollars to fly between St. Petersburg and Tampa, Florida. In 1927 Charles Lindbergh made the first flight across the Atlantic Ocean. By the end of the next decade, an airline called Pan Am was offering weekly passenger and mail flights between the United States and England. A trip that had taken a week by boat now took less than a day, with a few stopovers. Today that trip takes less than seven hours on a jet.

Hundreds of millions of people travel on airplanes every year. Airplanes have also saved countless lives by quickly bringing aid to areas hit by natural disasters. The Space Shuttle, a descendent of the airplane, sent men, women, and equipment, like communications satellites, into space. By making it possible for us to travel the world, the airplane has helped people appreciate and value different cultures, as well as understand what all people have in common.



CLOCK

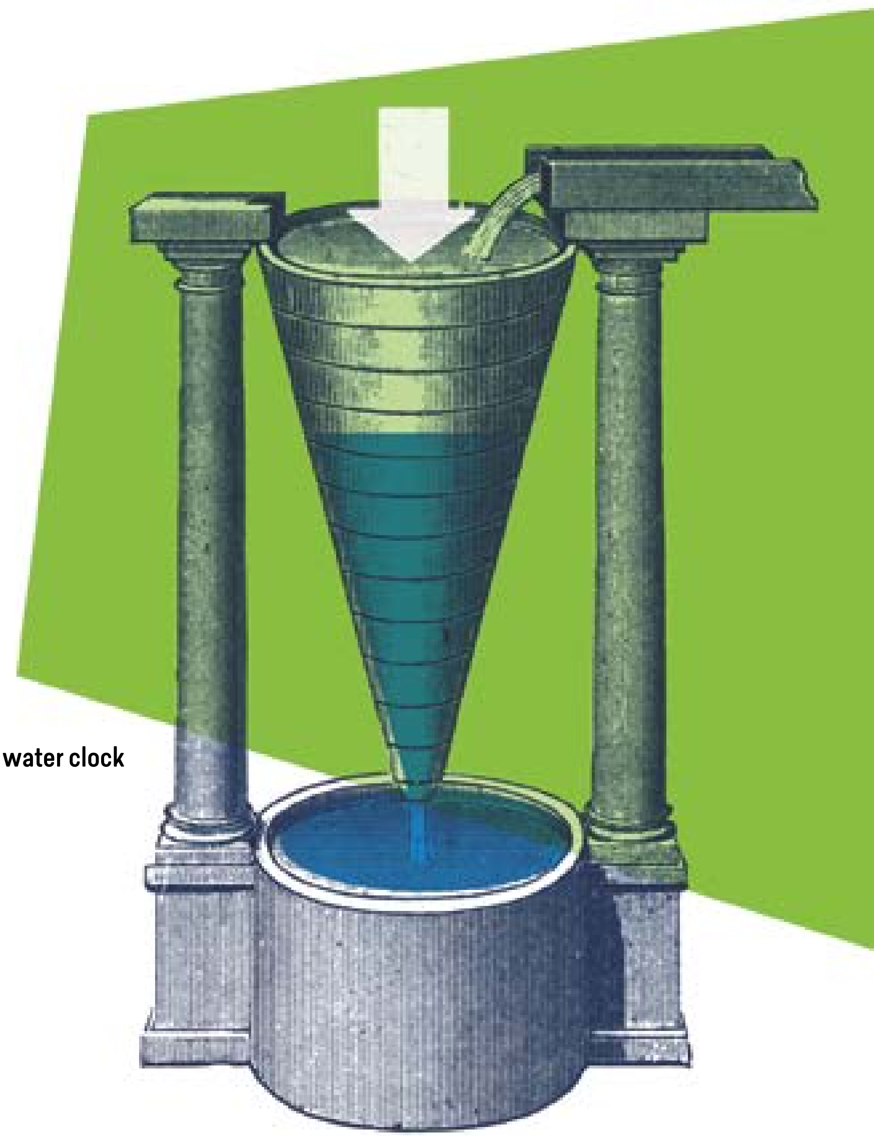
The Clock

BEFORE THE CLOCK: Telling Time

Even prehistoric men and women kept track of the passing of time. They noted the sunrise and sunset, the locations of the stars and planets, the changes in weather, and the cycle of the moon. These clues helped them know when to plant, when to hunt, and perhaps when to move to someplace warmer. As time went on, people began measuring smaller units of time with **sundials**, which told time using the direction and size of shadows cast by the sun. But sundials could not tell the exact time and were of no use on cloudy days or at night. As people started interacting with each other in more complicated ways, they divided the day into twenty-four hours and needed more accurate ways of keeping track of those hours.

INVENTING THE CLOCK: Water Clocks

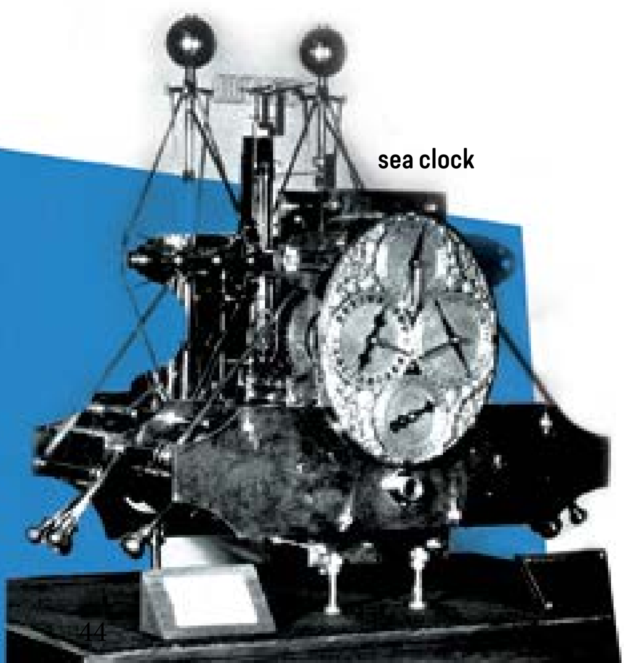
The next great innovation in timekeeping was the water clock. The first water clocks, which the Egyptians started using about 1400 BCE, were simple bowls with holes carved into them. If you knew how long it took for all the water to flow out of a full bowl, you could measure the passage of time by checking the water level. Over time water clocks improved, and in the eleventh century a Chinese engineer named Su Song built a water clock that was an architectural and mechanical wonder. Su Song's clock was powered by a waterwheel and stood forty feet high. **Intricate** puppets playing musical instruments emerged from five different doors to announce each hour. It also displayed the positions of the planets. Water clocks like Su Song's were the most accurate timepieces for hundreds of years.



water clock

Keeping Time at Sea

As the centuries marched on, clocks became more accurate as water power was replaced by springs and **pendulums**. However, these early clocks were very breakable and didn't work on ships because of all the motion caused by the sea. Sailors were desperate for a clock that would keep working on a ship. Knowing the time at home by using such a clock, and the time on board, which they could calculate using the stars, would let them figure out their ship's exact longitude (its location on one of the horizontal lines that circle a globe). Not knowing longitude often led to shipwrecks or ships becoming lost at sea. After more than 1,400 British sailors drowned in 1707 because of the "longitude problem," a carpenter named John Harrison spent almost fifty years designing clocks and watches that kept time at sea. His inventions helped sailors navigate safely.


sea clock

HOW THE CLOCK CHANGED THINGS: Time Marches On

As the number of clocks in the world continued to grow, more and more people were better able to coordinate with one another because of their shared understanding of time. Friends who planned to get together at 10:30 a.m. instead of "midmorning" were much more likely to arrive at the same time. Clocks also made workplaces run more smoothly because bosses could plan and assign work knowing exactly when their employees would be arriving and leaving. Railroads and airlines, which need to operate according to schedules, would not have been possible without clocks. And television stations need clocks to schedule their programming. Let's just hope the clock doesn't run out on *Eureka!*

MICROSCOPE

The Microscope

BEFORE THE MICROSCOPE: Bad Air

One reason doctors and scientists had difficulty curing many diseases before the invention of the microscope is that they couldn't see the tiny **organisms** that often spread sickness. Until about 150 years ago, most people believed that dirty, smelly air rising from rotting plants or dead animals formed a poisonous gas that spread illness. This idea of bad air causing disease made some sense at the time. After all, people could smell the bad odor of rotten meat, but could not see germs. A few scientists in ancient and medieval times suggested the existence of tiny living organisms, but not many people believed them. "Seeing is believing," they thought. And by the middle of the seventeenth century, no one had figured out how to examine tiny objects and organisms.

INVENTING THE MICROSCOPE: An Amateur Inventor

In 1654 a young man named Antonie van Leeuwenhoek opened up a shop in Holland selling cloth and textiles. Although he was a successful merchant, he was more interested in science, and began experimenting with glass lenses, like those used in eyeglasses. Van Leeuwenhoek manufactured a tiny lens that was double convex, which means the glass bulged out on both sides of the lens, like two tiny domes. He attached his lens to a brass plate and eureka!, he'd made a microscope. He started studying the tiniest details of organisms like mold, bees, and lice, while working on improving his lenses. By 1676 he had invented a microscope so powerful that he was able to see single-celled organisms, like bacteria. He wrote to a group of famous scientists in London about his discoveries, but they didn't believe him. "Seeing is believing," they thought. But when they sent representatives to look through the microscope themselves, they realized the importance of van Leeuwenhoek's invention.

HOW THE MICROSCOPE CHANGED THINGS: Tiny Organisms, Huge Impact

Over the years the microscope has been an important tool in great scientific and medical discoveries. Thanks to the microscope, nineteenth-century scientists like Robert Koch and Louis Pasteur were able to see the bacteria that cause many deadly diseases. Once these bacteria had been identified, scientists invented **vaccines** that saved millions of lives by preventing these diseases. The microscope has also helped the environment. For example, by studying river water samples, scientists have been able to analyze and improve the health of **ecosystems**.

Van Leeuwenhoek's most powerful microscope had a magnification of 270, which means tiny objects appeared 270 times their actual size. Today's most powerful microscopes can achieve a magnification of ten million. Modern microscopes have more uses than van Leeuwenhoek could have imagined. They are used to manufacture tiny computer parts. They also make possible many complicated medical procedures, like surgery on the eyes and blood vessels.

RADIO

The Radio

BEFORE THE RADIO: Wired!

For most of the nineteenth century, many Americans lived fairly **isolated** lives. They may not have ever traveled more than twenty or thirty miles from their homes. For entertainment they visited with neighbors, played cards and games, and maybe danced, sang, and played music together. Concerts and the theater were mostly for those who lived in cities. People didn't have much reason to communicate with those outside their communities, and when they did it was by mail, which could take weeks or months to arrive.

In 1861 the Western Union Company completed the first transcontinental electric telegraph, connecting the East and West Coasts of the United States. The telegraph was a machine that sent coded messages over a wire in the form of electricity in a matter of minutes. A telegraph operator tapped out the message in code in one city, and then a second operator decoded and wrote down the message in another city. At the

time the telegraph was the fastest and most efficient means of communicating over long distances, but putting up the wires (and making sure they stayed up) was so expensive that telegraph companies did it only where there were significant populations. This left many Americans who lived far from big cities out of reach of the telegraph.

INVENTING THE RADIO: Wireless

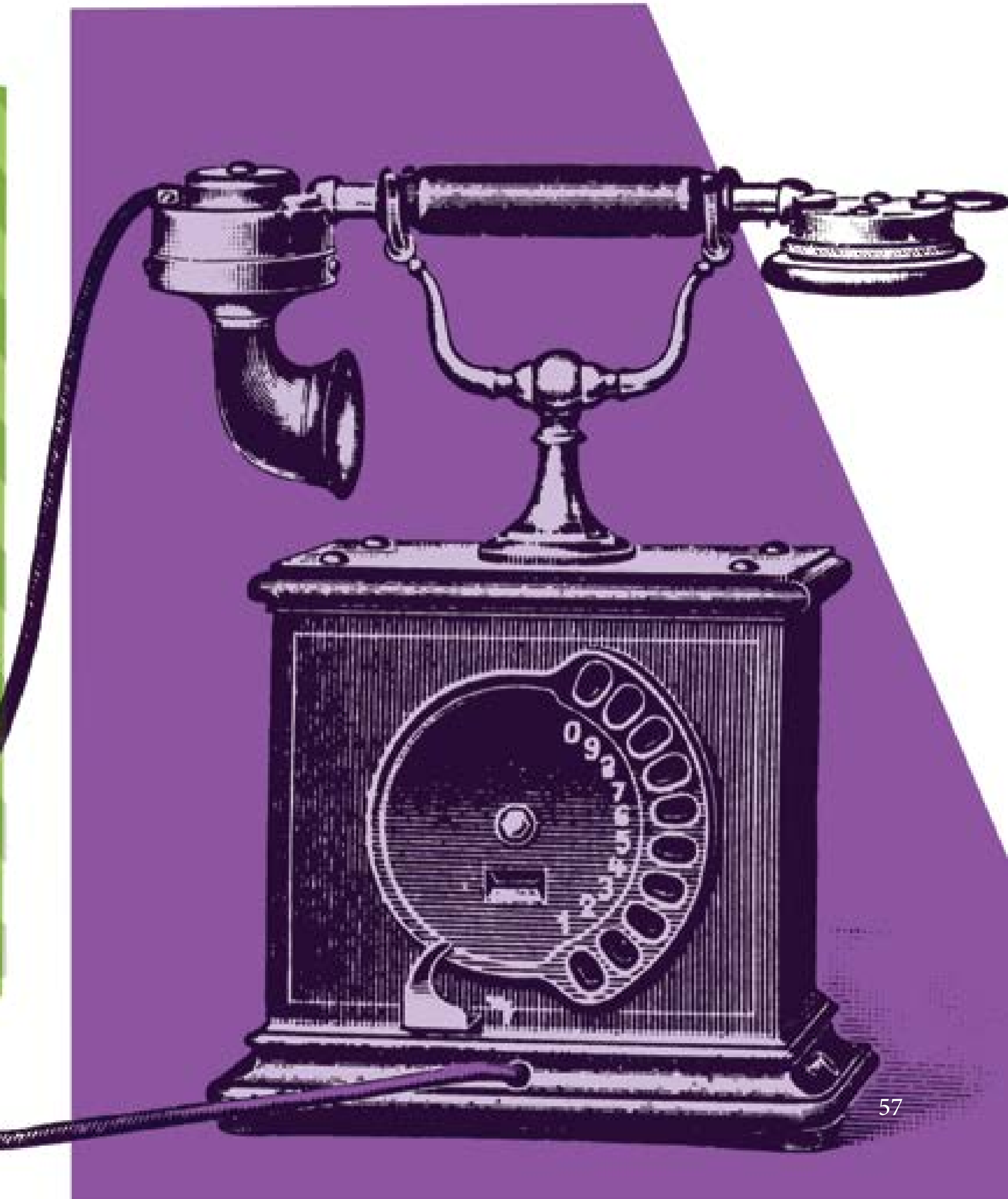
In 1894 a young man in Italy named Guglielmo Marconi read a book that explained electromagnetic waves—that's electricity that travels through the air. He reasoned that if electricity could travel through the air without a wire, then he could send telegraph messages wirelessly. He quickly got to work in his attic building a wireless **transmitter** (to send messages) and a wireless receiver (to receive messages). Soon Marconi was sending wireless signals across the room, and by 1895 he was sending them over a distance of a mile and a half.

Marconi wrote to an Italian official asking the government for money to help him further develop his invention. The official thought he was crazy, so Marconi moved to England, where he found people who believed in him. In 1898 Marconi sent a wireless message across the **English Channel** to France, and in 1902—only eight years after he built his first machine in the attic—Marconi sent a wireless message all the way across the Atlantic Ocean! Soon scientists and businesspeople realized that the future of Marconi's technology was in sending sound directly to receivers in people's homes. These receivers were called radios.

HOW THE RADIO CHANGED THINGS: Radio Waves of the Future

The first commercial radio station began broadcasting in 1920, and by 1930, long before televisions were available, radios were in twelve million American homes. Radio stations broadcast news, music, comedies, adventure shows, game shows, soap operas, talent contests—almost everything you can see on TV today. Lots of families gathered in the evenings to listen to the radio the same way many families now watch TV together. And along with the movies, the radio created national celebrities, as many radio performers became superstars. Today the electromagnetic waves that Marconi first sent across his attic are also used for cell phones, GPS, radar, and TV (including *Eureka!*), and even to control satellites in outer space.

TELEPHONE



The Telephone

BEFORE THE TELEPHONE: Voiceless Communication

For thousands of years, the only way for most people to stay in touch with those who lived far from them was through the mail, and letters could take weeks or even months to arrive. In the middle of the nineteenth century an invention called the telegraph was revolutionizing long-distance communication around the world. With the telegraph, an operator in one city could transmit a message to an operator in another city in minutes by sending an electric current over a wire. The telegraph did have some drawbacks, however. Most importantly, the telegraph could not transmit sound—only a complicated code of clicks that few people could understand. People couldn't hold back-and-forth conversations over a telegraph line. They had to go to special telegraph offices to give their messages to an operator to send, which meant messages were never completely private. And sending a message over the telegraph might require a lot of traveling if you didn't live in a city or town with an office.

INVENTING THE TELEPHONE: The Voice!

The telegraph proved that electrical signals could be sent across a wire. Alexander Graham Bell aimed to send the human voice across a wire by turning it into electrical signals. In 1875 he was **tinkering** in his lab when he accidentally spilled acid on his pants. He called to his assistant, Thomas Watson, who was in the next room, where the receiver of Bell's invention sat on a table. Eureka! Watson heard Bell's voice coming out of the machine. The first phone call!

Bell worked on improving the invention and the next year, he and Watson had a telephone conversation over a distance of two miles. When Bell spoke into the telephone, his voice caused a thin piece of parchment (the **diaphragm**) to vibrate. A magnet turned those vibrations into electricity that traveled over the telephone line. At Watson's end, a second magnet and diaphragm turned the electrical signal back into sound vibrations.

HOW THE TELEPHONE CHANGED THINGS: A Ringing Success

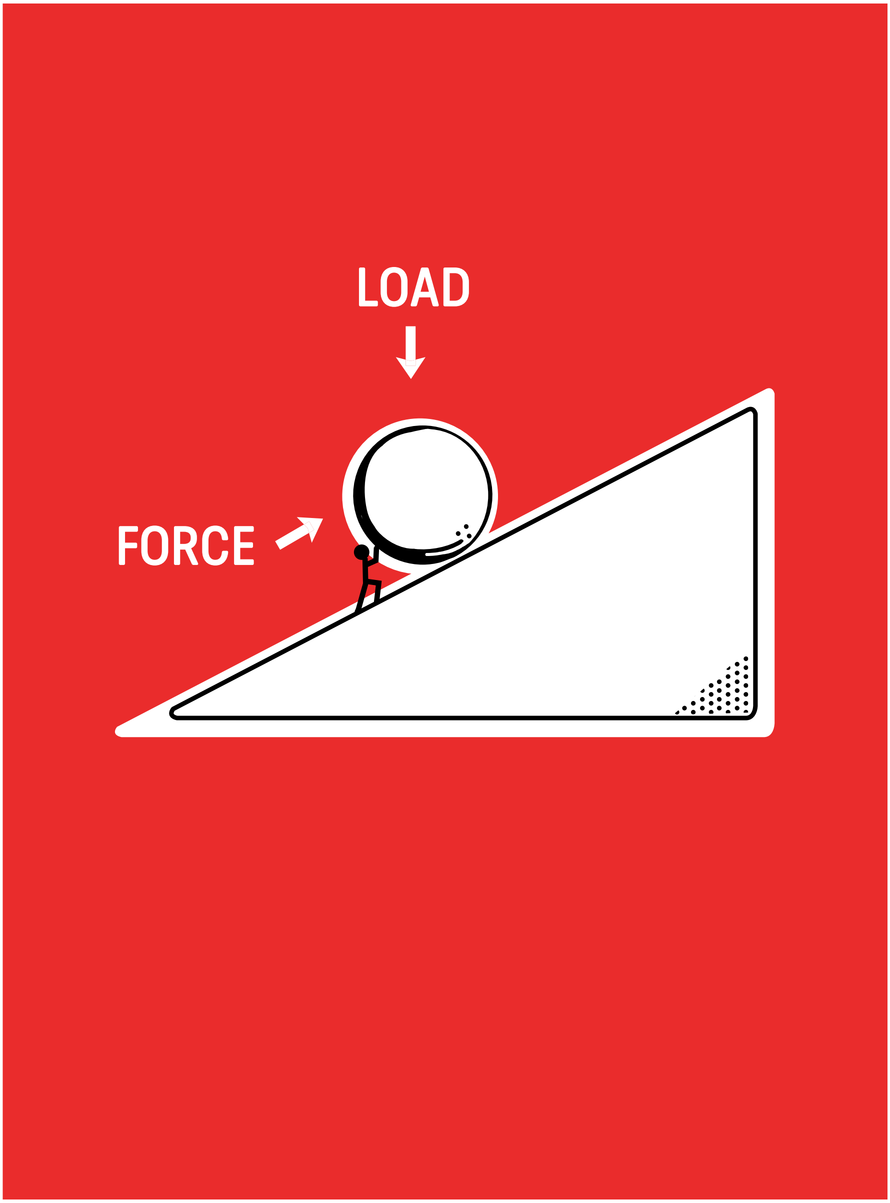
By 1886 more than one hundred thousand Americans had telephones in their homes. The country, and eventually the world, became much more connected because people were able to pick up their phones and speak to anyone anywhere. Businesses saved money, as meetings that had once required long-distance travel could now be held over the phone. People who lived in isolated areas were now able to call for help in an emergency. News traveled more quickly and long-distance friendships became possible. Eventually the telephone put the telegraph out of business and became one of the most successful inventions of all time.

The Inclined Plane

An inclined plane is really just a ramp—a flat surface tilted so that one side is higher than the other. It is the one simple machine that doesn't move, but it sure makes moving things a lot easier.

Here's an example of how it might be used: There is a rumor going around that the network is thinking of replacing *Eureka!* with a monkey modeling competition (*Next Top Monkey Model*, in case you were wondering). Now let's say some network **bigwigs** are planning to load a barrel of beautiful **baboon** contestants into the trailer of a truck to bring them down to the studio. (Don't worry, the barrel is equipped with air holes, and magnifying mirrors for last-minute makeup application). The barrel may be too heavy to lift into the truck, but it's probably not too heavy to roll up an inclined plane into the trailer. That's because by lifting the barrel, you are carrying the entire weight of those stunning **simians**, but when you roll the barrel up the inclined plane, a big part of the weight is now supported by the plane (and not you). That's the *mechanical advantage* of the inclined plane—it helps you accomplish a task *indirectly* (by rolling the barrel instead of lifting it) and with less effort.

You probably encounter inclined planes all the time. A winding trail up a mountain is an inclined plane. So is a wheelchair ramp. The inclined plane is a tool that has been around a long, long time. Archaeologists tell us that humans were using inclined planes to move things way back in prehistoric times. The ancient Egyptians hauled stones to build the pyramids by sliding them up inclined planes. And just the other day, some desperate TV producers used an inclined plane to roll a barrel of monkeys into a truck. For *Eureka!*'s sake, I hope those **primates** aren't ready for prime time.

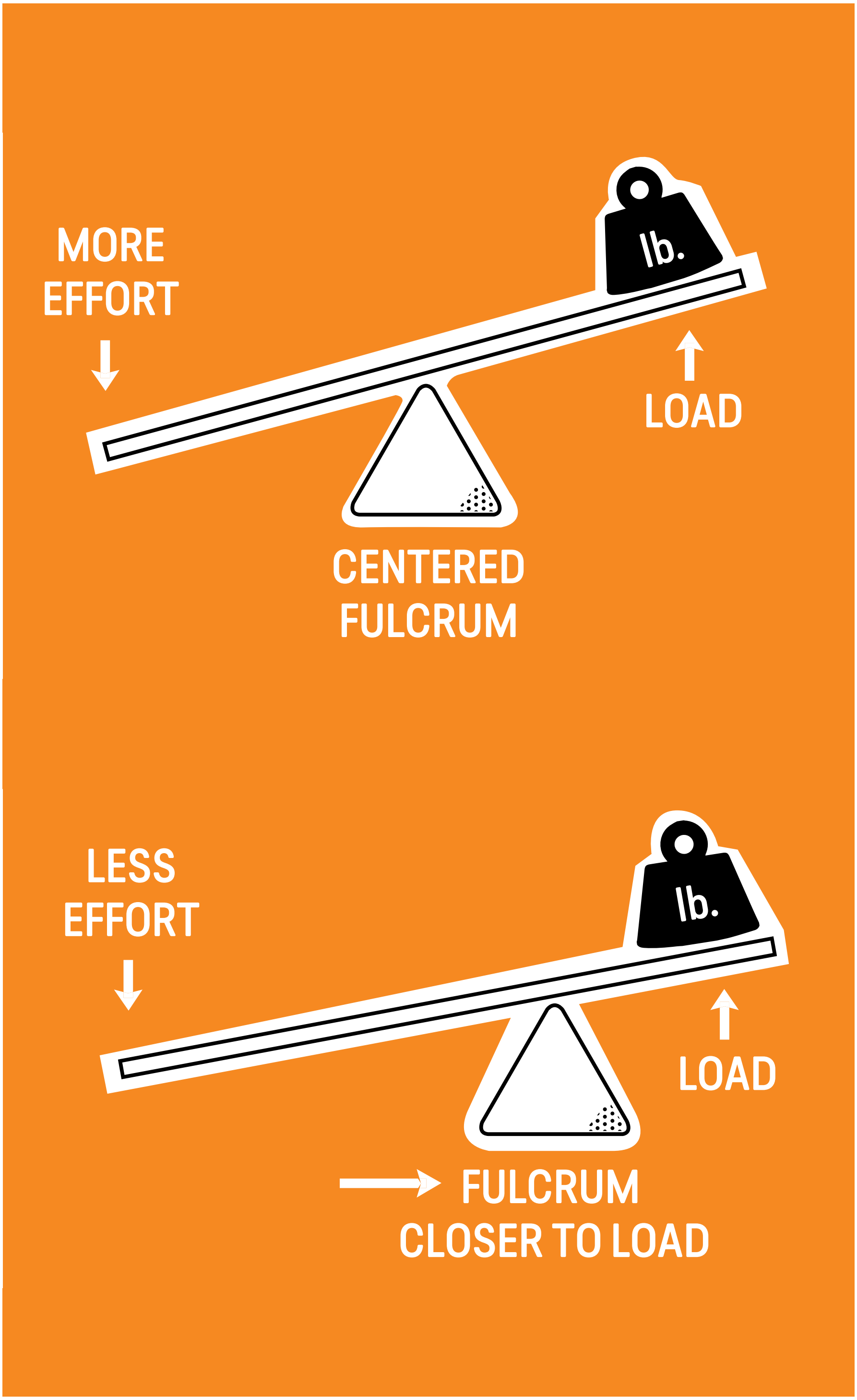


The Lever

We don't know who made the first lever, but the ancient Greek scientist Archimedes figured out the math of how levers work. He once said, "Give me a place to stand, and I shall move the earth." He meant that with a big enough lever (and it would have to be really big), one person could lift up our whole planet.

A lever consists of a beam and a *fulcrum*, which is the hinge or support that the beam rests on. The object lifted by the lever is called the *load*, and the work that you put in to operate the lever is called the *effort*. Like all the simple machines, the lever provides a mechanical advantage allowing you to do more with less effort. The size of the mechanical advantage depends on the location of the fulcrum. The closer the fulcrum is to the load, the easier it is to lift the load by pushing down on the other side of the lever. A playground seesaw is one example of a lever.

Now, suppose Professor Carver hears that Mr. Edison is interested in planting a garden. The professor is thrilled to share his passion for agriculture with his friend, so he brings Mr. Edison a gift to help him get started: a two-hundred-pound bag of **manure**. Mr. Edison isn't around, so Professor Carver decides to leave the bag on Mr. Edison's dressing room coffee table. Perhaps the bag is too heavy for the professor to lift onto the table, but if he manages to get it onto one end of a lever beam, he can push down on the other end to lift the manure, and then just slide it onto the coffee table. The closer the fulcrum is to the bag of manure, the easier it will be for Professor Carver to lift the bag. Let's hope Mr. Edison enjoys his gift!

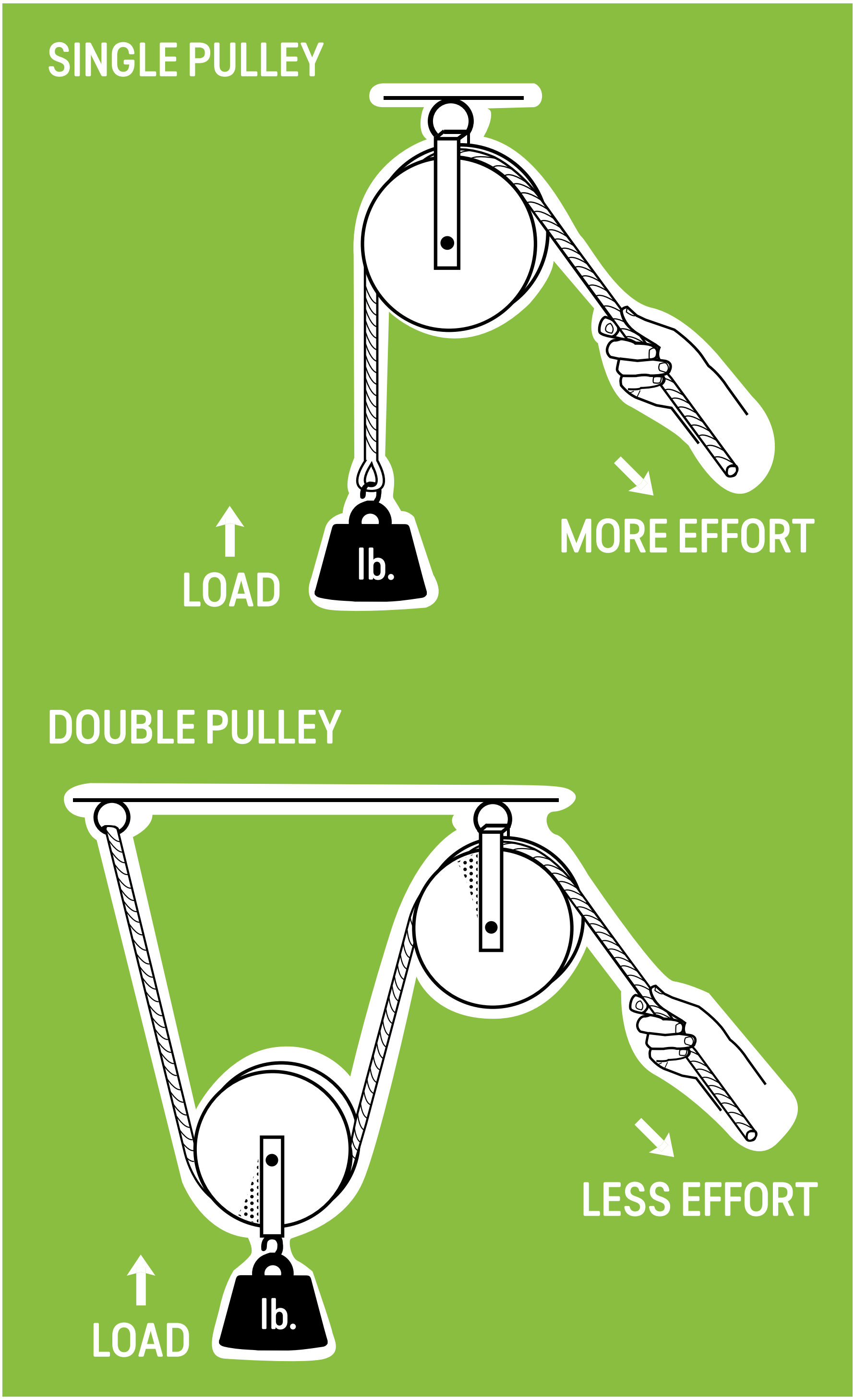

MORE EFFORT
lb.
LOAD
CENTERED FULCRUM
LESS EFFORT
lb.
LOAD
FULCRUM CLOSER TO LOAD

The Pulley

Ever opened up the blinds? You've used a pulley. Ever flown a flag up a flagpole? You've used a pulley. Ever had a dream where you were being chased by a tiger? No pulley there, but it happens to the best of us. The important thing to remember is that a simple pulley is just a wheel that is attached to something sturdy and has a rope running over it. The elevator is another important invention that makes use of a pulley.

How does it work? Last season Jacques needed to load two hundred pounds of jellyfish food onto his boat, the *Calypso*. As we know now, that was a big mistake, but let's take a look at how he did it anyway. First he hoisted the bag onto his shoulder and tried carrying it up the gangplank, but it was too heavy. Then he attached a simple pulley to a beam hanging over the edge of the boat. He tied the jellyfish food to one end of the pulley's rope and pulled on the other end. This way he was using his body weight to help lift the jellyfish food, but the bag was still too heavy.

Don't worry, though. Jacques knew that by attaching one end of the pulley's rope to the beam, and then hanging a second pulley from that rope, he could make a double pulley, which would give him a mechanical advantage. That means the machine lets him do more with less effort. Specifically, with a double pulley, a bag that actually weighs two hundred pounds feels as if it weighs only one hundred pounds. Unfortunately, that mechanical advantage almost got *Eureka!* canceled for good!


SINGLE PULLEY
lb.
LOAD
MORE EFFORT
DOUBLE PULLEY
lb.
LOAD
LESS EFFORT

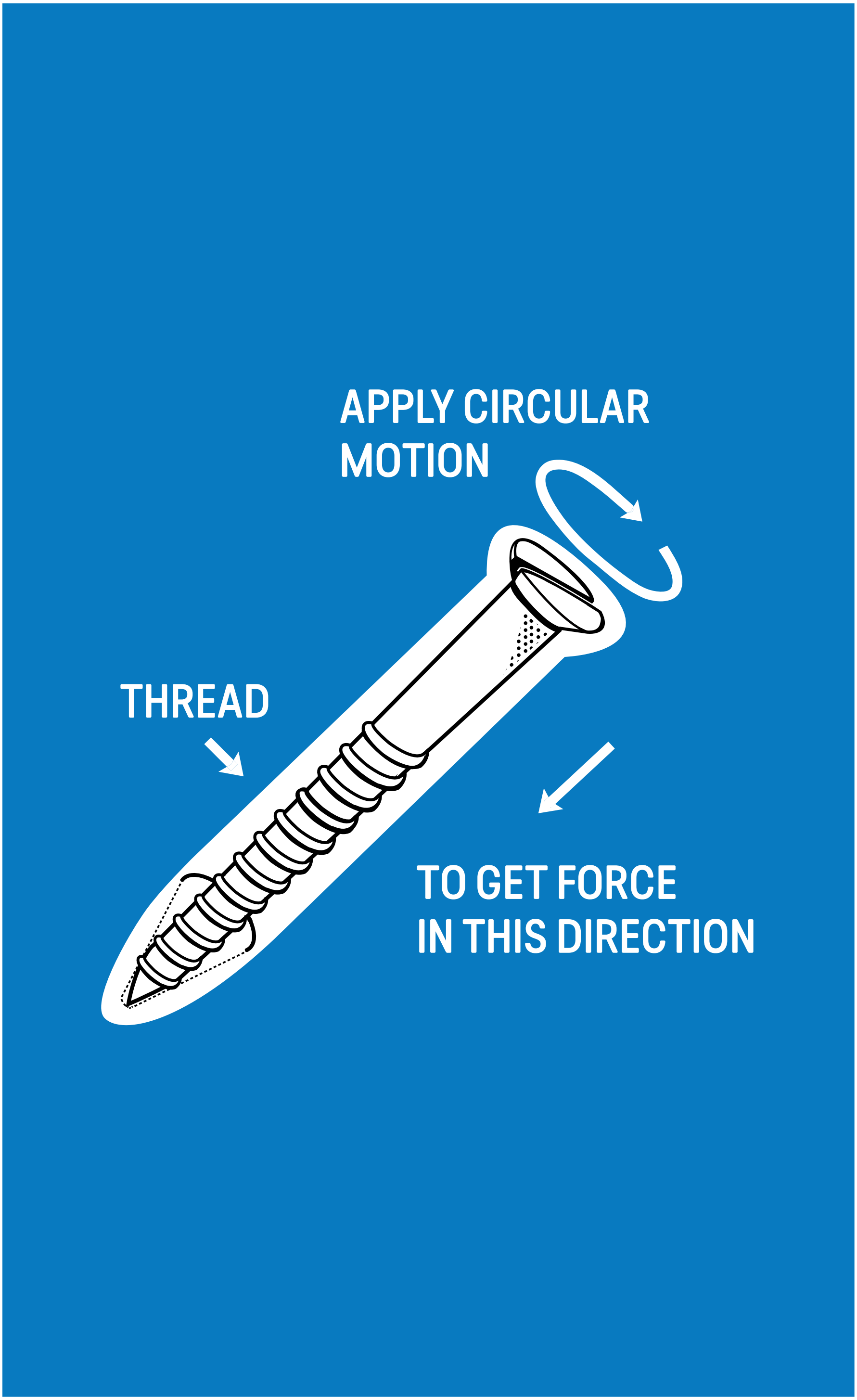
The Screw

The humble screw is everywhere. Hardware stores have thousands of them. The desk or table you're sitting at was probably put together with screws. But don't take the screw for granted; it is actually a remarkable simple machine that makes tough jobs a lot easier.

Just ask Professor Carver. Not surprisingly, he is the only judge who regularly offers to pitch in to help the *Eureka!* construction crew build the set. Today the crew is working on a wooden banner that will hang over the judges' table. Professor Carver has generously volunteered to fasten together two planks of wood that will make up part of the letter *E* in *Eureka!*

Using a screw and a screwdriver will make the job so easy that Professor Carver will be able to finish the whole *E* and maybe even start on the *U* during his break (while the other three judges drink coffee and eat pastries). After all, it doesn't take a lot of strength to turn a screw clockwise with a screwdriver, but the screw then converts that circular movement into a powerful force that drives it through the wood. That's called a mechanical advantage.

A final word: one of your esteemed judges should thank his lucky stars for this simple machine. We won't name names, but how many inventors does it take to screw in a light bulb?


APPLY CIRCULAR MOTION
THREAD
TO GET FORCE IN THIS DIRECTION

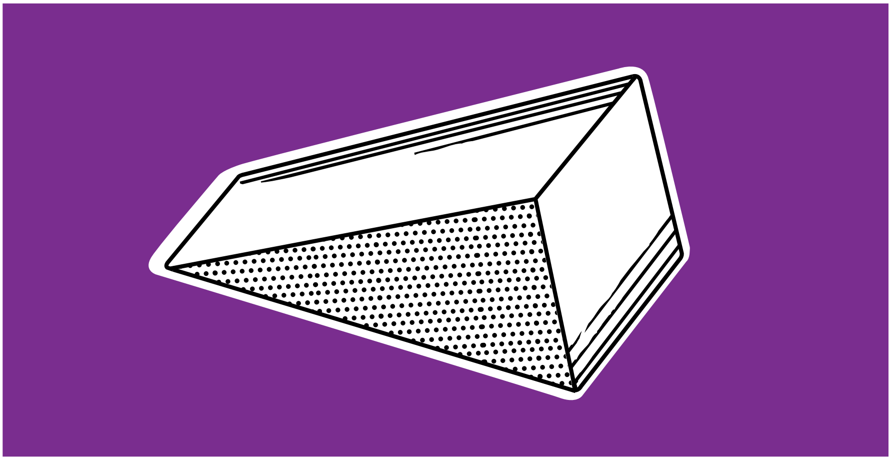
The Wedge

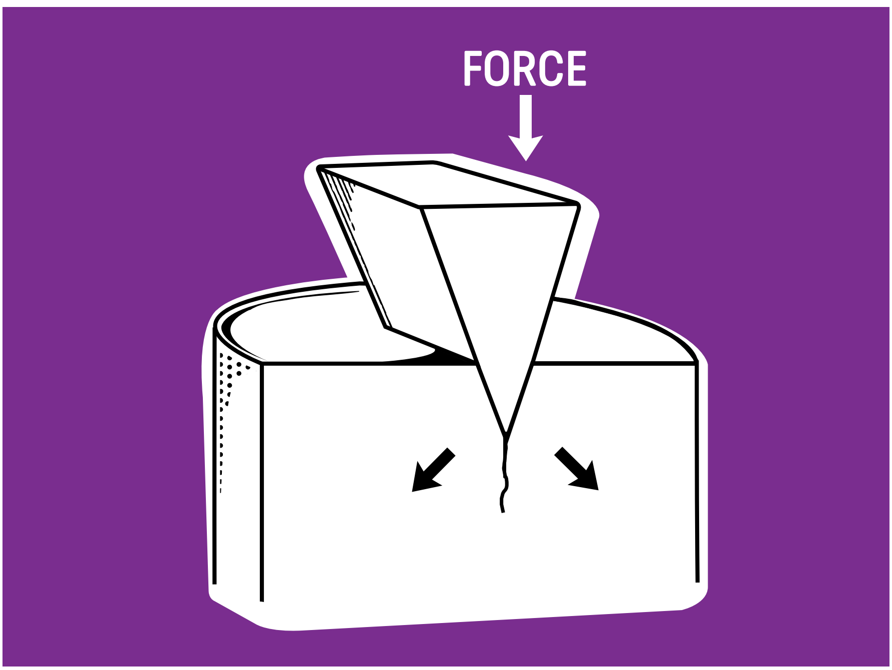
This article is about wedges, not wedgies. If you want to read about wedgies, you'll have to look somewhere else (and also, you're probably a little weird). A wedge is a piece of material (usually hard) with two sloping sides that meet to form an edge (usually sharp). Pound a wedge into something hard enough, and it will split that something apart. The blade of an ax is a good example of a wedge. The two large sides of the blade slope diagonally toward each other until they meet to form the sharp edge.

Like all the simple machines, the wedge offers a mechanical advantage. In other words, it takes whatever effort you put into a task and provides an output that is greater. Imagine, for example, that you are a lumberjack splitting a tree stump with an ax. The wedge shape of the blade turns the force of your swing into an even stronger force once the blade makes contact with the stump.

You can find wedges all over. The pointed ends of a fork are wedges. The slider you pull down to unzip your jacket is a wedge that splits apart the "teeth" of the zipper. And speaking of teeth, you have about ten wedges with you at all times—built right into you, as a matter of fact. Feel the upper and lower teeth near the front of your mouth. (Ms. Lamarr hopes your hands were clean. Otherwise, "Yuck.") Your teeth start out thick near your gums, and then narrow to a sharp edge. Those tiny personal mouth wedges work the same way as an ax blade. The force of your bite causes the sharp edges of your teeth to split apart that delicious brussels sprout.

Humans were using wedges to split things way back in the **Stone Age**, which makes the wedge one of the first inventions ever. Wedges helped early humans cut wood for fire, hunt (the sharp ends of spears and arrows are wedges), and grow food (the blade of a plow, a very important farming tool, is a wedge). Think about that as you're brushing your mouth wedges tonight.



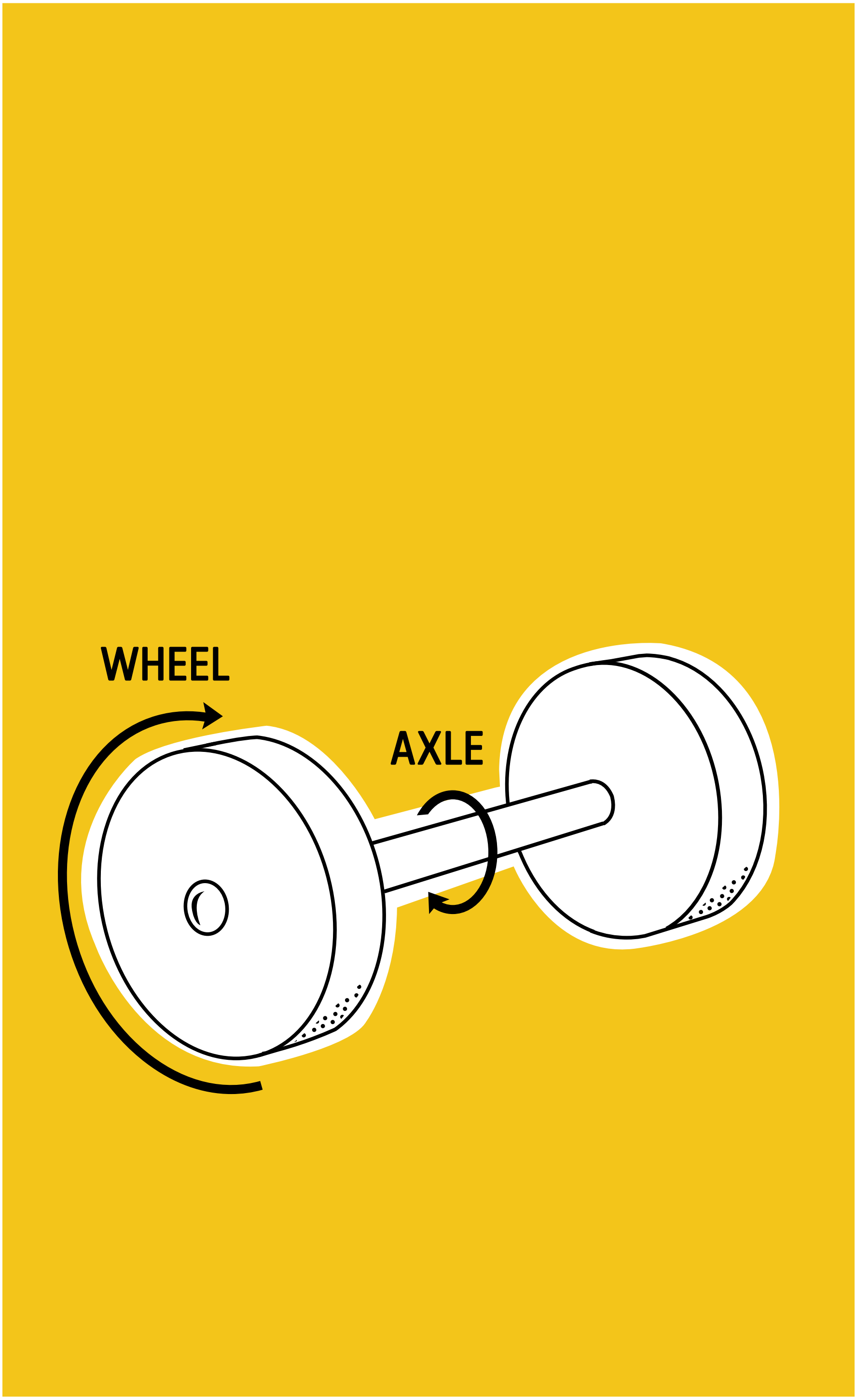


The Wheel and Axle

When you finally have all those invention wedges you're competing for, they are going to form a wheel. Join a wheel with an axle and you're looking at a simple machine that has been a building block for many other machines.

You might think of the wheel as an invention mainly connected with transportation. But wheels can be used for a lot more than moving things from place to place. Attach a long, thin cylinder (an axle) to a wheel and you've got a simple machine that offers a mechanical advantage, helping you accomplish more with less effort. For instance, imagine pulling a bucket full of water up from an old-fashioned well. The bucket hangs from a **cylinder** (the axle) that you turn with a crank (the wheel). You could try raising the bucket by pulling the rope directly or by turning the axle by hand, but either of those methods would require more effort than hoisting the bucket by turning the crank (the wheel).

When Jacques steers his boat, the *Calypso*, he's using a wheel and axle, too. Boats change direction when the rudder, a flat plank attached to the back of a boat, moves left or right. But at sea, a boat's rudder is under water, which means moving it by hand would be a very hard (and wet) job. The wheel and axle make the job easy. A boat's steering wheel (which sailors just call the wheel) is attached to an axle, which is connected by rope to the rudder. With very little effort, Jacques can turn the wheel of his boat, which turns the axle. Then the axle does the hard work of moving the rudder left or right. Let's hope he steers clear of jellyfish.


WHEEL
AXLE

Louis Braille

Bonjour!

Where to start … well, I was born on January 4, 1809, in Coupvray, France, a small town not too far from Paris. When I was a child, my favorite place to play was my father's workshop. Oh, it was ***très magnifique***! He made saddles and harnesses for horses. I'll never forget the wonderful smells and sounds of the leather and the tools. But these simple joys would not last. The entire course of my life changed when I was only three years old. One day, when I was using some of my father's tools, I managed to poke myself in the eye. But this was not just any poke. ***Quelle guigne***! What bad luck—the eye became infected and the infection spread to my other eye. By the age of five I was completely blind. While it made learning more challenging, being blind didn't dampen my desire. As you probably hunger for chocolate or pizza, I hungered to read. Unfortunately, at that time, books for the blind to read by touch were scarce. They featured giant raised letters, but they were very heavy, difficult to produce, and not at all **practical**. Consequently, almost everything I learned from books was read *to* me by my teachers at the school for the blind in Paris.

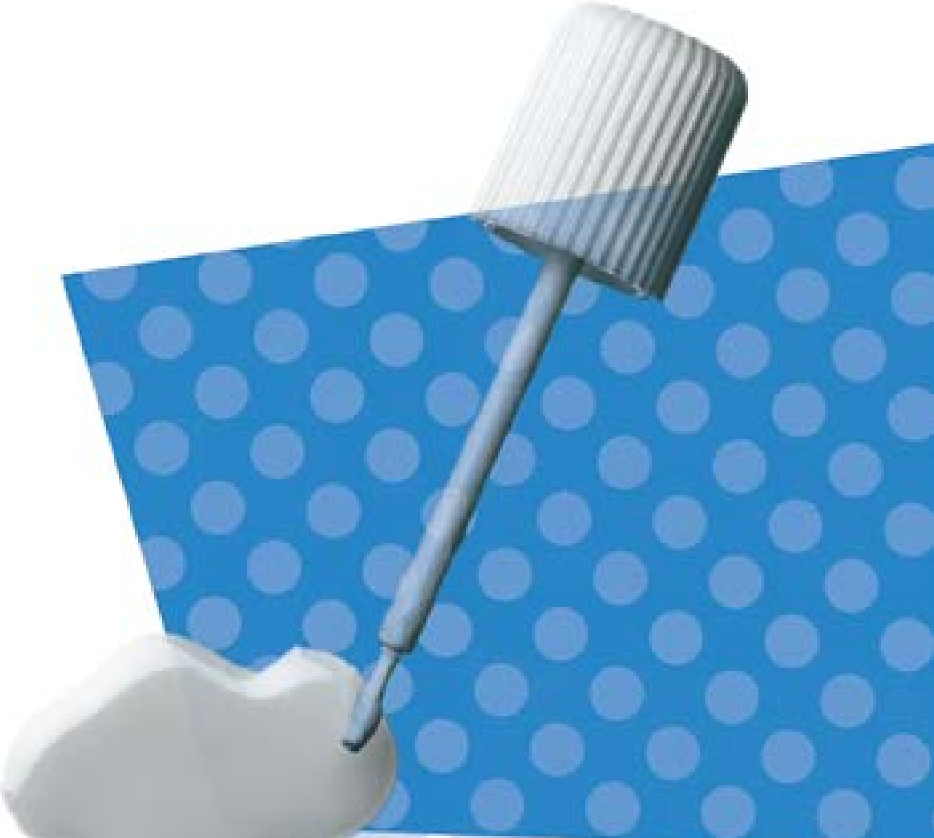
Then, when I was twelve, a French army captain named Charles Barbier visited my school. He told us about *night writing*, a communication system he'd invented for soldiers on the battlefield. Night writing was a complicated code of dots pressed into paper. And I do mean complicated! The system was so hard to learn that the army gave up on it. But it got me thinking … what if there were an alphabet for the blind that could easily be read but didn't have to be written in extra-large letters? And what if blind people could also write in this alphabet without using big, clunky machines?

Transforming night writing into this new alphabet became my mission, and by age fifteen I had done it. In my new system, each letter was represented by a simple arrangement of tiny raised dots. Just as I hoped, my invention allowed full-length books for the blind to be lighter and smaller, so they were much easier to print. And even more importantly, my alphabet was very easy to read by touch, and also gave the blind a practical way to write using only a simple **stylus**. In the years that followed, I added to my invention so that blind people could read and write music and mathematical equations. The *Braille alphabet* caught on, and Braille books have been published all over the world. ***Quelle merveille***! It is incredible, don't you agree?

Bette Nesmith Graham

Howdy, guys and gals. And thank you all so much for the chance to appear on the program. I'm afraid my invention may seem a little old-fashioned today, but in the 1950s it was **revolutionary**. Back then I worked as a secretary at a big bank in Dallas, Texas—which also happens to be the town where I was born on March 23, 1924. Of course, we didn't have computers and printers in those days. All our letters and business documents were typed on typewriters. You've seen typewriters, haven't you? Oh gosh, maybe not—you're all so young! Anyway, we had the darndest time if we typed even one letter wrong. A pencil eraser doesn't work on typewriter ink. No eraser does—believe me, I tried lots of them. The **upshot** was, if you made a mistake, you had to go back to the beginning and start again. Can you imagine?

Then, one December, I was painting holiday snowflakes on the bank windows when it suddenly hit me. Painters don't erase their mistakes; they paint over them. Maybe the same idea would work for fixing typing mistakes! So I mixed up a batch of quick-drying paint that matched the color of the bank's typing paper, and put it in a bottle with a tiny little paintbrush. The next day at work, when I made a mistake in my typing, I just painted over the wrong letters and then typed the correct ones over the paint after it dried. Soon all the secretaries at the bank were asking for my magical Mistake-Out. A chemistry teacher at the local high school helped me improve the formula, and all of a sudden I was selling my invention—now called Liquid Paper—all over the world. I ran my own company, bringing a rarely seen feminine touch to the business world: for instance, it was almost unheard of in the 1970s for a company to have a child care center, as mine did. I was unstoppable and one of the most successful women in business (My company sold for nearly fifty million dollars in 1979!). So you little pups should really keep your eyes open for problems to solve, and keep your minds open for all kinds of different ways to solve them. You never know what you'll think up!



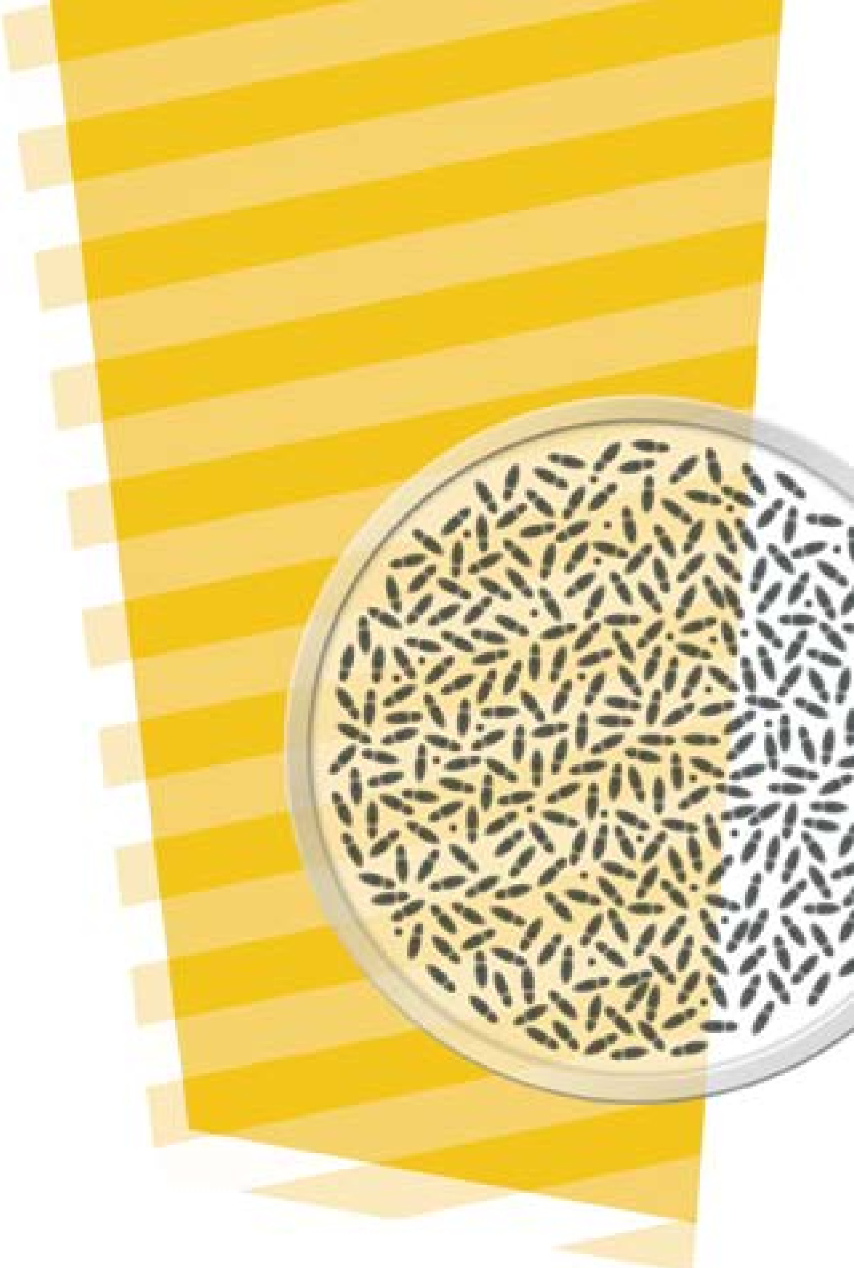
Alexander Fleming

Hello and good day to you, student inventors! It's a pleasure to be on the show. My name is Alexander Fleming—well, Sir Alexander Fleming, as of the day I was knighted by King George VI in 1944. But I'm getting ahead of myself. I was born on August 6, 1881, on a farm in Ayrshire, Scotland. But I wasn't meant for farm life. I moved to London as a young man and became a **bacteriologist**—a scientist who conducts experiments on bacteria. During World War I, I served as a captain in the Royal Army Medical Corps. There I saw too many men die needlessly in field hospitals, where I suspected the **antiseptics** used to clean their infected wounds were more dangerous than the wounds themselves. But no one **heeded** my warnings and the antiseptics continued to be used—it was, to say the least, a frustrating time for me.

After the war I was busy at St Mary's Hospital in London, studying a particularly nasty bacterium called staphylococcus that causes **boils**, **abscesses**, and sore throats. I had a very good reputation amongst those studying bacteria, though I was known to be a little sloppy—OK, very sloppy—in my lab. I admit it: being orderly isn't my strength. You can't imagine the trouble this got me into growing up on the farm—I mean,

do you know how angry a cow gets when you forget to milk her? But I **digress**. On September 3, 1928, I returned from a lengthy family holiday to find that I'd left a stack of **petri dishes** filled with live bacteria **cultures** sitting out on a bench (needless to say, this is not where cultures ought to be left, even for a night or two!). Unsurprisingly, one of the cultures had become **contaminated**—invaded—by a fungus, a kind of mold. But surprisingly, the fungus seemed to be preventing the bacteria from growing around it. This was curious. So I decided to grow the fungus, which I called penicillin, again, and realized that it successfully killed bacteria!

This was great, but I still didn't comprehend the huge import of what I'd discovered. What can I say? We can't always see precisely what we have when we have it. After all, I tested penicillin for a number of years, but came to the conclusion that it couldn't survive long enough within the human body to fight infection successfully, and I moved on. Luckily, other scientists stuck with it. By the end of World War II, penicillin was saving many soldiers' lives. And shortly thereafter I became Sir Alexander Fleming and shared the Nobel Prize in medicine. Penicillin was the first **antibiotic** and it unquestionably changed the world. It is widely considered one of the most important inventions of the twentieth century. The moral of the story? I think I'd put it something like this: "One sometimes finds what one is not looking for. When I woke up just after dawn on [that day in September, 1928], I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer. But I guess that was exactly what I did."



Glossary

A

abscesses, ***n:*** inflamations caused by bacteria

agricultural, ***adj:*** relating to farming

airborne, ***adj:*** in flight

antibiotic, ***n:*** a medicine that kills or stops the growth of diseased cells

antiseptics, ***n:*** substances that prevent the growth of disease-causing microorganisms

aquatic, ***adj:*** relating to water

arguably, ***adv:*** able to be supported by a reasonable argument

avid, ***adj:*** eager or excited

B

baboon, ***n:*** a kind of monkey

bacteriologist, ***n:*** a scientist who studies microscopic organisms that often cause disease

bigwigs, ***n:*** important people

boils, ***n:*** a painful skin condition

botanist, ***n:*** a scientist who studies plants

botany, ***n:*** the scientific study of plants

C

charred, ***adj:*** burnt

contaminated, ***adj:*** harmful or unusable due to contact with something unclean

crop rotation, ***n:*** yearly switching of which crops are grown on a piece of land

cultures, ***n:*** growths of microorganisms in a nutrient medium

cylinder, ***n:*** an object with identical flat ends and a circular or oval section

D

deliberately, ***adv:*** on purpose

deter, ***v:*** discourage

diaphragm, ***n:*** a thin disk or piece of material that vibrates when producing or receiving sound waves

digress, ***v:*** get off the subject

dim, ***adj:*** not bright

drawbacks, ***n:*** disadvantages, problems

E

ecosystems, ***n:*** systems formed by the interaction of communities of organisms with their environments

English Channel, ***n:*** a body of water separating England and France

evaporate, ***v:*** change from a liquid state into a vapor

F

fertile, ***adj:*** capable of producing healthy plants

financiers, ***n:*** people who give inventors money to develop and sell their products, in return for a portion of the profits

frequency, ***n:*** the rate at which radio signals are transmitted

G

greasy spoons, ***n:*** slang for cheap and unsanitary restaurants

H

heed, ***v:*** pay attention to

humble, ***adj:*** not significant; modest

I

illumination, ***n:*** brightness

indifference, ***n:*** lack of interest

inspire, ***adj:*** give rise to, lead to

intricate, ***adj:*** detailed, complicated

inventory, ***n:*** a complete list

irk, ***v:*** bother, irritate

irritation, ***n:*** the state of being annoyed

isolated, ***adj:*** far away from other places, buildings, or people; remote

M

malfunctioning, ***adj:*** not working properly

manure, ***n:*** a substance made from animal poop that is spread on plants to help them grow

marketing, ***n:*** activities involved in advertising and selling a product

O

optimistic, ***adj:*** expecting a favorable outcome

organisms, ***n:*** living things

P

parchment, ***n:*** animal skin prepared for use as a writing surface

patent, ***v:*** get a government license giving an inventor the right to be the only one to manufacture and sell their invention for a certain period of time

pendulum, ***n:*** a weighted, swinging lever that regulates the speed of a clock

petri dishes, ***n:*** shallow, circular, transparent dishes with flat lids, used for the culturing of microorganisms

phonograph, ***n:*** a machine that reproduces sound by means of a needle in contact with a grooved rotating disk

player piano, ***n:*** a piano fitted with an apparatus enabling it to be played automatically

potential, ***n:*** qualities or abilities that may be developed and lead to future success

practical, ***adj:*** useful

prestigious, ***adj:*** highly respected

primates, ***n:*** a category of mammals that includes humans, monkeys, and apes

producers, ***n:*** people who supervise a televison production

profit, ***n:*** (often financial) gain

Q

quelle guigne, French for "what bad luck!"

quelle merveille, French for "how marvelous!"

R

rehabilitation, ***n:*** recovery

revolutionary, ***adj:*** bringing about major change

S

self-sufficient, ***adj:*** able to take care of oneself

sharecroppers, ***n:*** farmers who had to give part of their crop away as rent

simians, ***n:*** monkeys

spearhead, ***v:*** lead

Stone Age, ***n:*** a period in the history of mankind marked by the use of tools and weapons made of stone

stylus, ***n:*** a pointed, pen-shaped instrument used to make an imprint on a surface

sundial, ***n:*** an instrument showing the time with the shadow of a pointer cast by the sun onto a plate marked with the hours of the day

synchronized, ***adj:*** occurring at the same time

T

take root, ***v:*** begin

telegraph, ***n:*** a machine that transmitted and received messages across great distances using electrical signals and wires. Messages were transmitted in codes that had to be received and translated by specially trained operators

tinker, ***v:*** to work at something

transmitter, ***n:*** a set of equipment used to generate and transmit electromagnetic waves carrying messages or signals, especially those of radio or television

très magnifique, ***adj:*** French for “really wonderful”

U

upshot, ***n:*** result

V

vaccines, ***n:*** medicines to make people immune to diseases

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TEXAS
ELEMENTARY LITERACY PROGRAM

Grade 4 | **Unit 2** | Reader

Eureka! Files

800L

ISBN 9781643837482

Grade 4

Unit 2: *Eureka! The Art of Invention*

Use the Interactive Read-Aloud lesson and text on the following page to kick off this unit with your students.

Unit-level Essential Question

How can an invention change the world?

Lessons 1–5

Guiding Question: What skills or traits make a good inventor?

Writing Prompt: Consider a household invention—such as the light bulb—you use every day. Who invented it? Research to find out more about that person and how they came to invent what they did.

Lessons 6–10

Guiding Question: How does "invention breed invention"?

Writing Prompt: What has been the most difficult process of inventing so far, and what has been the most rewarding?

Unit 2 Culminating Activity

You have learned a lot about different types of inventors in this unit. How is your inventing process similar to an inventor you have read about? What struggles and successes did they encounter that you did too?

GRADE 4 UNIT 2

Read-Aloud

Use the following Read-Aloud to introduce **Grade 4 Unit 2**.

Tell students that throughout this unit, they will think about the following **Essential Question:** How can an invention change the world?

Explain that over the next few weeks they will be part of a very special experience—a game show in which they learn from famous inventors throughout history and work to invent their own creations. Before starting that game show, though, they will hear new insights from a famous inventor they have already encountered—Benjamin Franklin.

Read the Read-Aloud, pausing after each section to discuss the text-based questions.

Benjamin Franklin, An American Inventor

by Elizabeth Wade

You may remember learning about Benjamin Franklin before. Today, you'll hear more about him and his inventions—and you will get to hear some of his own words about being an inventor. You may remember that Franklin, who was born in the colony of Massachusetts, had an important role during the American Revolution. He served the American people by speaking on their behalf in front of Parliament, part of the British government. He also traveled to France to ask for its help when they decided to form their own independent nation. In fact, the work Franklin did to help establish the young nation even made one historian claim that he helped invent the United States!

It might seem unusual to talk about inventing a country, but it is important to remember that the world had never seen a nation quite like the United States. Franklin and his fellow Founding Fathers had to imagine and create the new country they wanted to live in.

Literal. What were some of Franklin's contributions as a statesman?

» He represented the American colonists in front of other governments and helped create the new nation, the United States of America.

Evaluative. Why might a historian say that a country could be invented? What kinds of things would you have to create to form a new nation?

» Answers will vary, but students may recall documents such as the Bill of Rights and the Declaration of Independence.

This may sound like a big challenge—and it was! But Franklin was actually no stranger to this kind of challenge. In fact, he invented many things throughout his long life, and we still use some of his creations today.

Franklin had a keen interest in science and the way things work. His brain was working constantly, spilling over with questions and ideas. Often he answered those questions—and solved problems—by creating new things. When he was a child, he thought of a way to be a faster swimmer. He found some wood and carved some wooden paddles to fit over his hands and feet, kind of like the flippers that divers use today.

As Franklin grew older, he encountered new kinds of problems, and he kept trying to produce solutions through his inventions. For example, he had two pairs of glasses, one for reading and one to help him see things far away. He didn't like having to switch glasses all day long, so he asked a glass cutter to slice all of his lenses in half. He made one new pair of glasses, with the distance lenses on top and the close-up lenses on the bottom. Franklin had just invented bifocal glasses, still worn by many people today.

Of course, most people know about Benjamin Franklin's experiments with lightning. Though it was not really safe to fly a kite during a thunderstorm, but by doing this Franklin discovered that lightning was electricity! Franklin used his discovery to invent the lightning rod, a pole that helps carry electricity away from buildings and into the ground. His creation is still used today to prevent fires caused by lightning strikes.

Literal. What were some of the things Franklin invented?

» flippers, bifocals, the lightning rod

Evaluative. Which of Franklin's inventions do you believe is most important? Use evidence from the Read-Aloud in your answer.

» Answers will vary, but students should cite an invention and a reason for its importance, such as stating that the bifocals were his most important invention because they are worn by many people today.

That experiment was pretty dramatic—and even quite dangerous. Other times, though, Franklin got his inspiration for an invention while relaxing. For example, while sitting by the fire one night, Benjamin Franklin watched warm air disappearing up the chimney and wondered how he could trap more warm air inside the house. He made a wood-burning stove out of iron. It put out twice as much heat as a regular fireplace and burned less wood. This stove was named the Franklin stove, after its inventor.

In his autobiography, Franklin described inventing this stove. Here's what he had to say:

"Having, in 1742, invented an open stove for the better warming of rooms, and at the same time saving fuel, as the fresh air admitted was warmed in entering, I made a present of the model to Mr. Robert Grace, one of my early friends, who, having an iron-furnace, found the casting of the plates for these stoves as a profitable thing, as they were growing in demand."

Literal. What problem was Franklin trying to solve when he invented a new stove?

» He wanted to stop warm air from going up the chimney.

Literial. What were two ways Franklin's stove was better than other stoves?

» It saved fuel, and it did a better job heating rooms.

Inferential. Why might Mr. Grace benefit from the stove, besides being warmer from using it?

» He had an iron furnace, which meant he could make and sell the stoves.

Franklin continued:

"To promote that demand, I wrote and published a pamphlet . . . This pamphlet had a good effect. Governor Thomas was so pleased with the construction of this stove, as described in it, that he offered to give me a patent for the sole vending of them for a term of years, but I denied it from a principle which has ever since weighted with me on such occasions . . . That, *as we enjoy great advantages from the inventions of others, we should be glad of an opportunity to serve others by any invention of ours, and this we should do freely and generously.*"

Literal. How did the governor feel about Franklin's stove?

» He liked it.

Inferential. Franklin writes that the governor offered him "a patent for the sole vending" of the stoves. What is a patent?

» A patent gives someone the right to be the only person to make or sell a product.

Franklin could have charged people a lot of money for his invention of the stove, but by deciding to share it he made life better for many people throughout the world. You might say that Franklin had a philosophy of inventing, or an idea of its purpose and meaning. Franklin's philosophy was that that inventions should be used to help others.

Of course, not every inventor has felt that way throughout history. In this unit, you'll meet some other inventors with their own ideas—strong ideas—about inventing. And maybe you'll start to develop your very own philosophy, just like Benjamin Franklin!

Literal. What is Franklin's philosophy of inventing, and why does he hold this philosophy?

» He believes that inventors should share their inventions because they benefit from the inventions of others.

Inferential. Franklin writes that he declined the patent because of a principle. What is the kind of principle he is referring to?

» a strong feeling or belief

Use the following prompts to extend student understanding of the Read-Aloud.

Guiding Question: How did Franklin's inventions help improve people's lives?

Writing Prompt: Think about the things Franklin invented and how he liked to use inventions to solve problems. Describe a problem in your everyday life, and imagine what you could invent that could eliminate that problem.

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TEXAS
ELEMENTARY LITERACY PROGRAM

ENGLISH

Grade 4

Unit 2 | Digital Components

Eureka! The Art of Invention

Grade 4 | Unit 2

EUREKA!
The Art of Invention

Digital Components

Contents

EUREKA! The Art of Invention

Digital Components

EUREKA! STUDENT INVENTOR SCOREBOARD

 **AIRPLANE**	
 **ALARM CLOCK**	
 **MICROSCOPE**	
 **PAPER**	
 **RADIO**	
 **TELEPHONE**	

Orville and Wilbur Wright practiced flying and steering gliders for two years before building the *Flyer*.

They succeeded in keeping the *Flyer* airborne at Kitty Hawk, North Carolina, in 1903 because they had installed innovative controls to keep it balanced and stable.

They continued experimenting for two more years, eventually building the *Flyer III* which had separate levers for turning it left or right, lifting its nose or tail, and tilting it from side to side.

These additions, known as three-axis controls, were the secret to their success. Three-axis controls are still used today.

In the 1650s a young Dutchman named Antonie van Leeuwenhoek began experimenting with glass lenses.

He manufactured a tiny lens that he then attached to a brass plate.

By 1676 he had improved his invention to the point where he was even able to see single-celled organisms, like protozoa.

Thanks to van Leeuwenhoek’s invention, nineteenth-century scientists like Robert Koch and Louis Pasteur were able to identify the bacteria that cause deadly diseases like cholera and tuberculosis.

In ancient China, people wrote on silk, which was very expensive, or on scrolls of bamboo, which were very heavy and difficult to manufacture.

Around the year 105 CE, a record-keeper named Cai Lun decided he would come up with a better option—a writing surface that was light, cheap, and easy to make.

He succeeded, and his invention made his job of writing down, transporting, and storing records much easier.

His invention also enabled people to spread knowledge over great distances by carrying lightweight documents with them wherever they traveled.

As people started interacting with one another in more complicated ways, time became important.

They divided the day into twenty-four hours and needed to keep track of those hours accurately.

People began measuring small units of time with sundials, determining the passage of daylight hours by observing the direction and size of shadows cast by the sun.

The next great innovation in timekeeping was a simple bowl with holes carved in it: if you knew how long it took for all the water to flow out of a full bowl, you could measure the passage of time by checking the water level.

As the centuries marched on, these inventions became more accurate as water power was replaced by springs and pendulums.

In 1894 a young man in Italy, Guglielmo Marconi, read a book that explained how to produce electromagnetic waves—electricity that travels through the air.

He quickly got to work in his attic building a wireless transmitter (to send messages) and a wireless receiver (to receive messages).

Soon scientists and businesspeople realized that the future of Marconi's technology was in sending sound directly to receivers in people's homes.

The first commercial stations began broadcasting in 1920, and by 1930 programs were being heard in twelve million American homes.

Stations broadcast news, music, comedies, adventure shows, game shows, soap operas, talent contests—almost everything you see on TV today.

Alexander Graham Bell aimed to send the human voice across a wire by turning it into electrical signals.

Bell worked on improving the invention, and in 1876 he and his assistant had a conversation over a distance of two miles. The first words spoken were “Mr. Watson, come here. I want to see you.”

Businesses saved money, as meetings that had once required long-distance travel could now be held using his invention.

People living in isolated areas were now able to call for help in an emergency.

Name: ______________________ Date: ______________

KNOW THE SIMPLE MACHINE!

Indicate the Simple Machine used in each invention.

1. **Electric Drill:** ______________________
2. **Window Blinds:** ______________________
3. **Egg Beater:** ______________________
4. **Dump Truck:** ______________________
5. **Jar Lid:** ______________________
6. **Ladder:** ______________________
7. **Crane:** ______________________
8. **See-Saw:** ______________________
9. **Shovel:** ______________________
10. **Stapler:** ______________________
11. **Pencil Sharpener:** ______________________
12. **Knife:** ______________________

CERTIFICATE OF VICTORY

presented to

EUREKA! STUDENT INVENTOR THE QUEST

presented by

George W. Carver | Jacques Cousteau | Hedy Lamarr | Thomas Edison

Name: ____________________

Birthdate: ____________________

Birthplace: ____________________

Invention(s):

____

____

Describe a challenge or disappointment that this inventor faced.

____

____

____

Name one fact about this inventor or the story of their invention that you find interesting.

____

____

____

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LECTOESCRITURA EN ESPAÑOL

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TEXAS
ELEMENTARY LITERACY PROGRAM

ENGLISH

Grade 4

Unit 2 | Video Clip Scripts

Eureka! The Art of Invention

Grade 4 | Unit 2

EUREKA!
The Art of Invention

Video Clip Scripts

Contents

EUREKA! The Art of Invention

Videos

Welcome to Eureka!

Jacques Cousteau, Hedy Lamarr, George Washington Carver and Thomas Edison sit behind a long table *à la* judges of *American Idol*. Jacques is wearing goggles on his forehead and lots of scarves; Hedy is attired like the 1930s movie star she was, George has a flower tucked behind one ear, and Thomas wears a period-appropriate suit with cufflinks that light up. They all turn to look at the camera abruptly and in unison. It is very dramatic.

Jacques: (*with a thick French accent*)

Bonjour, my intrepid leettle inventors. And welcome to our show!

Thomas: But what have they invented? *Maybe* with enough hard work they'll invent something. But right now? They're not inventors.

George: Come on, get excited! These students are themselves an undreamed invention. What they will make, what they will become, remains to be seen. Isn't it thrilling, Hedy?

Hedy: (*with utter boredom*)

Yes, I could not be more thrilled.

Jacques: But—you will be when our show is a beeg heet! Then even you, lovely Hedy, even you will be excited.

Hedy: Oh, Jacques, it is very sweet zat you think our show vill be a hit when I have heard that ve are in danger of being cancelled at any minute! Vhy? Because no one actually vatches ze show.

George: Well, with these intrepid students, as opposed to the more, shall we say—

Thomas: Unimpressive.

George: I was going to say "less motivated" students of past seasons, with this crop of seedlings, the show will certainly be a success.

Jacques: It is not in such danger, is it? I know for a fact that my mother's elderly friend Mathilde watches it when she is very very bored!

Thomas: Every year there is a 45% chance that a television show will survive to see the next season. That's not so bad!

Hedy: But zis means zere is a 55% chance ze show vill fail. If zere was a 55% chance I vould die ven I left ze house tomorrow, I do not sink I vould be leaving ze house.

Jacques: But you are already dead.

Hedy: How dare you address a lady in zis manner!

Thomas: He's just stating a fact. We are—all four of us—dead.

(*Off camera, one can view the unseen audience's shocked faces.*)

Yup: dead, dead, dead. That's right, folks (*and now Thomas attempts a* Price Is Right-*announcer-ish voice, and some cheesy music plays after each name is said aloud*)—Jacques Cousteau, who invented what today is commonly referred to as *scuba*—he is dead. George Washington Carver, who came up with hundreds of ways to use a peanut—

George: And a sweet potato—

Thomas: (*annoyed*)

And a sweet potato—

(*enthuasiastic again*)

And helped countless people in doing so—even that kind of extraordinary achievement cannot ward off death. Hedy Lamarr, who was not only a movie star but an amazing inventor to boot—her lovely self died many years ago.

George: And then we have Thomas Edison—

Thomas: Thomas Edison, inventor extraordinaire.

Hedy: Extraordinaire?

Thomas: Well, I did register over a thousand patents. No one else has come close to that number—

Hedy: (*interrupting him*)

Okay, yes, you are very smart, and very accomplished, no von vill contest zis, but zis show is not all about you.

Thomas: (*matter-of-fact*)

Sure it is.

George: (*looking at the camera*)

No, this show is about YOU—the students. You will spend the first part of the show completing "the Wheel of Invention" so that—oh it's just so exciting!—so that by the final episodes you can invent something *yourselves*.

Hedy: Yes, you vill accumulate ze vedges that vill equip you to invent. Each vedge corresponds to a skill that you vill need in order to come away a vinner.

George: But it is much more about what you, the students, will invent than about winning. I mean, you will think up something that was never there before! That's what this whole show is about, all in the name of—

Hedy/ Jacques: Vinning! And the vinning group vill be crowned—

Hedy/ Thomas/ Jacques/ George Eureka! Student Inventor!!!

(*Cut to black. End of Intro.*)

Irate Edison

Thomas: Oh no. Oh no, no, no. Oh you've got to be kidding me. This is . . . This is absurd. This is nonsense. This is fiddle-faddle and poppycock of the highest order. I call fiddlesticks! I call tommyrot! I call rubbish, rubbish, rubbish!!! Okay—okay, Thomas, calm down. Go take a bath. That usually works. Is there a warm bath around here anywhere? Does patenting over 1000 products get a man anything?? Are a tub and hot water and lavender-scented soap bubbles too much to ask??? Aaaaaah!!!

Good Pitch/Bad Pitch

(*Amber smiles at the class. She is a model student, but not a teacher's pet.*)

Amber: (*very naturally/enthusiastically*)

Hello, my fellow inventors! I'm really pleased to be here today to tell you about one of the truly terrific things that mankind—or in this case, womankind—gave to the world: the chocolate-chip cookie.

(*She holds up her piece of paper—her pitch—and begins to read, looking up at the class every now and then.*)

That's right, folks. You heard me. A simple cookie that you take for granted had to be *invented*. Someone had to think it up. And that person was Ruth Wakefield. A woman who owned a restaurant in Massachusetts and one day in 1930 wondered what would happen if you added pieces of chocolate to a butter cookie. And what she found was that the pieces of chocolate didn't melt! They stayed intact! And the cookie tasted delicious! So I would argue that, even though this invention doesn't fix all the problems of the world, it is really one of the most important inventions around—because it makes people happy. Here are two examples. Let's say you're on a long car ride and your little brother is being annoying. Maybe he poked you even though your mom said "no poking" and then when you poked him back—which is only fair, he started it—he began to cry. What a baby. But if you give him a chocolate-chip cookie, he might stop crying—which will make the trip much easier on everyone. Or, let's say you're watching your favorite TV show while lounging on your couch on a lazy Sunday afternoon. You think: "life could not get any better than this!" But then you realize it *could* get better. You *could* be eating a chocolate-chip cookie *while* watching your show, making the experience even sweeter.

Basically, the chocolate-chip cookie is "happiness in just three bites" (*or maybe more bites depending on the size of the cookie*).

Teacher: *(from offstage)* Thank you, Amber.

Great job, Team Cookie. Okay Team Light Bulb, you're up.

(*Paul stands and slouches. He looks deeply uncomfortable. He looks at his piece of paper. He looks out at the crowd. He doesn't say anything.*)

Teacher: *(from offstage)* Whenever you're ready, Paul.

Paul: (*mumbling*)

Okay, so, um, the light bulb. The light bulb is like, good, because, you know, it lights up and stuff.

Teacher: *(from offstage)* Could you speak up a bit.

Paul: (*a little louder*)

People needed the light bulb and then it got made and it made things easier . . .

Teacher: *(from offstage)* When did it get made? Who made it?

Paul: Oh, right. I think it was made by Thomas Edison in like, eighteen seventy-something?

(*just occurring to him*)

Oh hey! Once my dad told me a joke about light bulbs. "How many policemen does it take to change a light bulb?" . . . And the answer is: "None. It turned itself in." Get it? It's funny because sometimes people turn themselves in to the police, but here the light bulb *turned itself* in. Get it? That's why it's funny. My dad explained it to me. He's a cop.

Teacher: … Okay, do you have anything else to add?
(from offstage)

Paul: (*looks at his paper. Then looks up again.*)
It was really important, the light bulb. It was just, like, important.

Teacher: (*unimpressed*)
(*from offstage*) Is that it?

Paul: Yeah, it's a cool invention.

Teacher: "A cool invention"? Is that really the best you can do?? I don't think
(from offstage) Mr. Edison is going to be pleased about this. He's not going to be pleased at all.

Simple Machines

George: Okay, goobers! You heard about how Ms. Lamarr's remarkable invention was based on the work of those who came before her. And how modern scientists then used her invention to develop Wi-Fi, GPS, cell phones and all sorts of things that none of us could have imagined when we were inventing.

Thomas: Please don't presume to know what *I* could have imagined.

George: Of course not, Thomas. Just a figure of speech. Anyway, let's talk simple machines! I get the tingles just thinking about these six inventions that became the basis for so many others.

Thomas: (*chuckles*.)

George: Did I say something funny?

Thomas: No, no. I suppose when your greatest triumph comes in chunky and smooth, a *simple* machine might seem extraordinary. But my inventions ushered in a new age! Electricity, movies, the phonograph. I'm way beyond simple machines, and frankly, I think our student inventors are, too.

George: That's where you're wrong, Thomas. All of our inventions are based on inventions that came before them. I mean, consider the humble screw. It's one of our simple machines. Without the screw, wouldn't your light bulb be difficult to connect?

Thomas: (*grudgingly*)

I suppose so.

George: And how about the wheel and axle? Another simple machine. Doesn't the handle of your phonograph depend on that mechanism?

Thomas: Well . . . yes, you could make that argument, I guess.

George: And take a look at the—

Thomas: I get your point, Carver!

George: Glad to hear it. Now, legumes, let's go over the simple machines one by one. Starting with the screw! Just a little cylinder with a spiral thread running around it. But that thread makes it one of the most powerful fastening tools around.

Jacques: Who invented it?

George: Great question, Jacques!

Jacques: *Merci, Georges.*

George: (*getting a little annoyed*)

It's "George." Just plain "George."

(*back to lecture*)

Anyway, the simple machines were all amazing breakthroughs, but we don't know who came up with them first. We just have to imagine how exciting it would have been to witness the invention of the wheel.

Hedy: Vi vould that have been exciting? Did zey have anywhere zey actually needed to go? "Oh goodie, zis morning ve can use our veels to get us from one cave . . . to another cave."

George: Actually, our number two simple machine, the wheel, wasn't first used for transportation. Wheels were attached to axles to make tasks easier. You see, it's easier to spin an axle attached to a wheel than an axle on its own. Think about the handle of a doorknob as a wheel. A few spins of the wheel and you've opened the door. It requires less force to turn the knob than it would to turn the axle all by itself. Oh, another great example is—

Hedy: Pick up ze pace, vill you? I can almost hear the United States changing ze channel.

George: Fine, our simple machine number three is the wedge! Tools shaped like a wedge are great for splitting, ploughing, all sorts of things. The blade of an axe is a wedge.

Jacques: So is the front of a boat. The prow. It cuts through ze water like a plough cuts through the soil.

George: The next two simple machines give humans superhuman strength. Simple machine number four, the lever, is an astounding device that consists of a beam resting on a fulcrum. You can lift very heavy loads on one end of the beam by pushing down on the other. Like a see-saw. Hey, with the right size lever, you could even lift . . . an *elephant*!

Hedy: You could even lift Thomas Edison's ego.

Thomas: Was that warranted?

George: Simple machine number five, the pulley, is a rope thrown over a wheel.

Jacques: I use pulleys to load cargo onto my boat. I string a rope through a groove on a wheel, attach my cargo to one end of the rope and pull on the other end. *Voilà*

George: If I were forced to choose a favorite simple machine, this last one would be it.

Hedy: How vould zis happen?

George: What?

Hedy: Zat you vould be *forced* to pick a favorite machine. Do masked bandits roam the land threatening to throw inventors off ze roof if zey do not choose a favorite machine?

George: It's just an expression, Hedy. Now, everybody. Imagine a flat surface tilted at an angle so that one side is higher than the other.

Hedy: It sounds like a ramp. Zis is your favorite machine?

George: It is, Hedy! Picture this. A prehistoric family lives in a cave, and the entrance to the cave is two feet off the ground. One day the cavewoman comes across a large rock she thinks would make a perfect coffee table to go in front of her couch. Which is also a rock, by the way.

(*He laughs quietly, then continues.*)

Before the inclined plane, if the rock was too heavy to lift into the cave, the family would be out of luck. But if they build an inclined plane, our simple machine number six, they can roll the rock right into the living room!

Thomas: Okay so that's six, right?

(*to Stage Manager, who is offstage*)

Can we move on?

Stage Manager: Yeah. Judges—take lunch.

(*The puppets begin to disperse.*)

Stage Manager: Oh, Carver. Some guy in a mask wants to talk to you. He's up on the roof.

George: On my way!

(*George exits. The others look after him for a moment, then at each other, then quickly hurry after George.*)

Thomas, Hedy, Jacques: George! Professor Carver! Stop! Georges!

Failure

George: So the producers tell me we should talk about flavor. I'll start with the sweet potato! I guess I'd say it's sweet, like a yam or a pumpkin, but also—(*he hears something in his earpiece*) What? . . . OH, you want us to talk about failure? I guess I must've failed to hear you.

(*He laughs, thinking this is very funny; but looks around and no one else is amused*)

Jacques: Georges (*pronounced in the French way*), can we be *sérieux*—that means serious.

George: It's George (*pronouncing it as an American would*)! How many times do I have to—

Jacques: That is what I said: Georges (*still pronouncing it the same way*). And anyway, it does not matter—failure is so closely linked to success; there is really no sense in trying to distinguish one from the other.

Hedy: Vat?? No, there is failure. It exists—all on its own, in ze crude light of day. I myself—beautiful movie star and brilliant scientific mind—have experienced failure. I myself have experienced crushing defeat.

Jacques: It is not possible.

Hedy: It is.

Jacques: It is not.

Hedy: (*sharply*)

I vill not play zis game vit you! It is possible. It happened many many times. For instance, I once invented a cube zat you could put in water to turn it into vat you Americans call "soda pop." I worked hard on zis thing and I thought it would change the world, or at least the beverage industry, and zen—poof! Nothing. It didn't make enough fizz.

Thomas: But if we don't risk failure, we don't stand to gain a thing. In fact, many of life's failures are experiments that were so close to success! So … you just have to keep going. And if you have enough ideas, some of them, a few of them, 1,093 of them, will be really good ones.

Jacques: Maybe it will be more helpful to ze little tadpoles to talk a bit more specifically about some actual failures on the road to actual success.

George: Right, like that light bulb you're always yammering on about.

Thomas: I thought you would never ask. Yes! Finally! Let me paint the scene—1878: horse-drawn carriages, candles in every window. There was electricity, but no one had figured out how to light small areas—rooms—as opposed to whole city streets. I thought I could figure it out in six weeks. And so I started experimenting with the filament—the metal wire inside the bulb. I tried making it out of different materials. But no matter what I did, the bulb would just—zap!—burn out. It was a year before I found a combination that worked. Then it took another whole year to make a lamp that wouldn't burn out after a week. But in that whole time I never felt I was failing. I felt I was ruling out possibilities one by one and getting closer and closer to the answer.

George: And that kind of patience and persistence in the face of frustration is the mark of a good inventor.

Thomas: Ahem.

George: (*reluctant*)

A great inventor.

Thomas: Ahem ahem.

George: (*really reluctant*)

Inventor extraordinaire.

Thomas: (*saying George as Jacques does*)

Indeed it is. Thank you, Georges.

George: It's George!!

(*George throws up his hands and exits. End of video.*)

Why We Invent

Thomas: Why we invent?? What an absurd question. We invent because we see a problem in the world that needs to be solved. Like people not being able to light their homes! A pretty big problem if you ask me. Why *else* would anyone invent?

Jacques: I will say only one thing—

Hedy: (*interrupting him*)

It vill be ze day ze pigs fly when you say only one sing.

Jacques: Oh, Hedy, you know me so well! You must be in love.

Hedy: I am absolutely one hundred percent not in love with you.

Jacques: (*he doesn't believe her*)

If you say so.

(*turning back to Thomas*)

So I did not invent with the objective of solving a problem in ze world. I invented for more personal reasons. I created ze scuba because I wanted to spend more and more time with the great love of my life—

Hedy: Jacques, please cut zis out now. It's enough!

Jacques: The ocean.

Hedy: (*a little hurt*)

Oh.

Jacques: At a certain point I wanted to be able to go deeper into the ocean and to stay there longer. And so, with a friend, I made something that would allow me to do so. And happily my invention helped ze world too—what can I say—I am just that good. For instance, if a ship filled with treasure were to sink, and you wanted to try to retrieve that treasure, you'd need to be able to stay underwater for quite a long time.

George: But how many people does that help? I mean, sure, maybe a *few* people get rich from finding lost treasure; maybe a *few* people get to enjoy the wonders of the undersea world but is that so practical? Does it save lives??

Jacques: It can!

George: Does it help the masses?

Thomas: Like the light bulb.

George: Like my many ideas about ways to use the peanut, the pecan, the sweet potato, and the soybean. I saw that southern farmers needed to make a better living—a problem—and so I came up with a solution: more and different uses for their crops. According to the Internet, I figured out ways to make adhesives, axle grease, bleach, buttermilk, chili sauce, ink, instant coffee, mayonnaise, paper, plastic, pavement, shaving cream, shoe polish, talcum powder and wood stain. Wow, the Internet really is thorough.

Hedy: I must say, George—you made a lot of use of those crops.

Jacques: But you can't compare scuba gear and mayonnaise.

Thomas: I can compare *anything* to the light bulb and find the light bulb superior every time.

Jacques: Anyway, it's not a competition, Hedy.

Hedy: Of course it is. It's—

All Judges: Eureka! Student Inventor!!

Man on the Street

Jacques: (*to the camera, in a conspiratorial whisper*)

Bonjour, it is me, Jacques Cousteau, your *favorite* judge. What can I say? I am very likeable. Recently I took that likeability to the streets. And guess what? Today is your lucky day because I will share with you the fruits of my labor. Here is the video that we made when I, Jacques Cousteau, asked the real people on the street about what they felt needs to be fixed in the world. And by listening to them we all will get ideas for new inventions! Let's roll that tape, yes?

(*Jacques Cousteau stops a woman on the street outside the Amplify offices.*)

Bonjour, madame! Would you mind very much if I asked you a few very simple questions about the whole world and your place in it and where you see it all going in the future?

Woman 1: Actually it would be helpful if you narrowed your questions a little.

Jacques: (*a little frustrated*)

Fine. I suppose I am most curious about problems you experience in your life, in the world; you know, problems in your home, in your place of work, in your neighborhood. In your community.

Woman 1: Okay, that's still a lot of questions.

Jacques: Really??

Woman 1: Yeah …

Jacques: (*really frustrated*)

Fine! Are there any problems in your life, your daily life, that you would love if someone solved?

Woman 1: Can I say "people bothering me on the street?"

Jacques: No.

Woman 1: Okay … Then I'd say I hate when I get in bed and realize I've forgotten to brush my teeth, but I'm too tired to get out of bed and do it. I think you should be able to brush your teeth in bed without lifting a finger.

Jacques: You would say that, wouldn't you.

Woman 1: Was that a bad answer?

Jacques: Well, it has nothing to do with the ocean.

Woman 1: Was it supposed to?

(*Producer whispers to Jacques*)

Jacques: Okay, we're moving on.

(*another man passes by*)

Excuse me, sir, I'm wondering what problem at your place of work might be solved with a new invention.

Man: Hmm … Maybe … Maybe it would be great to have a watch that beeped a few minutes before a meeting to remind you about the meeting and then you'd never be late to meetings … ?

Jacques: I'm fairly certain that exists already, but let's say the problem you've identified is being late to meetings at work.

Man: Yeah!

(*The man returns to his phone call.*)

Jacques: Can't anyone come up with a decent idea!?

(*A woman sits on a bench.*)

Excuse me! *Excusez-moi, madame.*

Woman 2: Yes?

Jacques: You look like someone who thinks about her community and problems it might be facing.

Woman 2: I *am* someone who thinks about her community and problems it might be facing.

Jacques: What are some of those problems? Name one.

Woman 2: Well, for one, it's a problem that in the mornings, the early mornings, the electric company is sometimes drilling in the street, and it's incredibly loud and it wakes everyone up.

Jacques: How terrible.

Woman 2: It's another problem that when I buy a banana and walk around with it all day in my bag it's mushy by the time I want to eat it.

(*She gets out a banana and demonstrate*s.)

It was just fine this morning.

Jacques: (*unimpressed*)

And I'm being told that's all we have time for.

Yes, I think we are out of time.

Thanks so much, and students—I cannot wait to see what kinds of problems you end up wanting to solve!

Eureka Survives!

Hedy: Well, how do you like zat? How do you like zat?!

George: Bravo, seedlings! Bravo!

Jacques: Those pitches were unparalleled—*sans précédent*. Far and away superior to last season's. Mi-Shell and I are very impressed!

Hedy: You certainly exceeded my expectations, even zough zey vere, admittedly, very low.

(*They all look at Thomas, waiting for him to offer his congratulations.*)

Thomas: Yes. That was fine.

George: That's it??

Jacques: Well—I'm still not sure they truly appreciate the wonders of the light bulb—

(*The judges get an announcement from the producers in their earpieces. They spontaneously jump up and down and break out in cheers, drowning Thomas out.*)

Hedy: We are saved! Ze show is saved!

Jacques: Oh my! Oh my! Oh my! Zis is more exciting than jumping into the ocean without any clothes on! Oh, how bracing that is. But also wonderful!

George: We've been renewed! Woo-hoo!!

Hedy: Incredible!

(*Jacques raises his hand for a high five.*)

Jacques: Come on, Hedy. High five!

(*She pauses and then high-fives him. Thomas stands very still and off to the side a bit.*)

George: Thomas!! Live a little. Undo those cufflinks and let your hair down.

Thomas: Well, I don't have much hair to—

George: It's an expression!!

Hedy: The leetle inventors saved the show!! This is good news for them, but also for me. Now I can afford to eat all the bockwurst and *wienerschnitzel* I could possibly desire!

Jacques: And now we can all be together—forever!

Hedy: Or at least for one more season.

(*all the judges dance*)

George: Well, okay—that wore me out! I'm gonna sit down for a spell. And you might want to sit down too, because the producers tell me you student inventors did such a good job that you have earned the right to make some more inventor cards—about yourselves!

Jacques: Yes, there is immortality in inventing! You stay alive through your inventions. We four here are a case in point. So make your inventor cards! And be proud of yourselves! I know I am.

Hedy: I am too.

George: And me.

(*They look at Thomas.*)

Thomas: I am too. Very proud.

All Judges: And you should be too!

Amplify.
TEXAS
ELEMENTARY LITERACY PROGRAM

Grade 4

UNIT 2

Eureka! The Art of Invention

Image of the Day

DIGITAL COMPONENTS

Grade 4 | Unit 4

Eureka! The Art of Invention

Image of the Day

Contents

EUREKA! The Art of Invention

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EUREKA!

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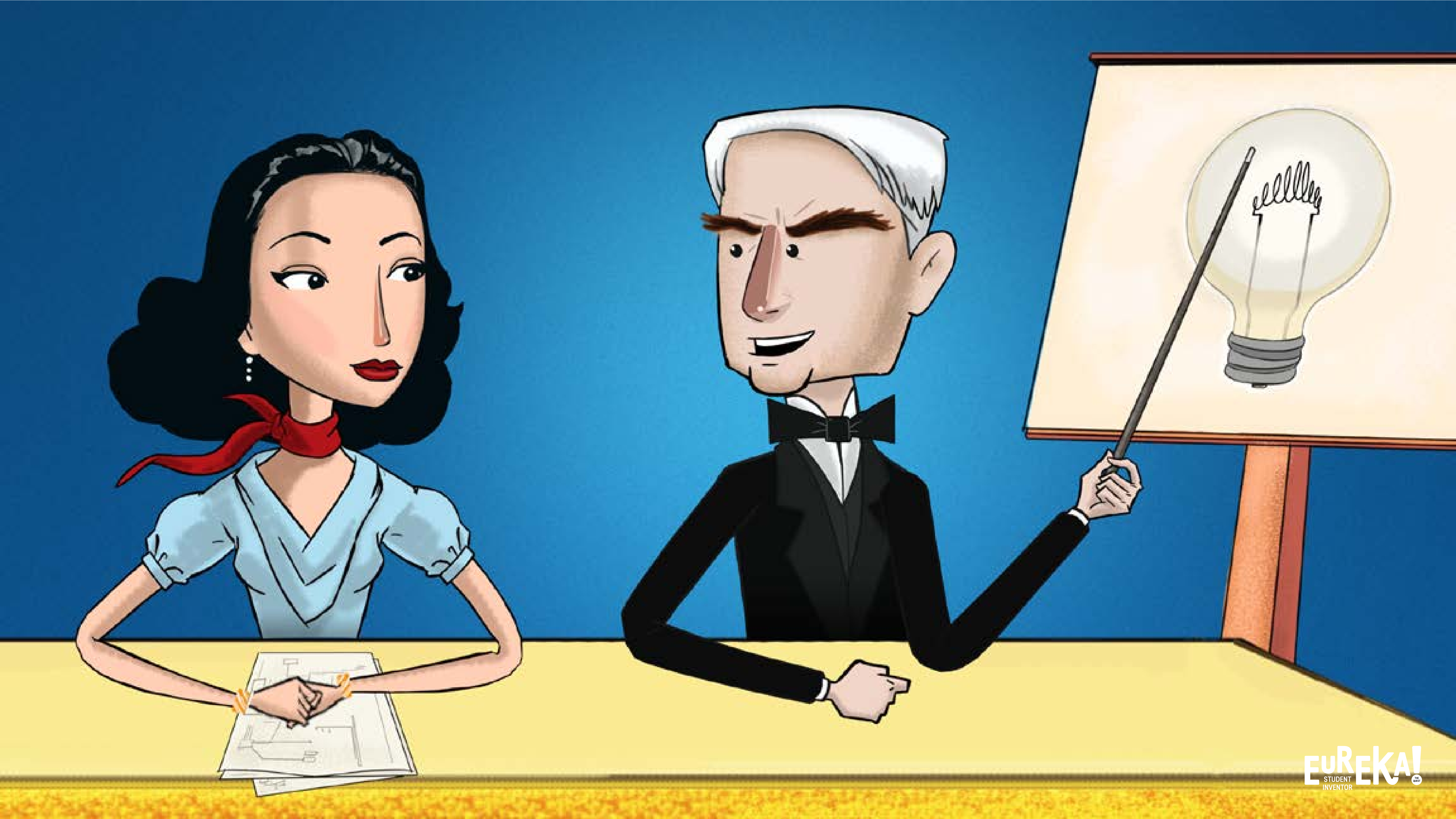
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EUREKA!
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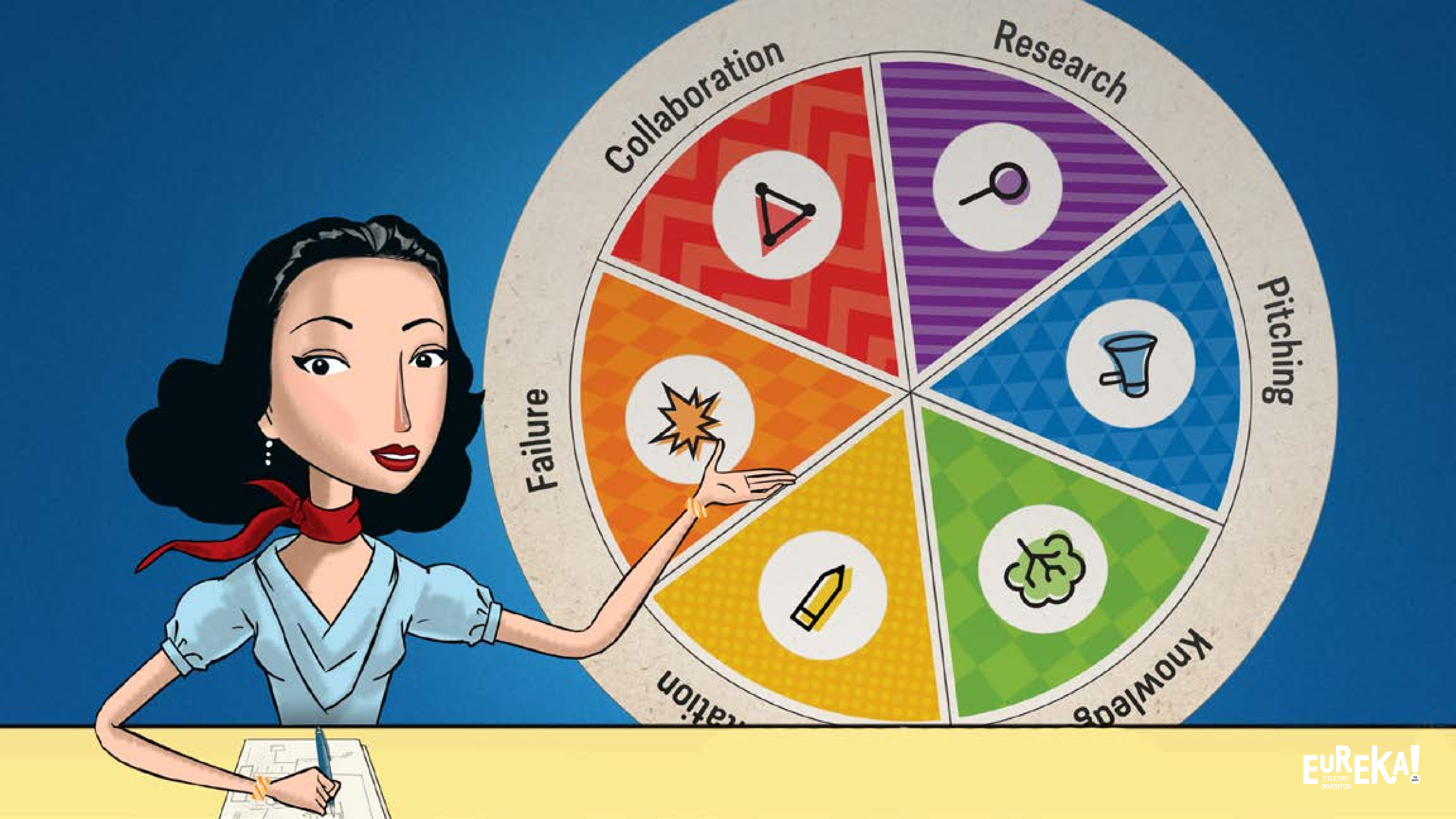
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ENGLISH

Grade 4

Unit 2 | Opening and Judges' Notes

Eureka! The Art of Invention

Grade 4 | Unit 2

EUREKA!
The Art of Invention

Opening & Judges' Notes

Contents

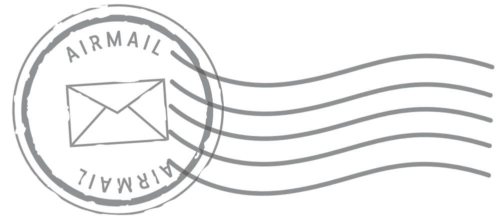
EUREKA! The Art of Invention

Judges' Notes

Opening:

Thrown together by the happenstance of where they live and go to school, a class of fourth graders has ten episodes to walk the path of invention and emerge—maybe scarred, maybe stronger, but almost certainly better inventors. This is the world of the reality game show Eureka! Student Inventor—where puppets pull the strings and “making it work” is only the beginning.

Judges' Note 1A



A Note from Thomas Edison:

Welcome, widgets. As your judge, and as the owner of 1,093 patents (by far the most of any of these clowns), I have the awesome responsibility of giving you your first challenge. How, you might ask, did I, one man with only twelve weeks of formal schooling, achieve so much? Hard work, hard work, and more hard work. And not just my own hard work: I started the first industrial lab in Menlo Park, New Jersey, hiring scientists, technicians, and mathematicians to carry out research and development to further my ideas. Honestly, I am not a huge fan of working with people, and I don't know that my employees were so thrilled to work with me, but we put up with it because we knew that many minds lead to excellent innovation! So you will also be working in lab groups. Go find them.

Sincerely,

Thomas Edison

Judges' Note 1B

A Note from Jacques Cousteau:

Bonjour, tadpoles!

Inventing—it is like a boat trip. Lab mates are at once alone and together amid the hostile seas. (Alas, this season they will not let me put you on a boat amid hostile seas to demonstrate this. I swear to you, the thing with the jellyfish was not something we could have prevented! And no one, including the jellyfish, suffered any permanent damage! The network, it spoils all my fun.)

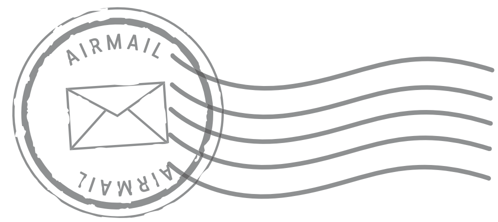
But I digress. Here is the thing: you must work together in this Quest. You must listen to one another. You must let everyone have a turn. You do not know—ze quiet one in ze corner could save your life. I mean . . . fix your invention. *Oui!*

It is not the easiest thing, collaboration. So today, we practice! You see the collaboration wedge? I am not giving that away for freebies!

Sincerely,

Jacques Cousteau

Judges' Note 1C



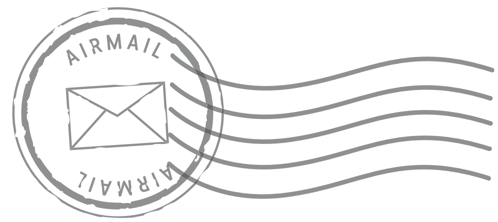
A Note from Jacques Cousteau:

It is all well and good to talk the collaboration talk, but what about when you must walk the collaboration walk, to put these rules into practice yourself? This is the big one, my wiggly fishies. If you succeed in this challenge—and by succeed, I mean work together thoughtfully and well, and then write about how you did it—you will earn your first wedge to get your Wheel of Invention rolling.

Sincerely,

Jacques Cousteau

Judges' Note 2A



A Note from George Washington Carver:

Welcome, seedlings!

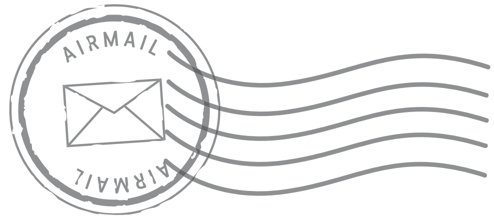
There are many ways to conduct research—for instance, in the field, in the lab, and in the library! In this Quest you will learn from some of the greatest inventors in all of history! That is the beauty of having a television show! These inventors like being mentioned on TV, so they will offer their advice for free, which is good since the producers slashed our budget this year. These inventors come from many different backgrounds and work in many different ways, but they all have very specific things to teach us about invention. Look to them for inspiration and practical suggestions when inventing on your own.

We don't want to be conceited, but perhaps your judges are a good place to begin learning about great inventors?

Sincerely,

George Washington Carver

Judges' Note 2B



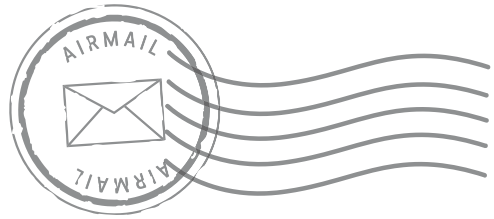
A Note from George Washington Carver:

Good work! We should look at another inventor while your research muscles are all warmed up. As the inventor of peanut butter, I am partial to tasty inventions—the very talented Ruth Wakefield, inventor of the chocolate-chip cookie, has graciously agreed to share her story of invention and the importance of careful research.

Sincerely,

George Washington Carver

Judges' Note 3A



A Note from Thomas Edison:

Dear widgets:

Hmph. Well, from what I've seen and heard so far, you seem to be doing a solid job on your analysis of the light bulb. Not everyone knows all the details of its illustrious history, but your research skills are serving you well. Let's make things a little more interesting. I am in the final-proof stage of my book *I Judge Inventions*. Obviously the light bulb is THE MOST important invention of all time, and the light bulb is going on the front cover. But the back cover needs art too. One of the inventions after which your labs are named, but only one, can be that back-cover art. Convince me that it should be yours.

Sincerely,

Thomas Edison

Judges' Note 3B

A Note from Hedy Lamarr:

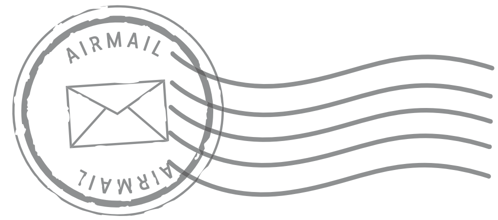
Meine kleinen inventors:

Look, there are not a whole lot of ways my two great talents—inventing and acting—overlap. But pitch presentations! This is where they overlap. So I have made a list: you would benefit from following it. Jacques is not the only one with rules.

Sincerely,

Hedy Lamarr

Judges' Note 4A



A Note from Hedy Lamarr:

Inventors!

I am very excited to learn more about zese inventions through your pitches. You should be, too. Zese are some of ze most revolutionary inventions in ze history of human civilization. Ve do not have any namby-pamby silly inventions on zis program. *Nein!* Breakthroughs, plus ze most important snacks ONLY are permitted on Eureka!

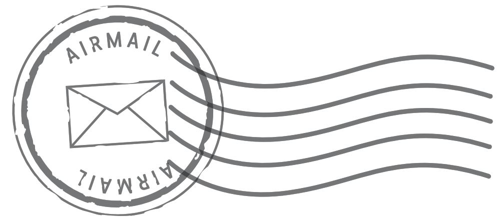
Ze learning—no, ze KNOWLEDGE you gain from zese presentations vill help you be a better inventor. As you listen to zese pitches, you should take notes. Here, I have made you a helpfully formatted and structured form. It is in your Inventor's Notebook. Ve call it "Hedy Lamarr's Notes for Knowledge." Ve vill talk more about knowledge tomorrow.

You vill only pitch once! You vill listen five times! Do not vaste ze listening! You vill need zese notes soon!

Sincerely,

Hedy Lamarr

Judges' Note 4B



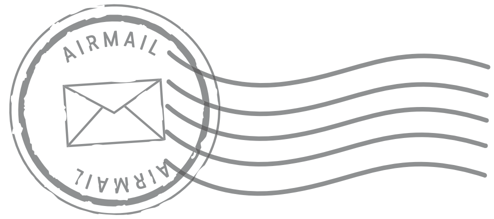
A Note from Hedy Lamarr:

Vell done, *meine kleinen* pitchpeople. Now ve are getting somewhere! Zree vedges, zat is half, zat is not so bad. Ve have a little extra time today, so let us get to know another outstanding inventor, a man who vas not very much older than you ven he began his great invention. I do not vant to give tomorrow's program away, so all I vill say as you read his note and complete his inventor card—VICH IS NOT OPTIONAL! NEIN! YOU VILL DO IT AND VHY VOULD YOU NOT?—is "invention breeds invention." Vat does zat mean? Ponder zat, and tomorrow it vill be revealed.

Sincerely,

Hedy Lamarr

Judges' Note 5A



A Note from Hedy Lamarr:

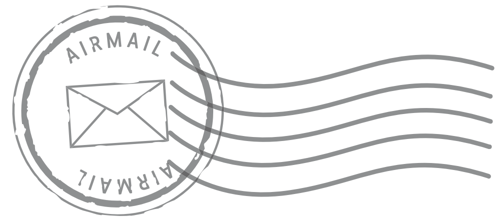
Invention breeds invention! Zat is the use of knowledge. Ze inventions you know can lead to ze inventions you create. Vat does zat mean? It means zat ze rely on the work of ze inventors who came before us! I am an outstanding example of invention breeding invention: you know zat I invented ze spread-spectrum technology? In order to do zat, I used technology zat had already been developed for ze first remote controls for radios, and also ze technology of player pianos—pianos zat play zemselves! True fact! Many years later, technology from my invention vas used to invent cell phones, Wi-Fi, GPS—all sorts of vireless communication! I got an Electronic Pioneer Award in 1995 ven someone finally noticed zis! I am only a little bitter zat by zen I vas too old to travel to accept it.

You see, my invention led to other inventions. Invention breeds invention!

Sincerely,

Hedy Lamarr

Judges' Note 6A



A Note from George Washington Carver:

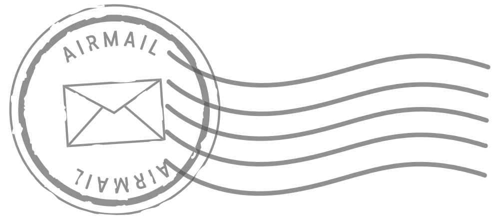
Welcome, seedlings!

I used inventions in my work, but I also worked a lot with ... vegetables. And legumes. The peanut, the peanut is not a simple machine. "Invention breeds invention" is a great tool for inspiration, but it's not the only one. Today we're going to think about perspectives—looking at things carefully and look at them from different angles.

Sincerely,

George Washington Carver

Judges’ Note 6B



A Note from George Washington Carver:

Seedlings,

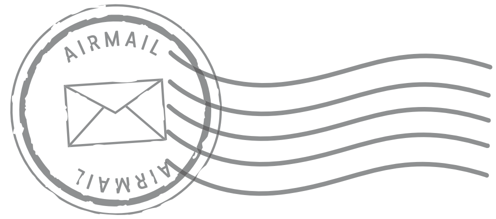
You are nearly ready to be transplanted into the wide-open garden that is Round 2. But not without building again! This building challenge is more . . . challenging. In your lab you must create one invention, and document how you did it.

The judges’ office at Eureka! is . . . well, it’s starting to be a fire hazard. We get so involved in our inventing, we don’t want to stand up and walk two feet to throw the many, many irritating memos we get from the network into the recycling can. Please help!

Sincerely,

George Washington Carver

Judges' Note 7A



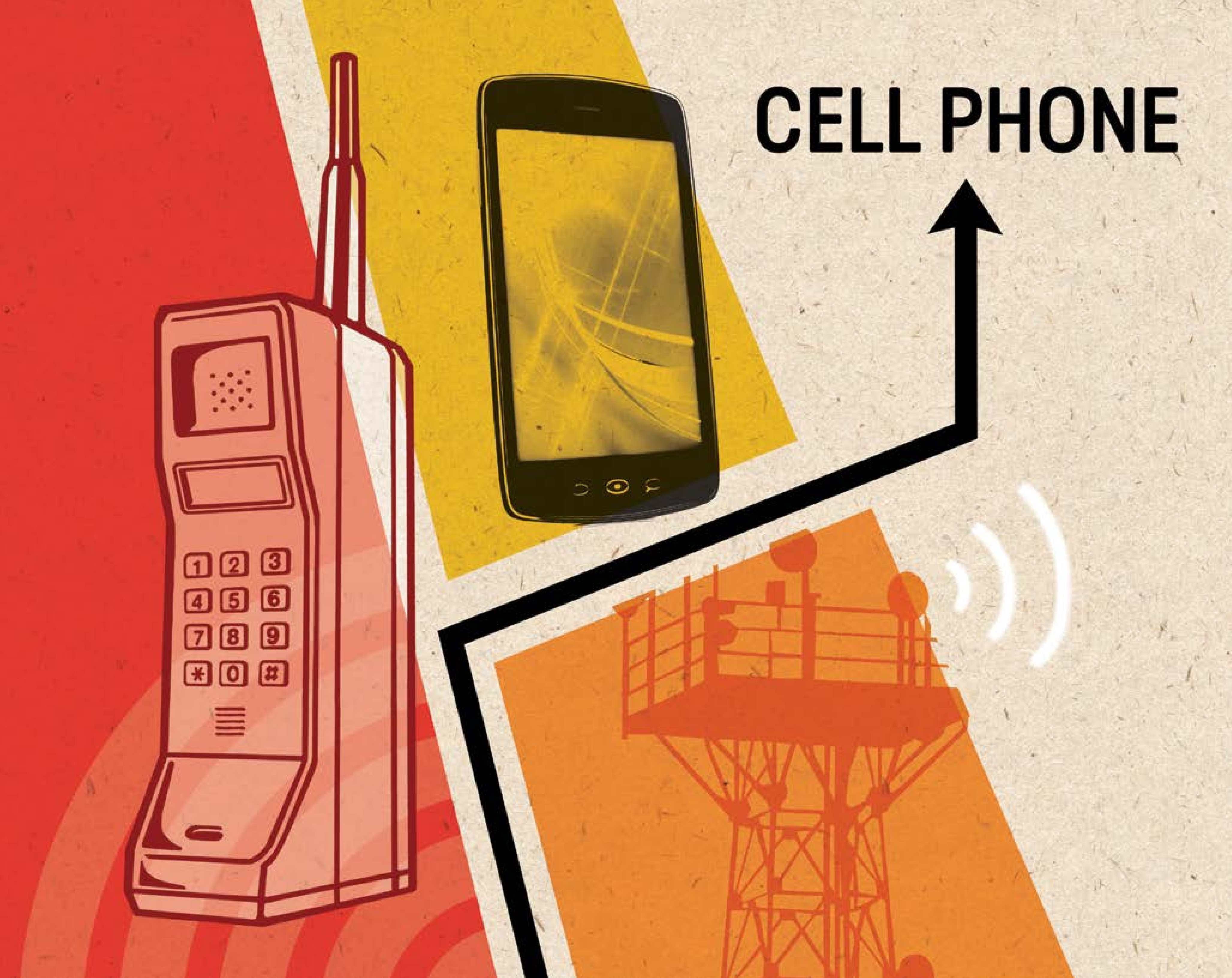
Look, widgets—you know I don't pull punches. But here's the truth: I NEVER fail, I just discover what doesn't work. For true innovation, you must take a true risk and try things that MAY NOT WORK. You never know, because you're the first to try them! Sometimes they WILL NOT WORK. At all. That's OK. Sometimes you succeed in your basic goal, but fail to do it as well as you wanted. Sometimes failure is a matter of perspective: you may have failed to do what you thought you wanted to do, but accidentally achieved something else. In any case, it's better to take the risk and fail than not to take the risk at all—especially on TV. Risk is interesting. Here—all the judges have things to tell you about failure. Go to the tape.

Sincerely,

Thomas Edison

(L-R): Shutterstock; Stephen Strathdee/E+/Getty Images; Pigami/E+/Getty Images

CELL PHONE



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CHOCOLATE CHIP COOKIE

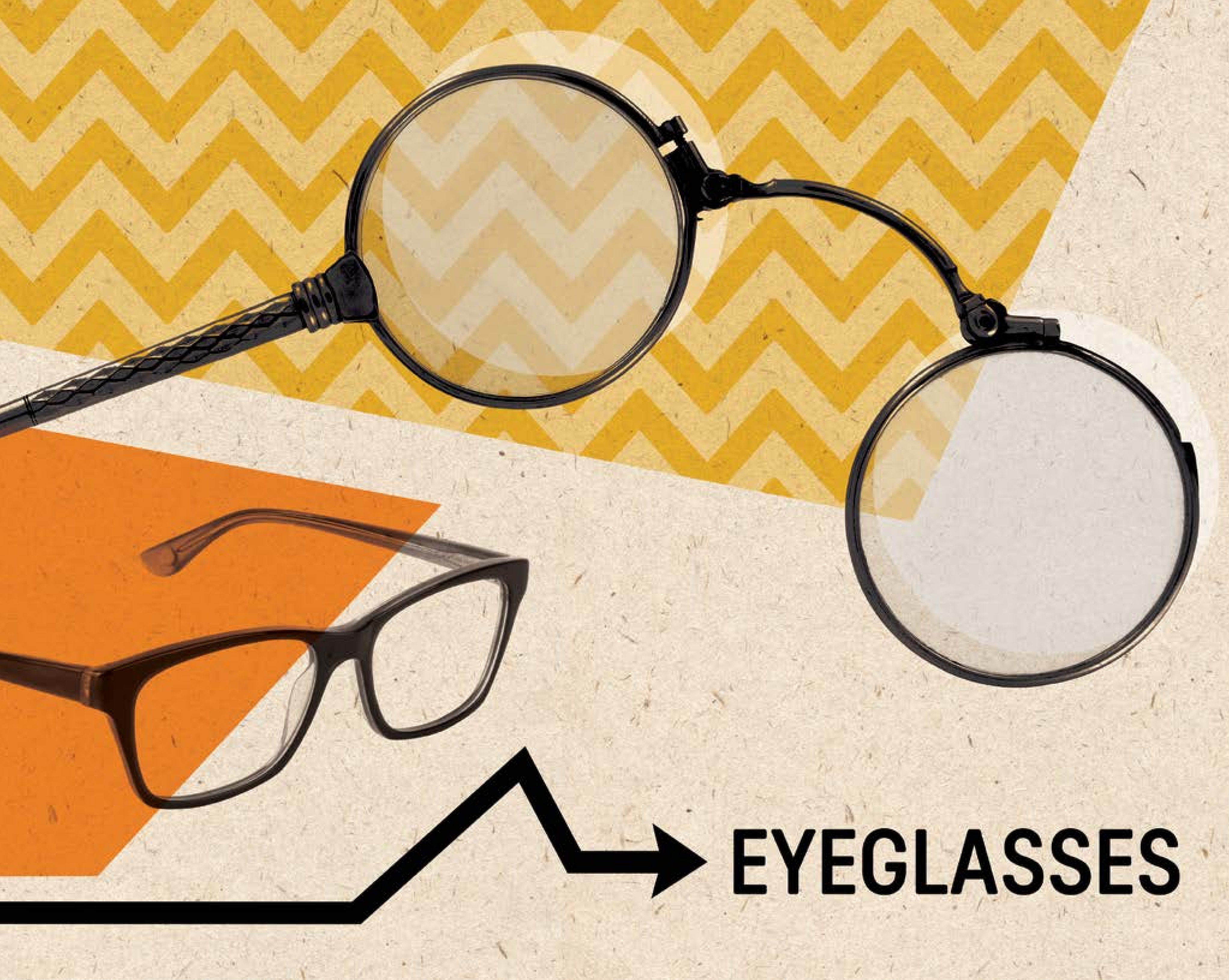
(L-R): khandisha/Getty Images; YinYang/E+/Getty Images; Shutterstock

COOKIE DOUGH ICE CREAM

(L-R): C Squared Studios/Stockbyte/Getty Images; Shutterstock (2)

DRY-CELL BATTERY

(L-R): Stockbyte/Getty Images; Shutterstock (2)



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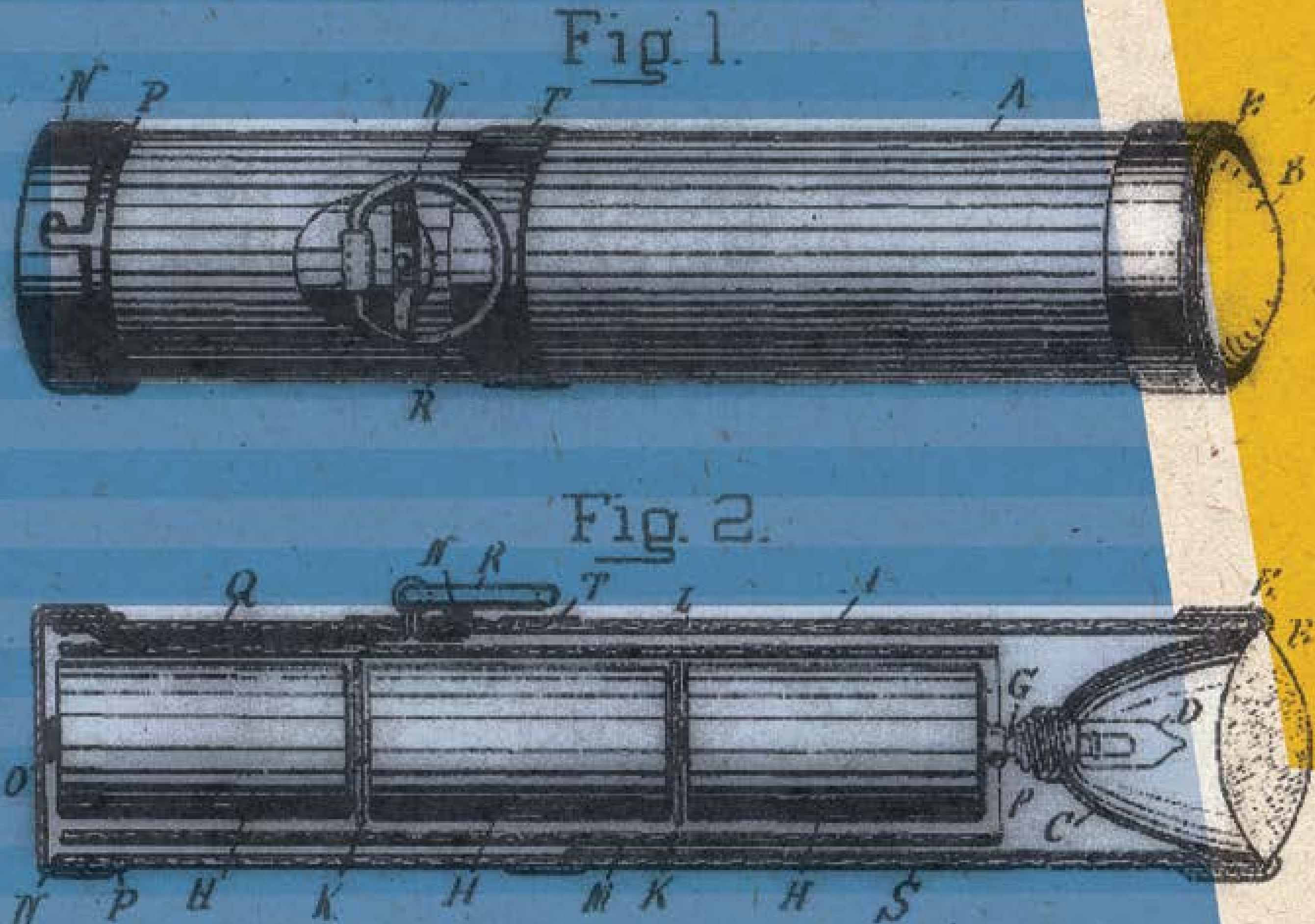
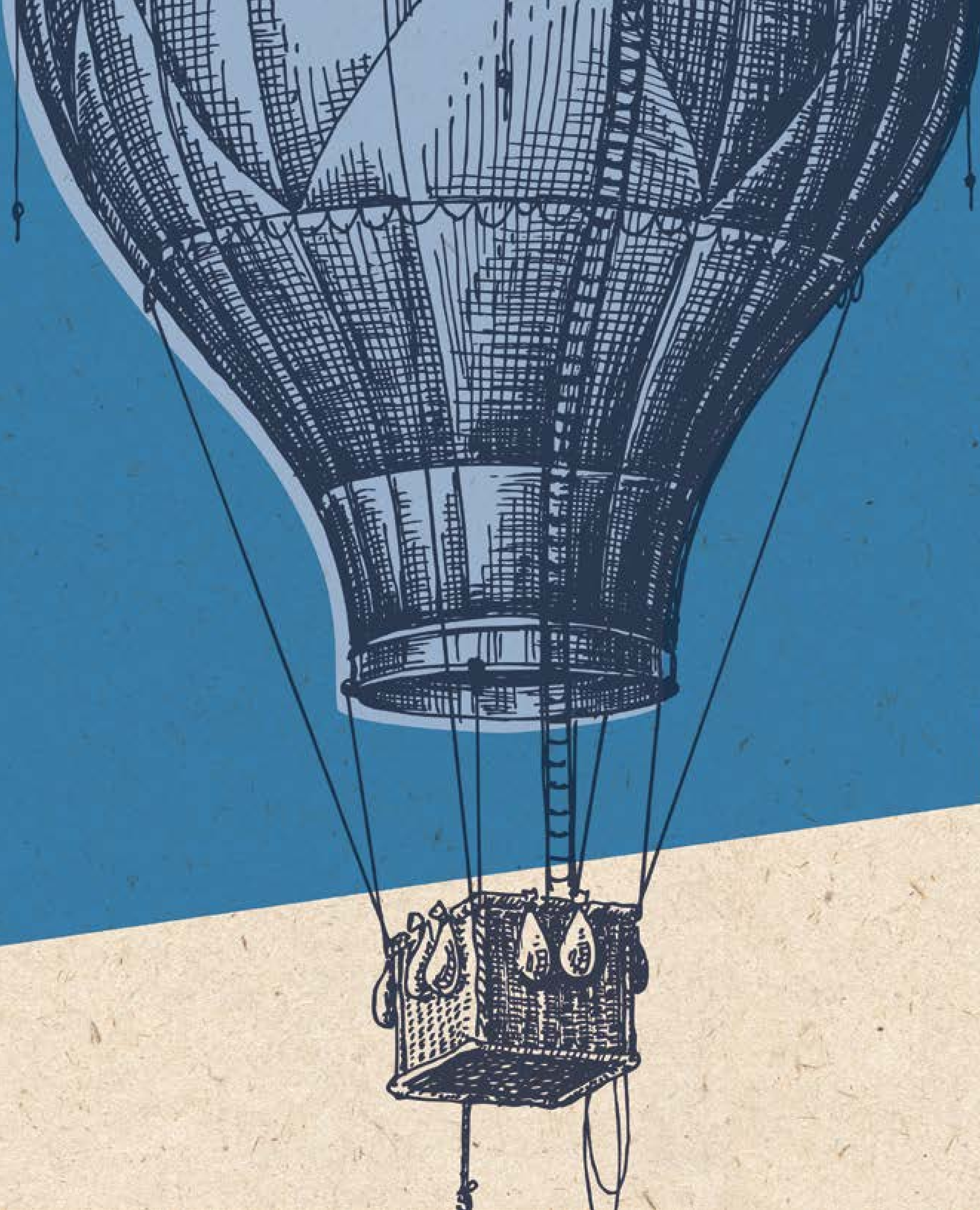


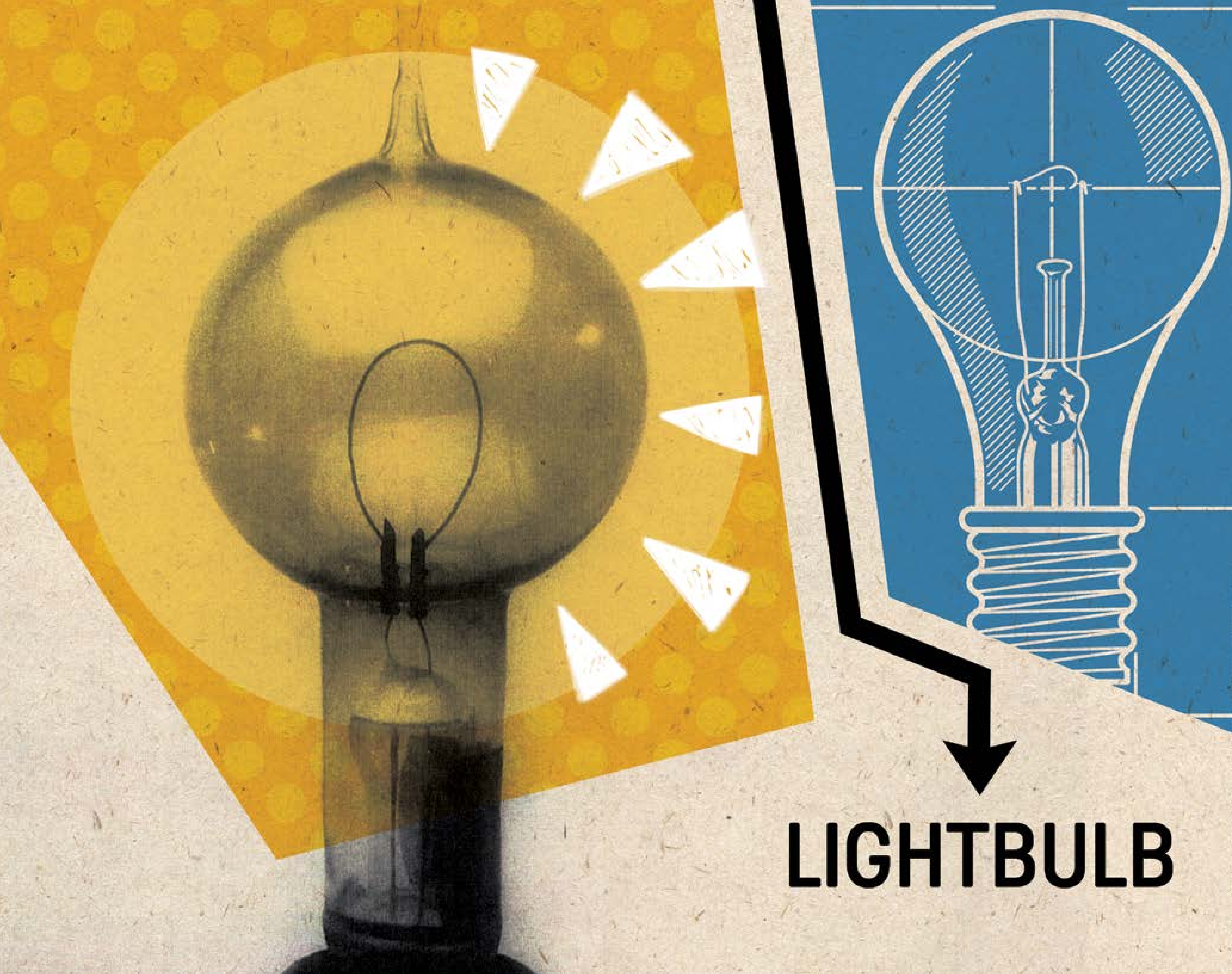
FLASHLIGHT

(L-R): Library of Congress; Siede Preis/Photodisc/Getty Images; Shutterstock



HOT-AIR BALLOON

(L-R): Shutterstock; Digital Vision/Photodisc/Getty Images



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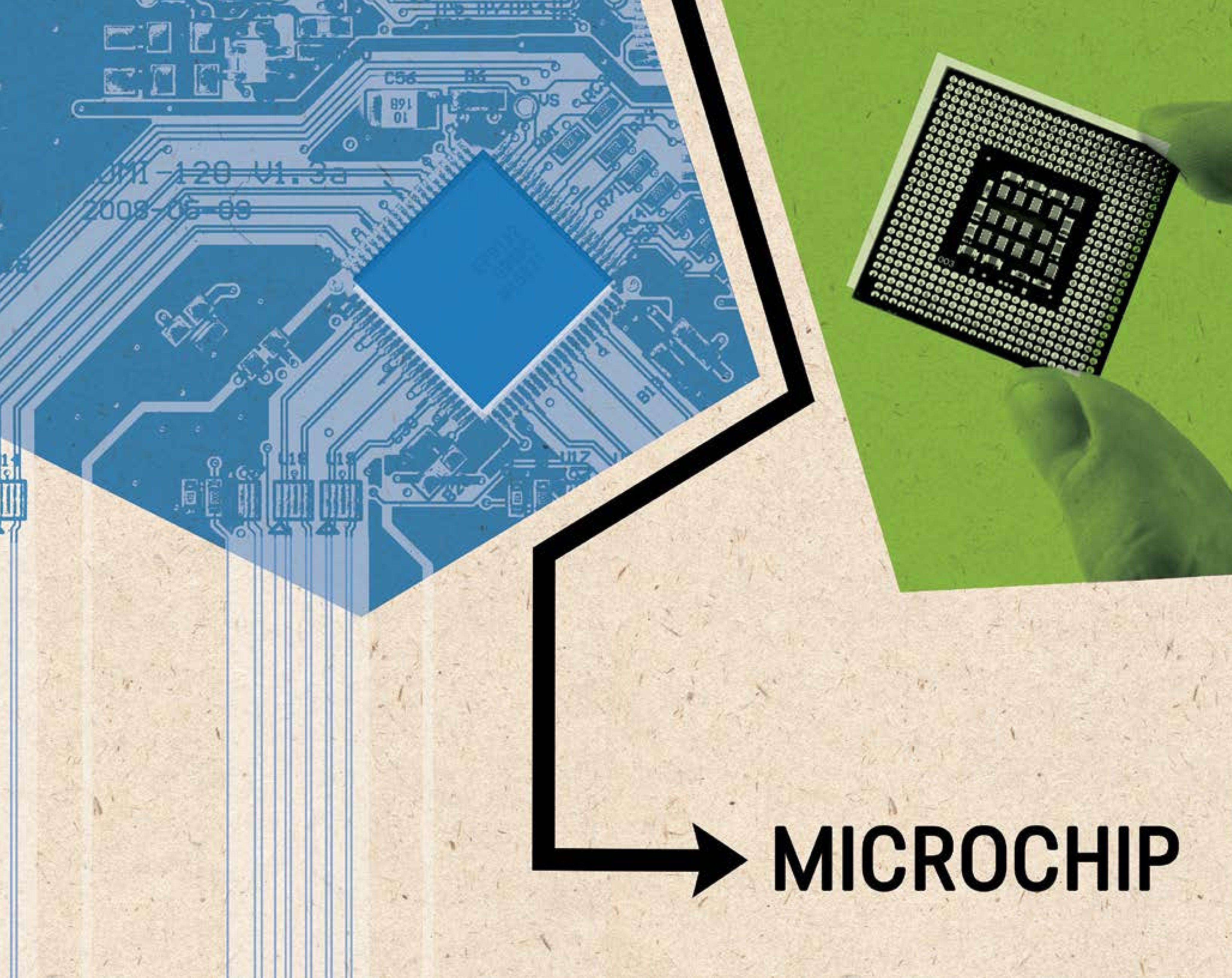

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MICROSCOPE

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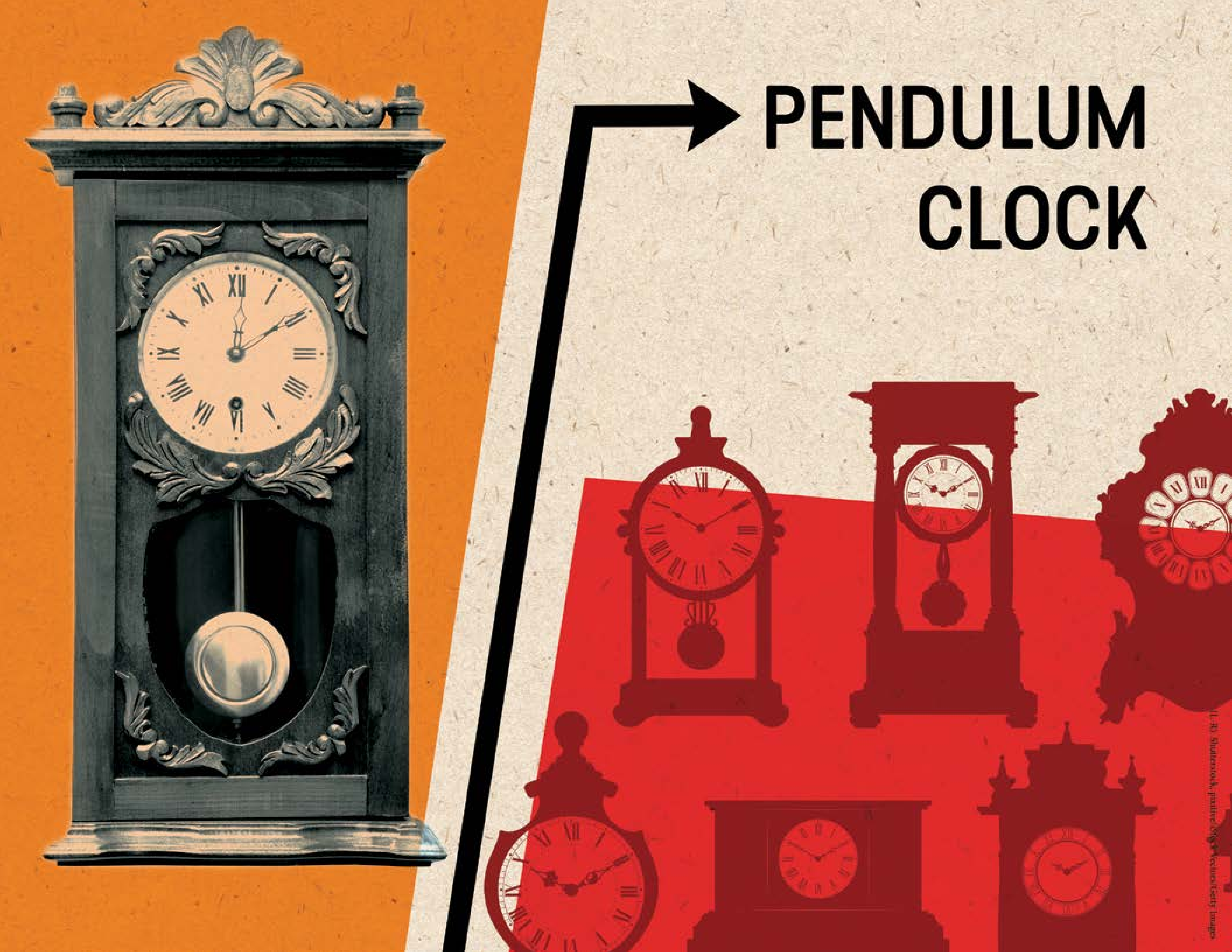
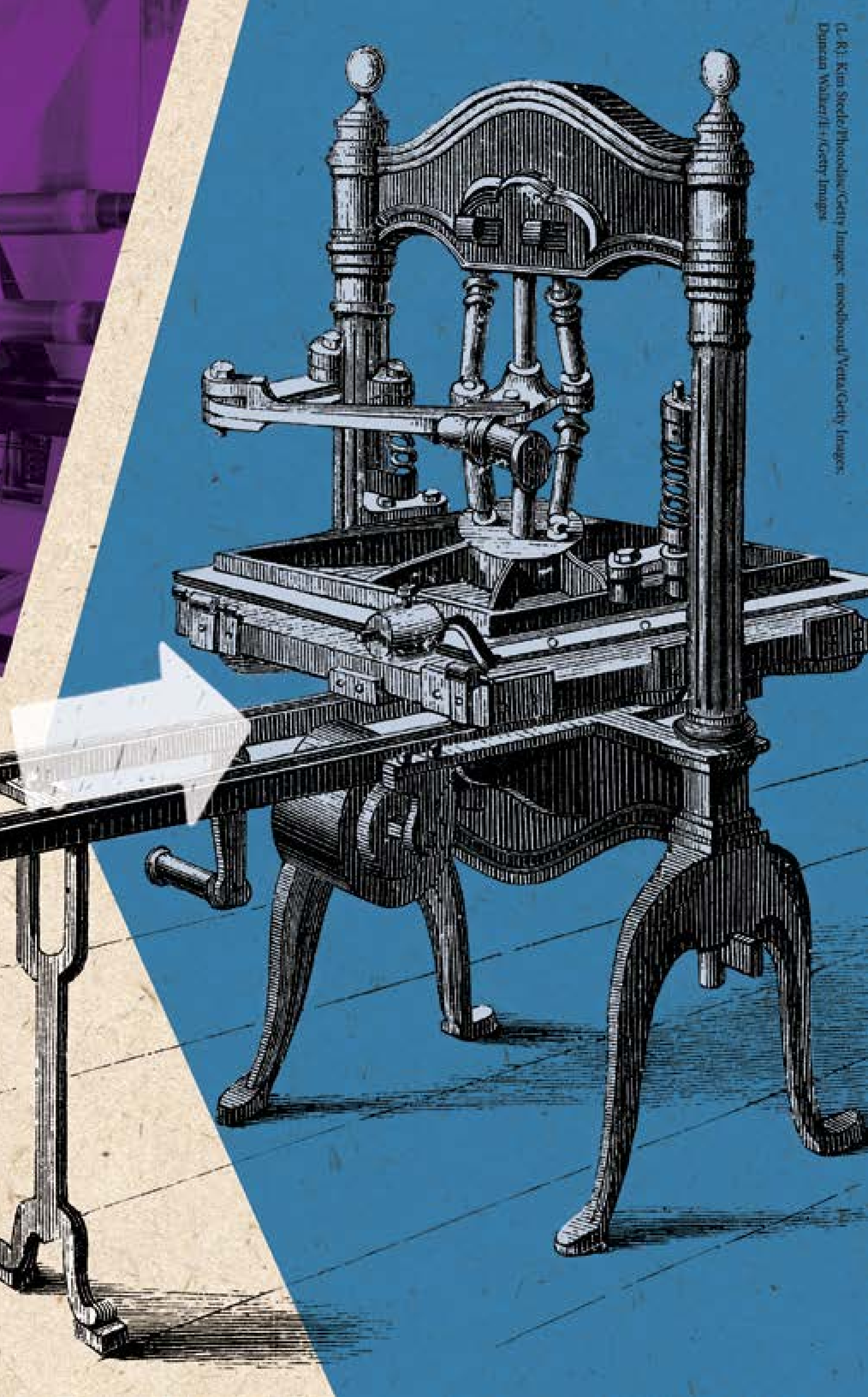
PAPER

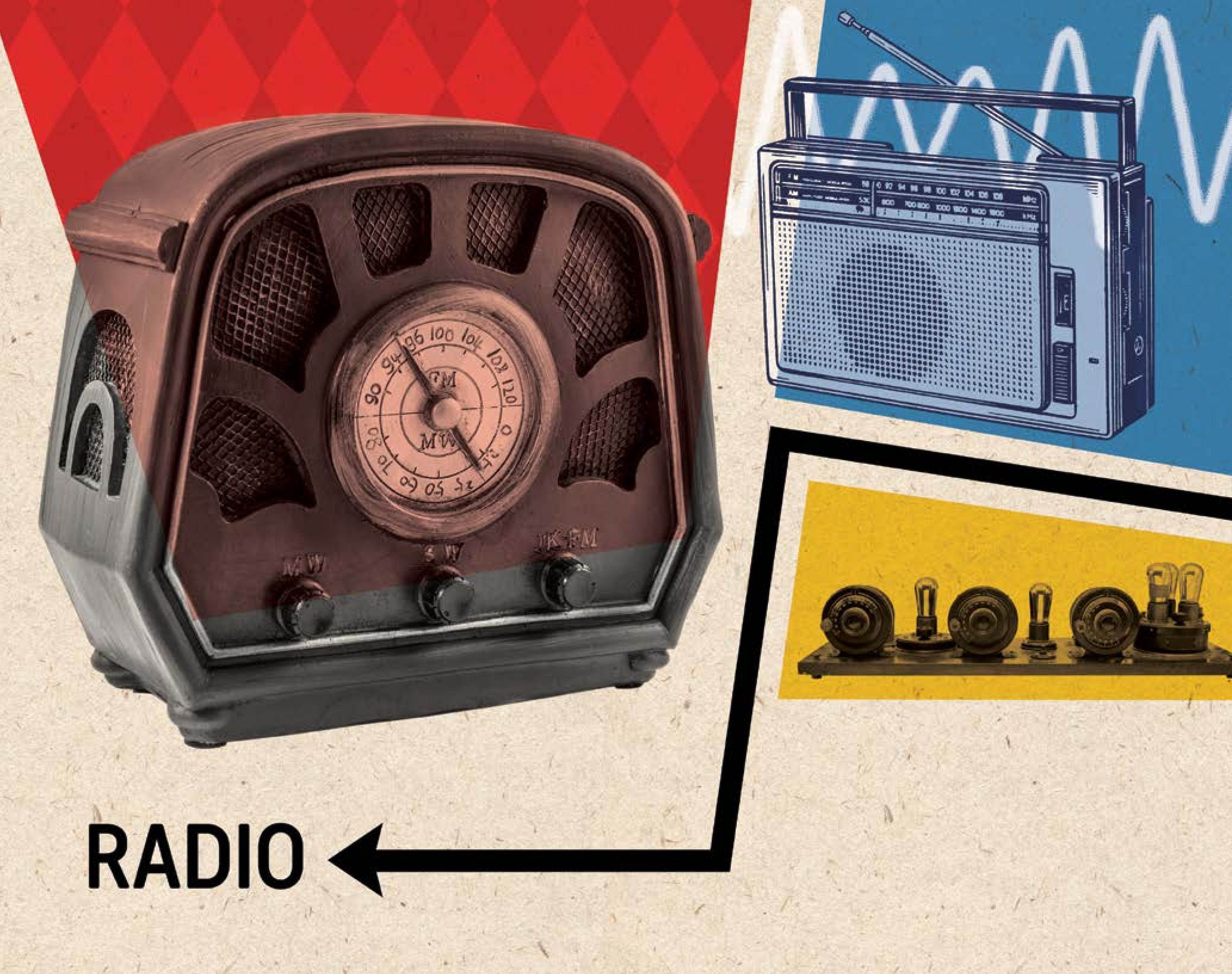
(L-R): Frank Ramspott/iStock Vectors/Getty Images; Bhaskar Dutta/Moment/Getty Images


PENDULUM
CLOCK



PRINTING PRESS

(L-R): Kim Steele/Photodisc/Getty Images; mseidbound/Vetta/Getty Images; Duncan Walker/E+/Getty Images



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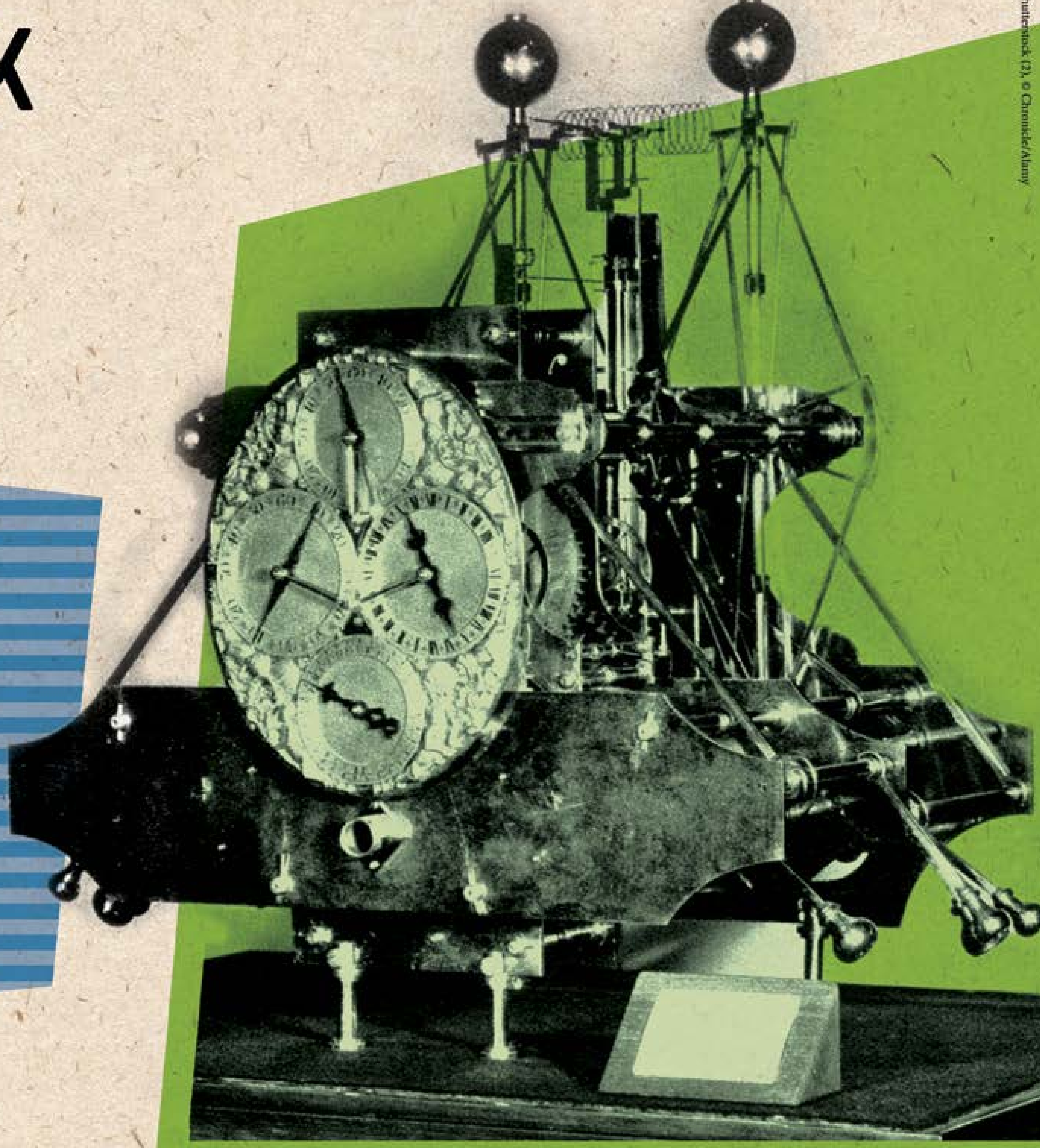
ROLLING SUITCASE

(L-R): Shutterstock (3)

SEA CLOCK

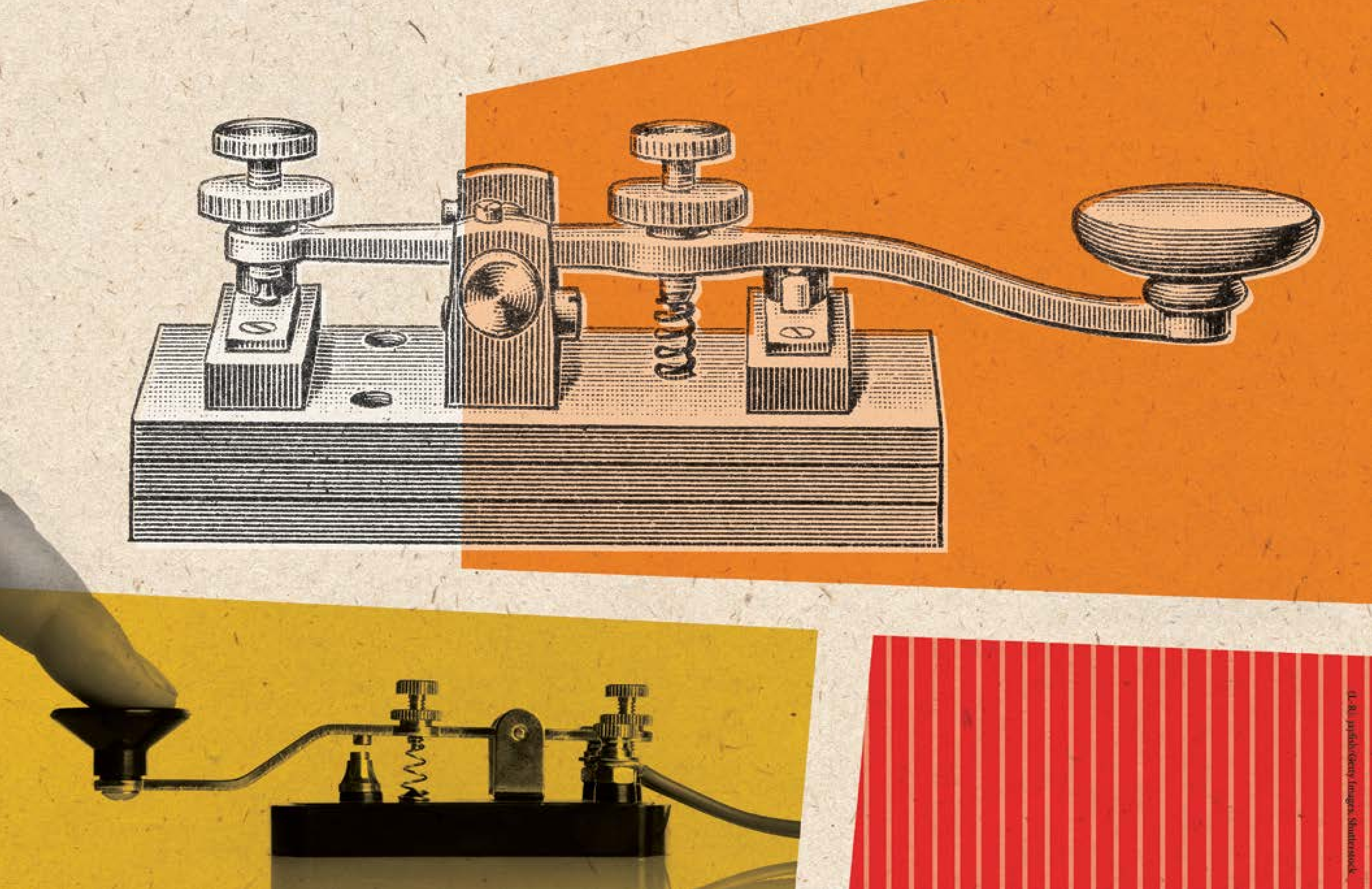


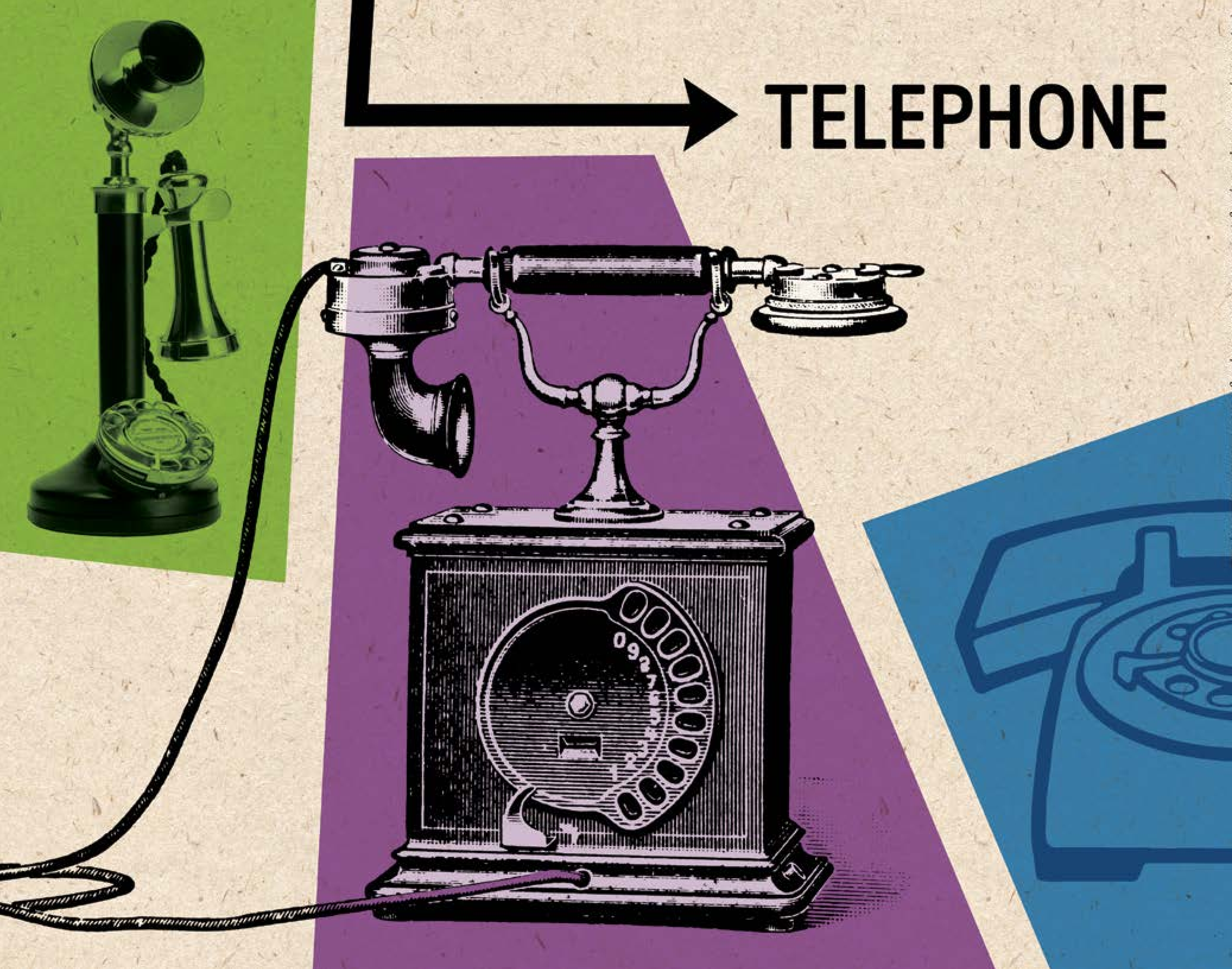
(L-R): Shutterstock (2), © Chronicle/Alamy

SPACE SHUTTLE

(L-R): BAVARIA/Digital Vision/Getty Images

TELEGRAPH

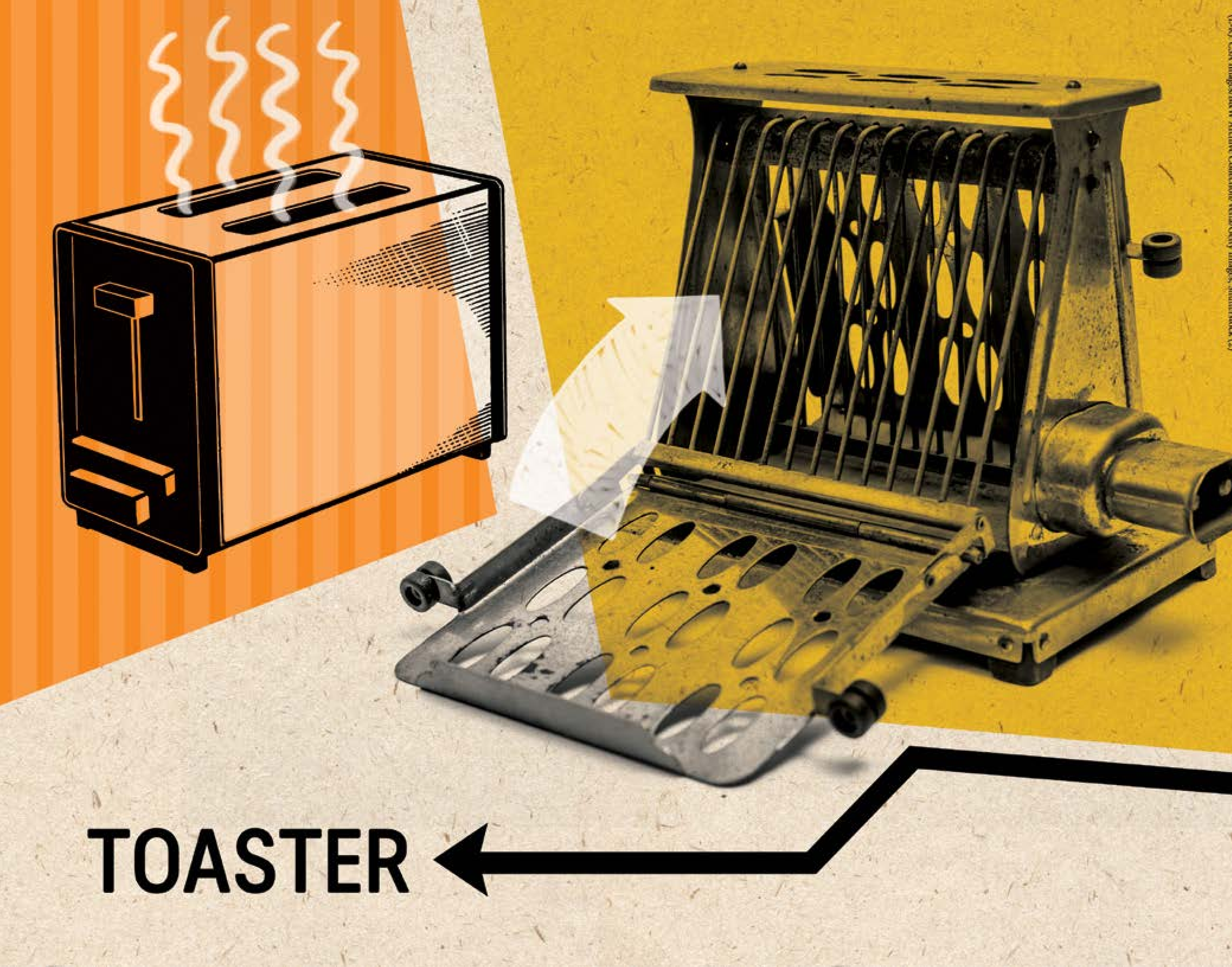




(L-R): Mark Matysiak/Moment Open/Getty Images; Steve Wisbauer/Photodisc/Getty Images; CSA-Archive/iStock Vectors/Getty Images

TELEVISION REMOTE CONTROL

(L-R): Joelcamera/Getty Images; Shutterstock (2)



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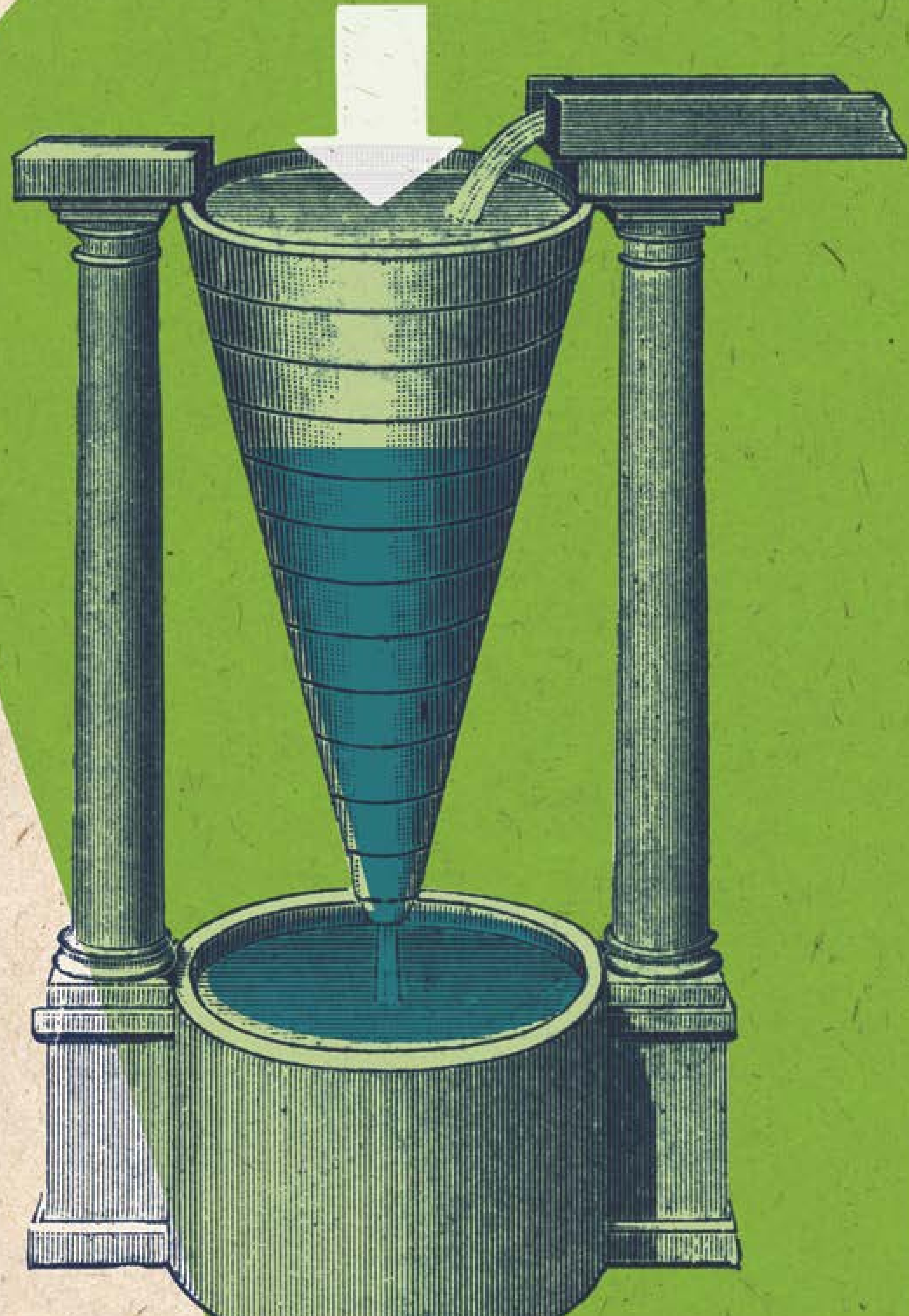
TOILET PAPER

(L-R): Image Source/Getty Images; Shutterstock (2)

WATER CLOCK



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(L-R): Shutterstock, Comstock/Stockbyte/Getty Images, Shutterstock

ALEXANDER FLEMING

RUTH WAKEFIELD

BETTE NESMITH GRAHAM

LOUIS BRAILLE

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

Name:

Birthdate:

Birthplace:

Invention(s):

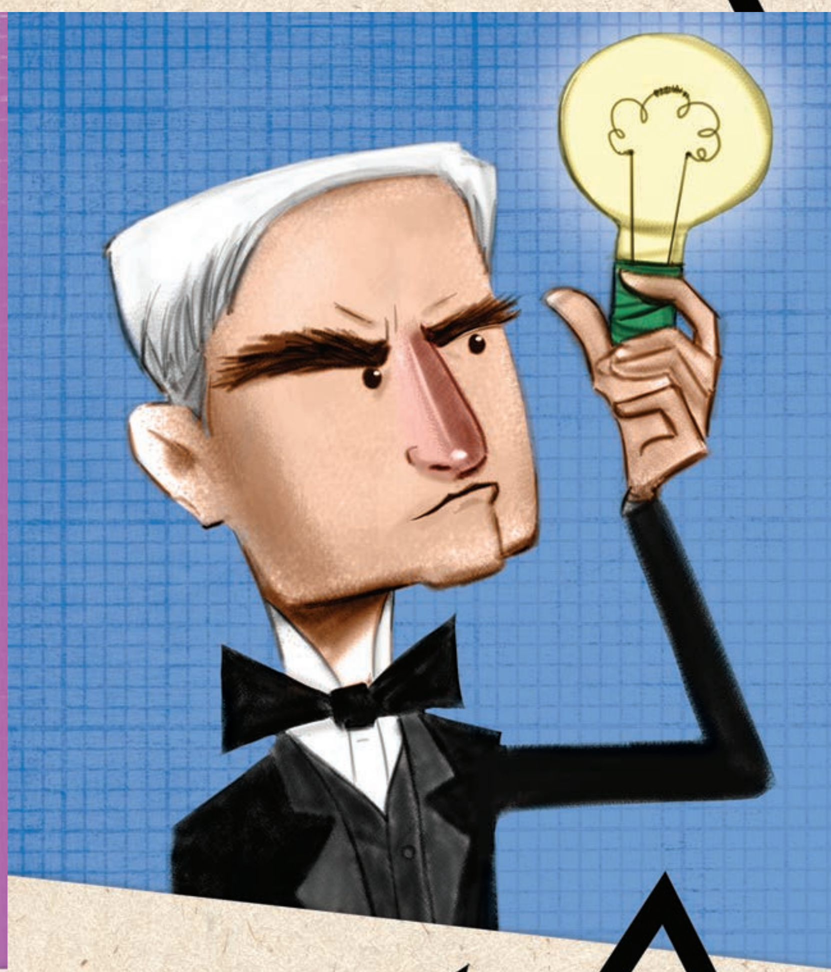
Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

HEDY LAMARR

JACQUES COUSTEAU

GEORGE WASHINGTON CARVER



THOMAS EDISON

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

Name:

Birthdate:

Birthplace:

Invention(s):

Describe a challenge or disappointment that this inventor faced.

Name one fact about this inventor or the story of their invention that you find interesting.

Name:

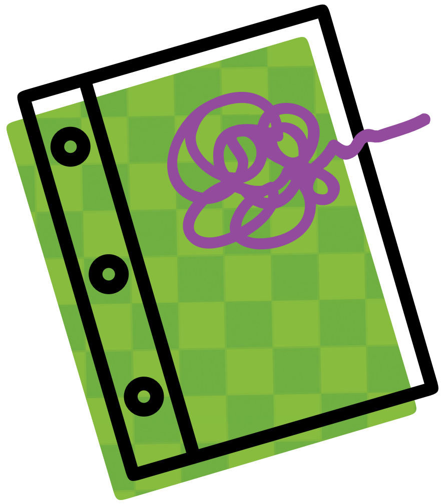
Birthdate:

Birthplace:

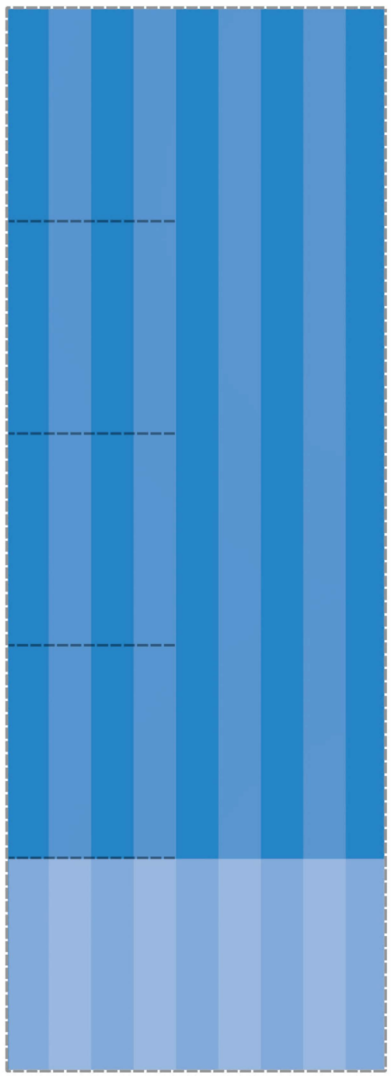
Invention(s):

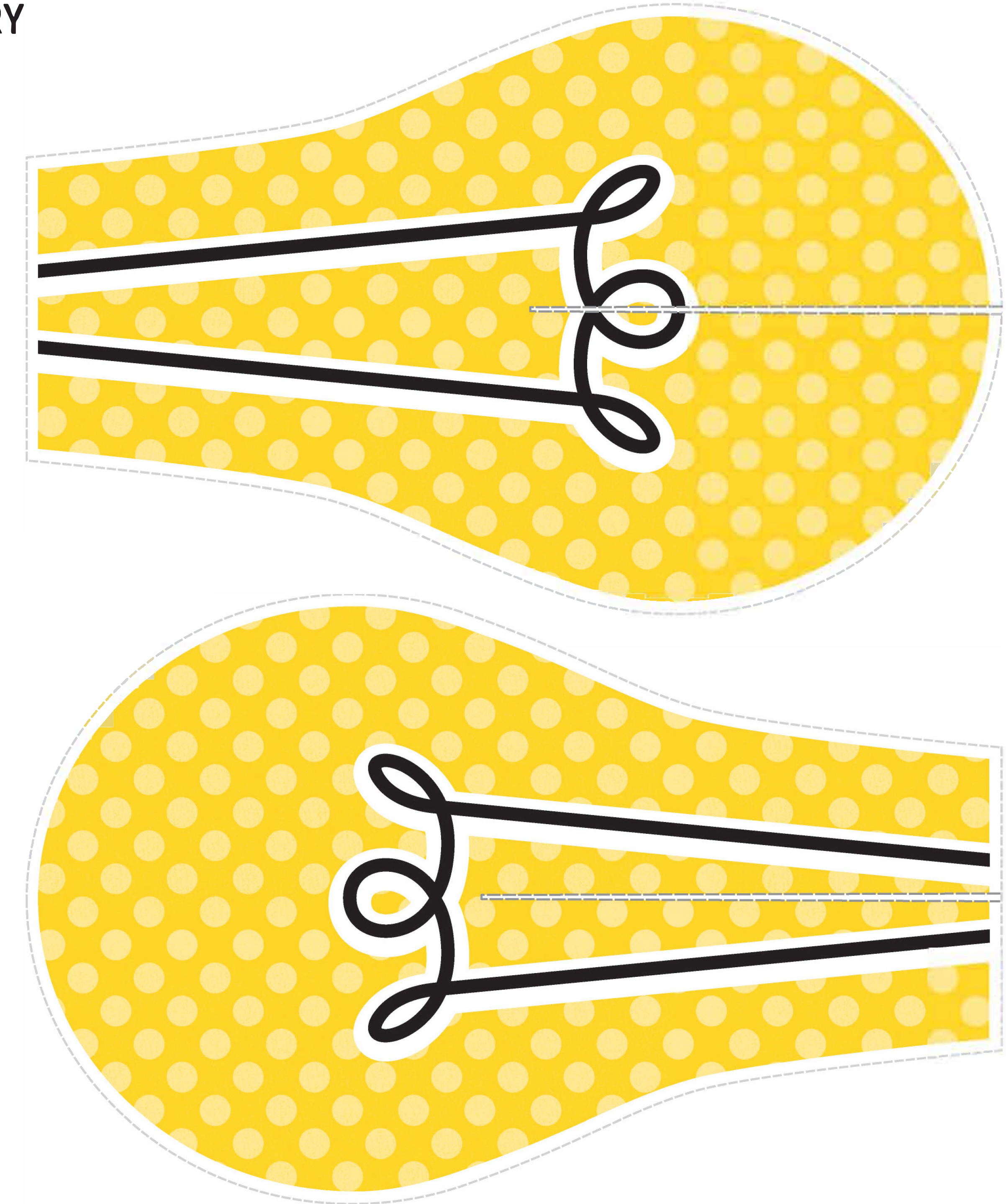
Describe a challenge or disappointment that this inventor faced.

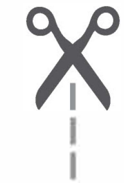
Name one fact about this inventor or the story of their invention that you find interesting.



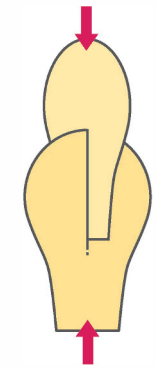
LIGHTBULB OF GLORY



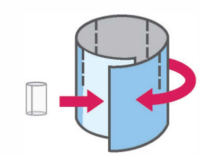




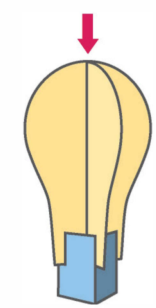
1. Cut along the dotted lines



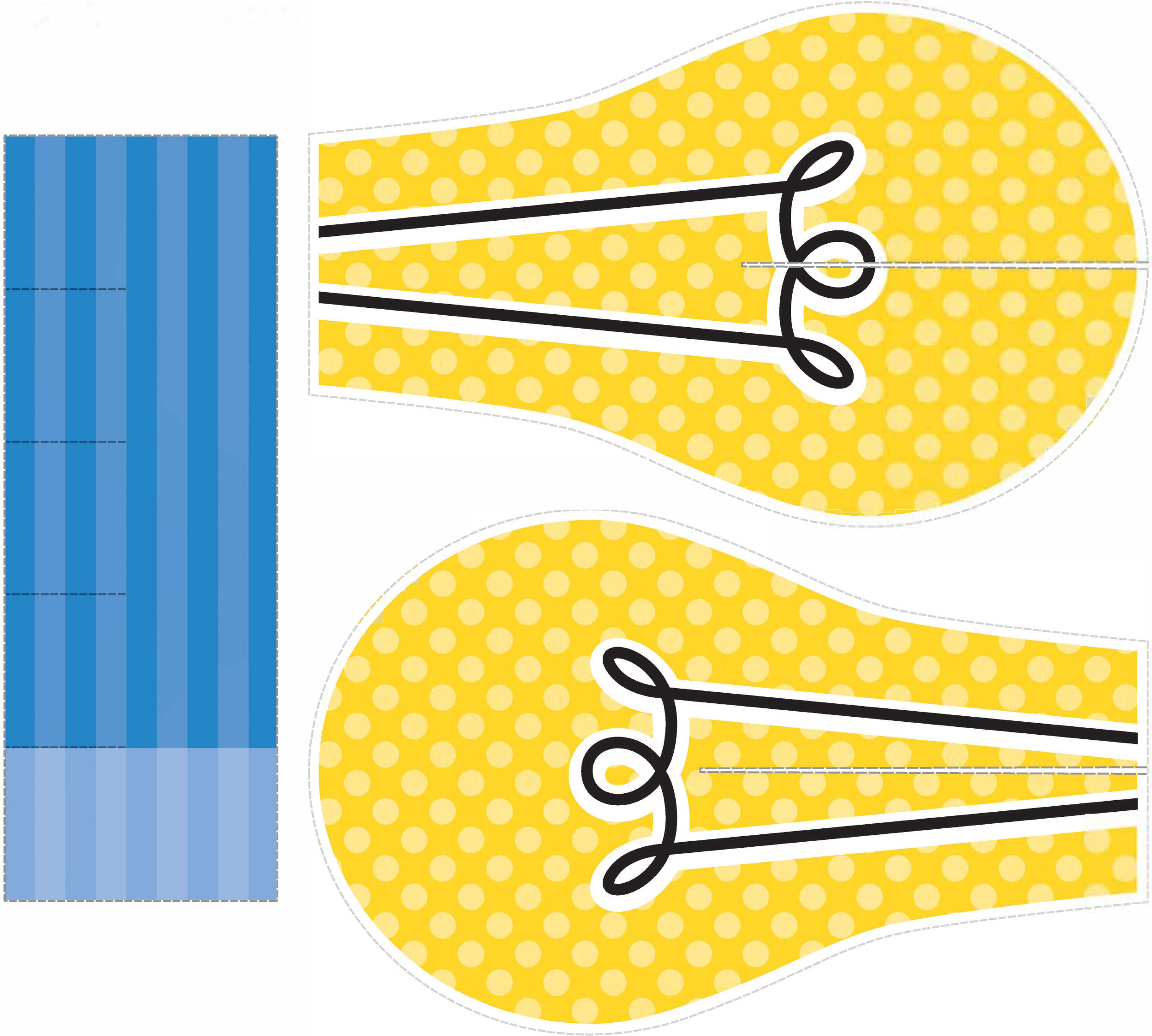
2. Connect the paper bulbs by sliding them together.



3. Wrap and secure the blue base with tape.

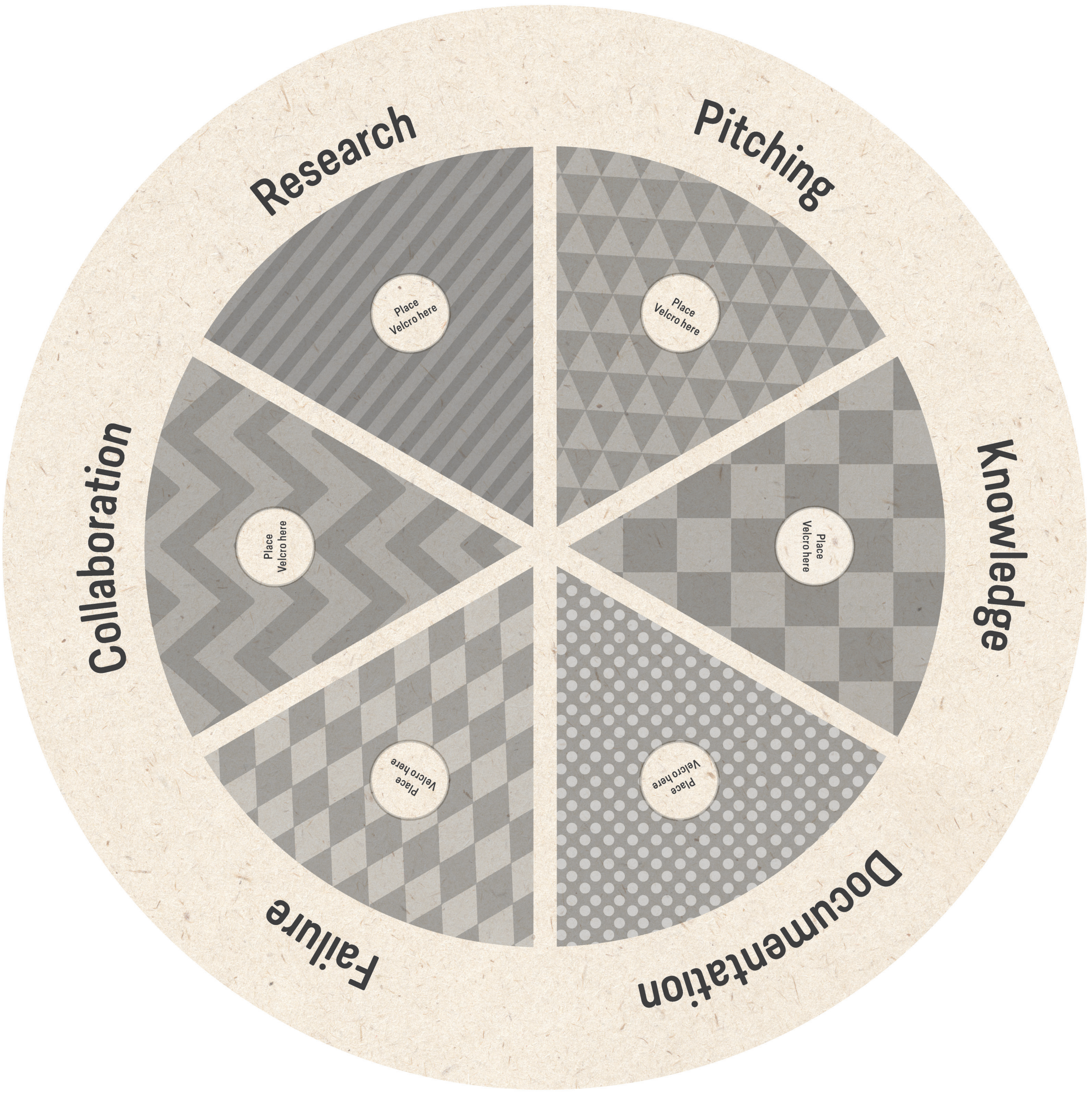


4. Connect the top and bottom pieces by sliding each yellow flap into one of the four blue slots.



QUIET

APPLAUSE!


Research
Pitching
Knowledge
Documentation
Failure
Collaboration
Place Velcro here
Place Velcro here
Place Velcro here
Place Velcro here
Place Velcro here
Place Velcro here

Welcome!

Grade 4, Unit 2

Eureka! The Art of Invention

This unit offers a unique learning experience for students as they read a range of informational texts about inventors, inventions, and the process of creation.

What's the story?

Students will have the chance to ultimately become inventors themselves while they **analyze the world** around them, **identify problems**, and **create solutions** for those problems.

What will my student learn?

Students will become contestants of an exciting reality TV game show. As part of the show, they will **practice observation**, **communication**, and **persuasion** in fun and interactive ways.

Students will engage in **collaborative discussions** and will **share ideas** with their classmates. They will work in teams to **participate in activities** and **challenges** that will be guided by both the teacher and inventor-judges, such as Thomas Edison and George Washington Carver.

Conversation starters

Ask your student questions about the unit to promote discussion and continued learning:

1. Describe what an invention is.
   Follow up: What are some examples of different kinds of inventions?
2. Tell me about Thomas Edison.
   Follow up: What were some of his inventions? I know he patented over a thousand inventions in the United States. What does it mean to patent something?
3. Tell me about George Washington Carver.
   Follow up: What challenges did he face as an inventor? What is one fact you learned about him that you find interesting?
4. Why did Ruth Wakefield feel like she needed to "clear up some untruths" about her invention?
   Follow up: What is the real story? Why do you think there have been so many false versions of her story on the Internet?
5. What do you think was the most important invention you learned about?
   Follow up: Why? How did the invention change things? How would our world be different if that invention never existed?

Name: ______________________________ Date: ____________________

Amplify.
TEXAS
ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 1 – What is a lesson about collaboration you will take away from today and apply to the rest of the Quest?

Name: ______________________________ Date: ____________________

Amplify.
TEXAS
ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 2 – Select one of the biographies you read today. Provide the main idea and two supporting details from that biography.

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 3 – Identify the invention you researched from your "Edison's Invention Evidence" pages. How did that invention change things? Provide at least one example or quote from the text to support your answer.

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 4 – In your lesson today, you read a biography about Louis Braille. Describe a challenge or disappointment that he faced. Use details from the biography to support your answer.

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 5 – Speaking personally, which simple machine is your personal favorite? Why?

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 6 – Why is documentation an important part of inventing?

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 7 – How did your lab collaborate today? What did you do to come up with improvements?

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 8 – How is choosing a problem you want to solve different from solving a problem you are given?

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 9 – Briefly describe your invention. Which judge do you think will like your invention the best? Why?

Name: ______________________________ Date: ____________________

Amplify. TEXAS ELEMENTARY LITERACY PROGRAM

Grade 4

Unit 2, Lesson 10 – What part of your presentation today was challenging? What part of your presentation today was the easiest?

Vocabulary

Grade 4 Unit 2: Eureka! The Art of Invention

Adages & Proverbs

Introduction: Adages & Proverbs

A **proverb** is a common statement that gives advice or expresses a well-known truth.

An **adage** is a short saying that shares wisdom or makes a common observation.

Proverbs and adages often use *figurative language*.

To understand the meaning of proverbs and adages, we have to recognize the difference between the *literal* meanings of the words in the statement and their *figurative* meanings.

The literal meaning is the dictionary definition of the words in the statement.

The figurative meaning is implied. It contains ideas, emotions, or connections that differ from the dictionary definition.

Let's look at a common expression that Jacques Cousteau might have used in our *Eureka!* unit:

You can lead a horse to water, but you can't make it drink.

Is this statement literal or figurative? Do you think he is really talking about a thirsty horse?

You can lead a horse to water, but you can't make it drink is a proverb that uses figurative language.

If Jacques Cousteau uses this expression, he really means:

You can give someone advice, but you can't make them follow it.

Let’s Try It Together!

Let’s look at this common expression George Washington Carver might have used in *Eureka!*:

Don’t count your chickens before they hatch.

Do you think this statement is literal or figurative? Is he really talking about counting chickens?

Stay seated if you think **Don’t count your chickens before they hatch** is a literal statement.

Stand up if you think **Don’t count your chickens before they hatch** is a figurative statement.

Turn to a partner and discuss what you think Carver means when he uses this expression:

Don’t count your chickens before they hatch.

Don’t count your chickens before they hatch is a proverb that uses figurative language.

If George uses this expression, he really means:

Don’t count on something that hasn’t happened yet.

Now you try one with a partner. Look at this expression Thomas Edison might have used:

Don’t put all your eggs in one basket.

Do you think this statement is literal or figurative? Is he really talking about gathering eggs in a basket?

Stand up if you think **Don’t put all your eggs in one basket** is a literal statement.

Stay seated if you think **Don’t put all your eggs in one basket** is a figurative statement.

Turn to a partner and discuss what you think Edison means when he uses this expression:

Don’t put all your eggs in one basket.

Did you remember the steps?

1. Read the statement or expression.

   Don't put all your eggs in one basket.

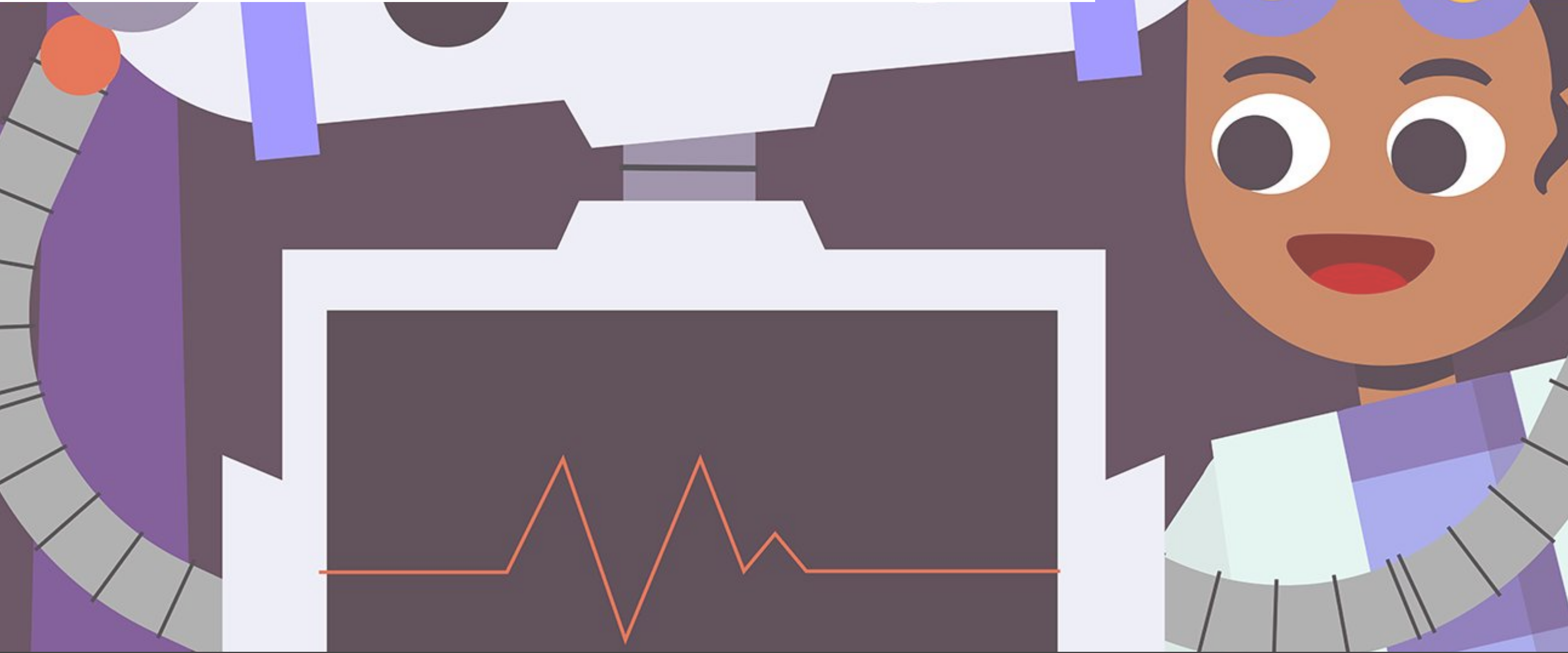
2. Decide if the statement is literal or figurative:

   figurative

3. Determine the meaning of the idiom:

   Don't focus on just one thing.

Now Try One by Yourself!



Look at this common expression:

Two wrongs don't make a right.

Write the word *literal* if you think this statement is literal.

Write the word *figurative* if you think this statement is figurative.

Then, write what you think this statement means.

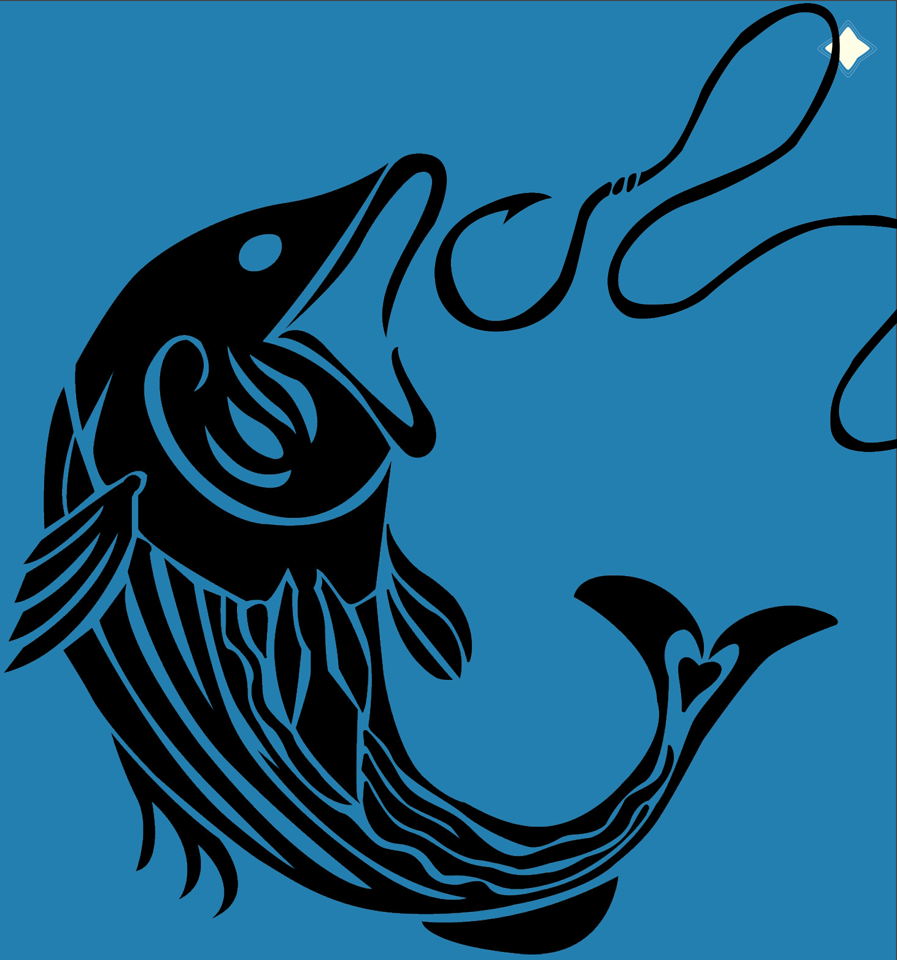
Answer

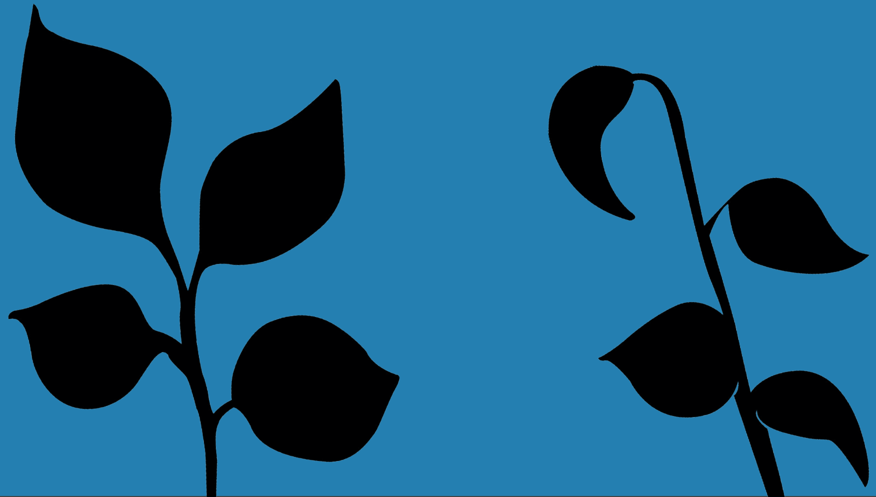
Figurative

If someone does something hurtful
to another person, that person shouldn’t do
something hurtful in return.

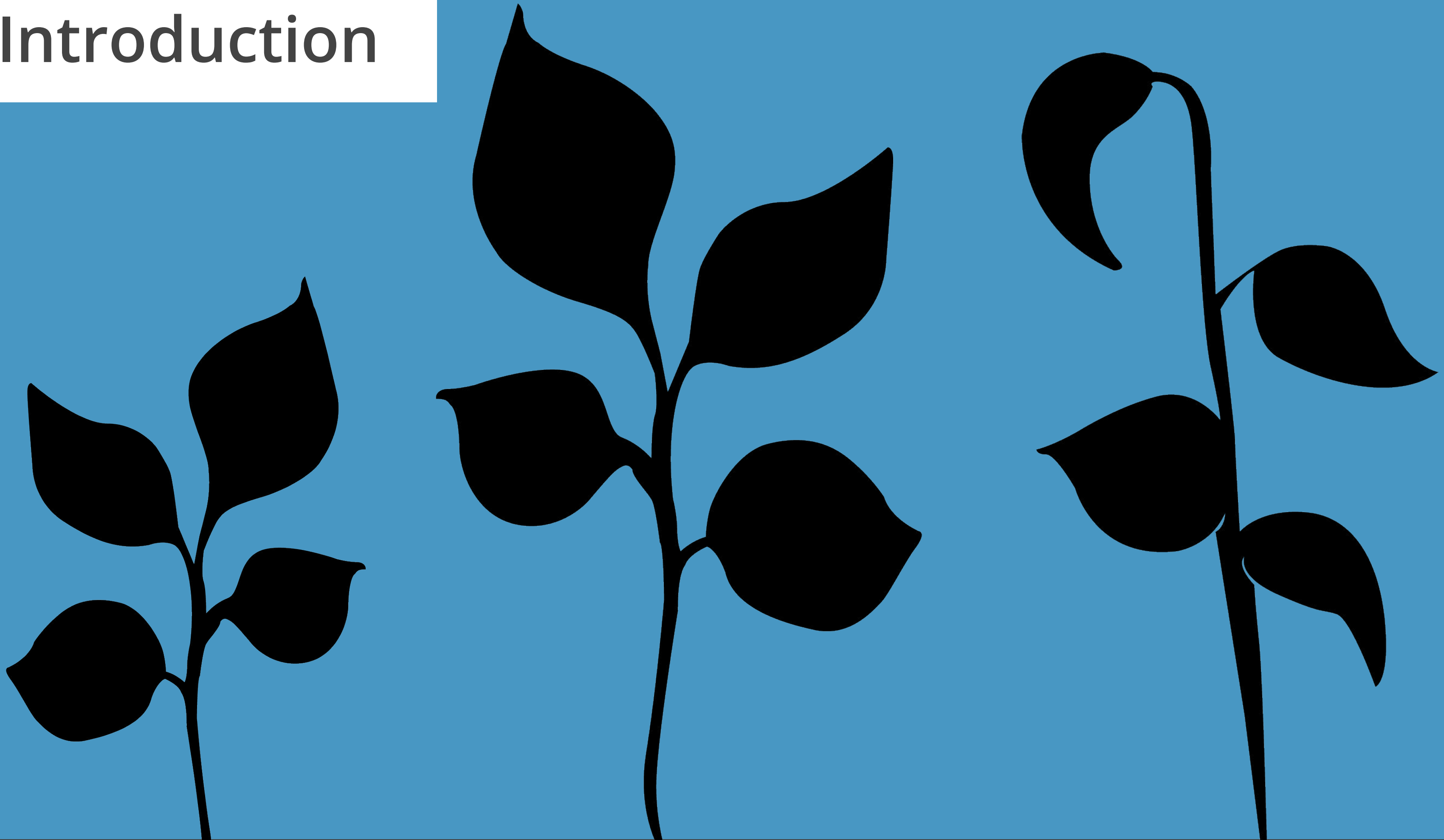
POETRY

Grade 4 Lesson 1:
“To Catch a Fish”by Eloise Greenfield





Introduction



Today we are going to read a poem in which a speaker gives some advice.

As we read, listen for the advice the speaker gives.

Read "To Catch a Fish" by Eloise Greenfield aloud.

The poem can be found online or from other sources, such as the library.

Summarize the poem. What is this poem about?

What is one piece of advice the speaker gives for catching a fish?

Summarize the poem. What is this poem about?

The poem gives advice about fishing.

What is one piece of advice the speaker gives for catching a fish?

Answers may vary but should reflect the text.

Reading

Authors use the structure of a poem to express meaning.

There are many different types of structure. Today we’ll look at two parts of a poem’s structure: rhyming and spacing.

In the Poetry unit, we discussed rhyme and rhyme scheme.

Turn to a partner and share the definition of rhyme.

Turn to a partner and share the definition of rhyme scheme.

the definition of rhyme

Rhyme occurs when two or more words have the same ending sound or sounds.

the definition of rhyme scheme

A rhyme scheme is a pattern of rhyming words. Poems with a rhyme scheme usually put those words at the ends of lines.

Rhyme in poetry is important for many reasons. One important job of rhyme is to establish the poem’s tone or mood.

I'm going to read the poem out loud.

Listen for rhyming words and look at the way they appear in the poem. Are they in a regular pattern, or do they vary?

Read “To Catch a Fish” by Eloise Greenfield aloud.

The poem can be found online or from other sources, such as the library.

What did you notice about the rhyming words? Did they make a regular pattern, or did the rhyming vary?

What did you notice about the rhyming words? Did they make a regular pattern, or did the rhyming vary?

The rhyme varies. There is not a regular pattern of rhyming words, but the poem does have some words that rhyme.

Turn to a partner and discuss the following questions.

Why might the author decide to have some rhyming words but no regular rhyming pattern in this poem?

Think about the poem's subject as you discuss. How might the rhymes connect to that topic?

Have you ever been fishing?

What do people do while they are fishing?

Do they move around a lot and experience many exciting things?

What do people do while they are fishing? Do they move around a lot and experience many exciting things?

Fishing is a low energy activity (sitting with the fishing pole waiting for a bite) with occasional moments of excitement (threading the hook, casting the line, reeling in the fish, etc.).

Think about the moments in the poem where the rhyming words were close together. What happens in the poem when the rhymes start to appear farther apart?

Think about the moments in the poem where the rhyming words were close together. What happens in the poem when the rhymes start to appear farther apart?

The rhymes slow down when the speaker has to wait on the fish.

Using rhyme is one way of thinking about how a poem sounds. Another way poets think about how a poem sounds is the way they arrange the words on the page.

Did you notice the section of the poem (line 7) where there was a big gap?

A gap or pause like this is called a caesura.

Let’s practice saying the word *caesura*.

Why might the poet use a caesura when writing about waiting?

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The speaker is talking about waiting and uses the caesura to make the reader wait for the next words.

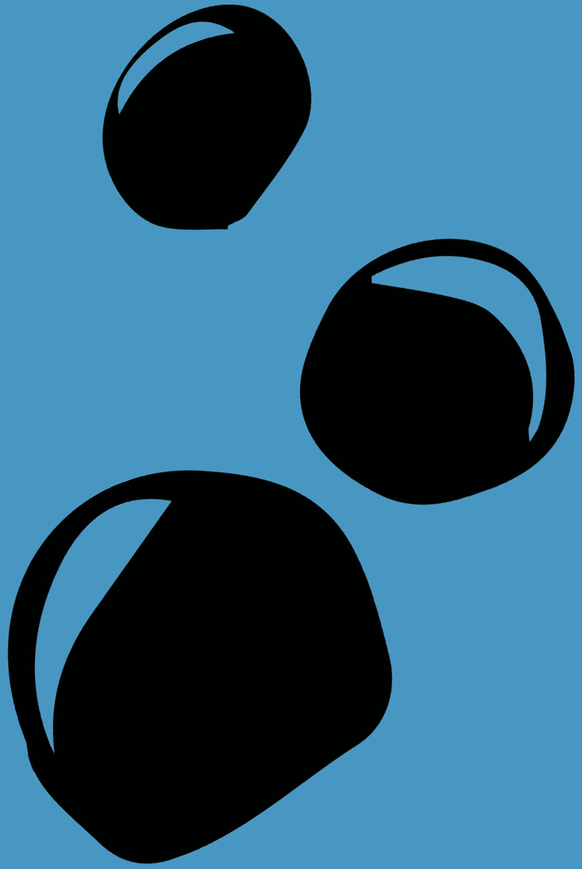
Wrap-Up

We’ve read “To Catch a Fish” and learned how a poem’s structure can help express the poem’s message.

On a slip of paper, answer the following question in 1-3 sentences:

How does the structure of “To Catch a Fish” help express the poem’s meaning?

Answer



A few different answers are possible, but your answer should reflect what we talked about today.

The speaker talks about waiting and uses a caesura to make the reader wait for the next words. The poem's structure helps the reader understand what it feels like to wait.

The poem also uses rhyme to illustrate the mood of the poem during different parts of the fishing trip.