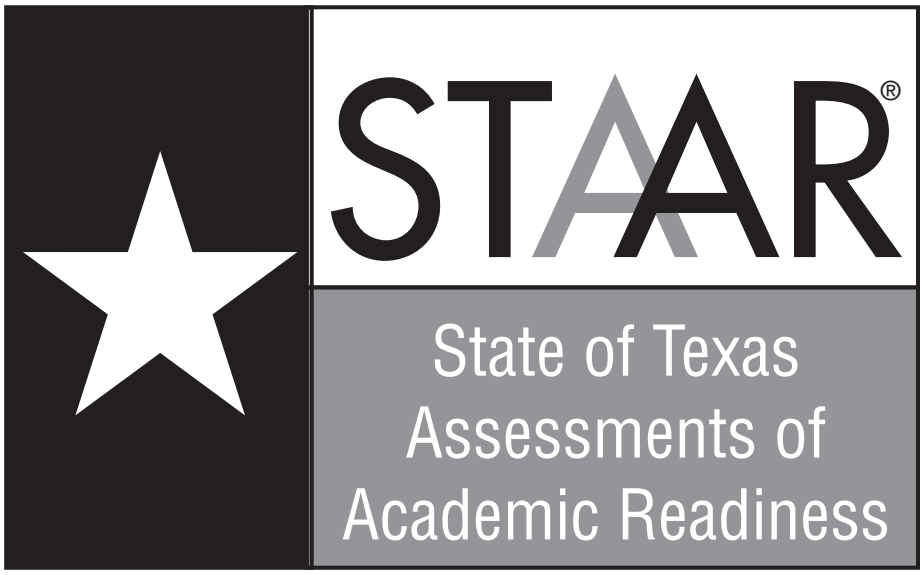


Biology

Administered May 2021

RELEASED

BIOLOGY

DIRECTIONS

Read each question carefully. Determine the best answer to the question from the four answer choices provided. Then fill in the answer on your answer document.

1 When the skin comes in contact with an irritant, receptors in the skin send signals to the spinal cord. The signal is then sent to the brain for processing, and the individual begins to scratch the affected area.

Which two systems are most likely interacting when a person experiences itching caused by a skin irritant?

A Circulatory and excretory

B Integumentary and nervous

C Digestive and muscular

D Respiratory and lymphatic

---

2 During the cell cycle, proteins called cyclins bind to enzymes that send signals for the cell to progress through stages of cell replication. At the end of this cycle, the cyclins degrade to prevent further signaling for the cell to divide.

Uncontrolled production of cyclins will most likely result in —

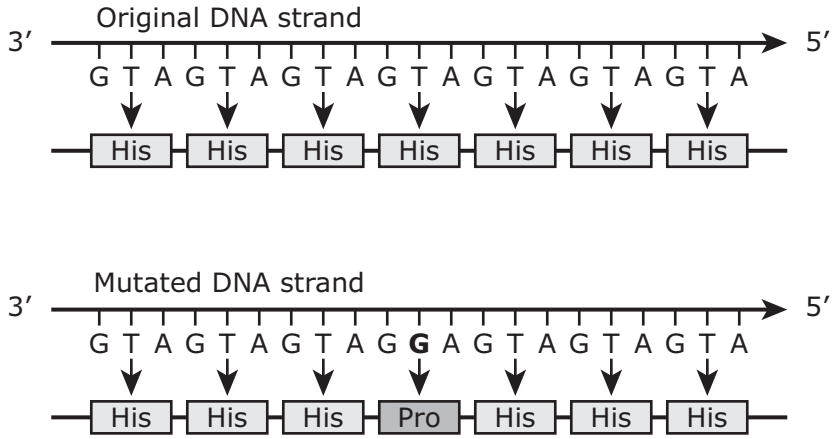
F the formation of tumors

G the immediate death of the cell

H the transfer of cyclins to other cells

J the formation of haploid cells

3 An illustration of how a particular DNA mutation will most likely affect the polypeptide produced is shown.



What type of mutation is illustrated?

A Insertion

B Translocation

C Substitution

D Deletion

---

4 Farmers spray pesticides on their plants to protect the plants from being eaten by insects. Some individual insects have a genetic mutation that makes them resistant to the toxins in the pesticides.

Which statement best describes how only a few resistant individuals resulted in the pesticide becoming ineffective?

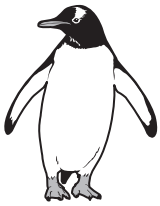
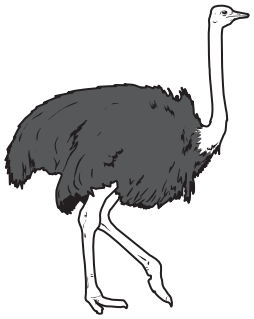
F The resistant insects change the toxin on the plants, making it safe for others.

G The resistant insects grow larger and eat less of the plants.

H The resistant insects eat the contaminated surface and leave the rest for others.

J The resistant insects are able to survive to reproduce and create a population that is also resistant.

5 The defenses of two flightless birds that live in different habitats are shown.

	Gentoo Penguin	Common Ostrich
Picture		
Habitat	Antarctic islands	African savanna
Defenses	Wings are flattened and tapered, like paddles, allowing penguins to swim and jump out of water at speeds up to 22 km/h.	Leg muscles are located closer to the body, allowing ostriches to run at speeds up to 70 km/h.

How do the wings of the Gentoo penguin and the legs of the common ostrich provide an advantage in their habitat?

A Allows them to find prey

B Allows them to escape from predators

C Allows them to control their body temperature

D Allows them to be camouflaged in their environments

---

6 Which property is shared by the cells of all living things?

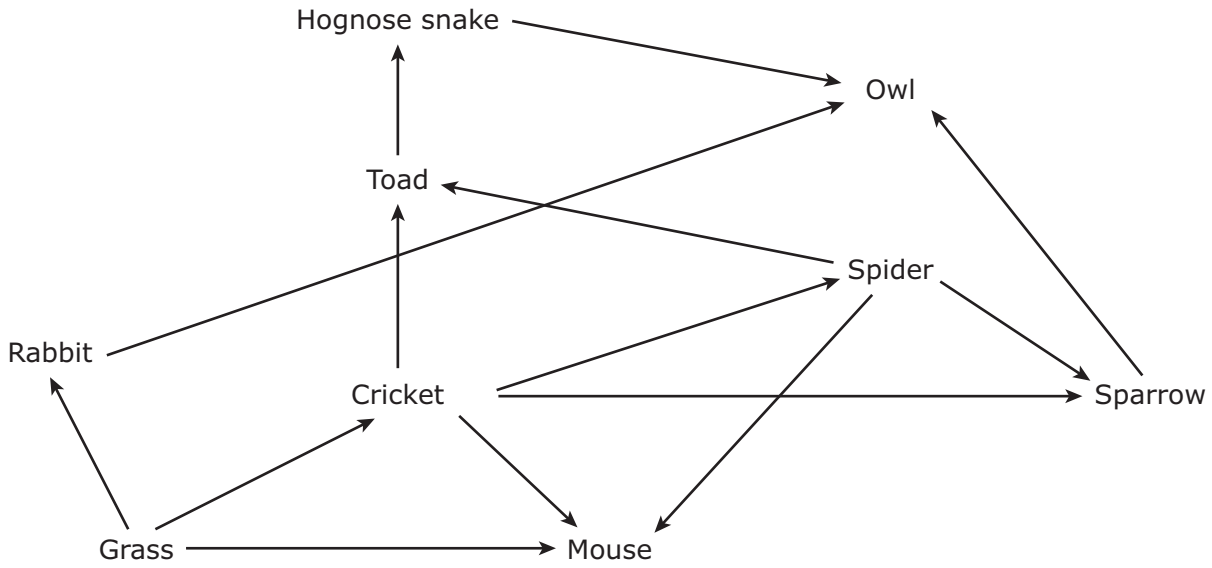
F The cells contain DNA composed of adenine, thymine, guanine, and cytosine.

G The cells are surrounded by a phospholipid bilayer and a cell wall made of cellulose.

H The cells have chromosomes that are located inside a membrane-bound nucleus.

J The cells rely on mitochondria to carry out aerobic cellular respiration.

7 The flow of energy in a grassland ecosystem is shown.



Based on the diagram, which two populations best represent trophic levels that receive the LEAST amount of the total energy provided to the ecosystem by the grass?

A Crickets and sparrows

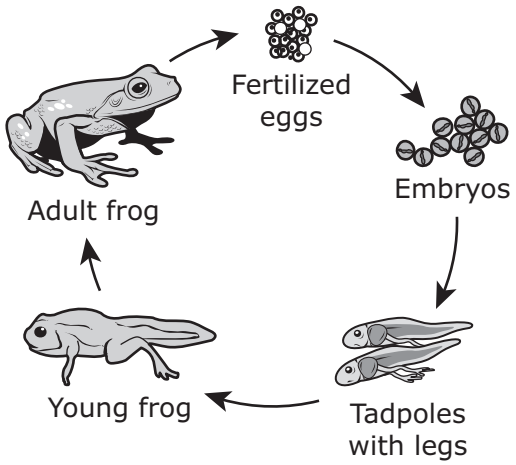
B Toads and spiders

C Rabbits and mice

D Hognose snakes and owls

GO ON

8 The life cycle of a frog is illustrated in the diagram.



Which statement best explains how the cell cycle is important to the life cycle of the frog?

F It enables frogs to produce tadpoles that are clones.

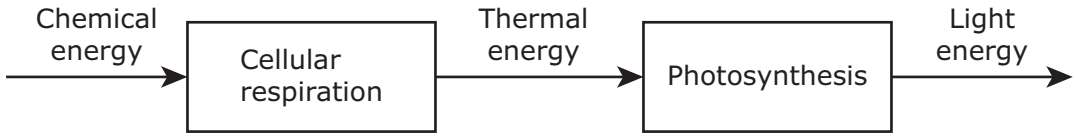
G It allows frogs to grow, develop, and reproduce.

H It prevents overproduction of frog offspring.

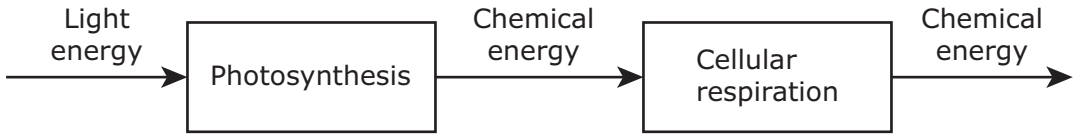
J It ensures the best adapted frogs survive and pass on traits to offspring.

9 Which graphic organizer best compares the energy inputs and outputs of cellular respiration and photosynthesis?

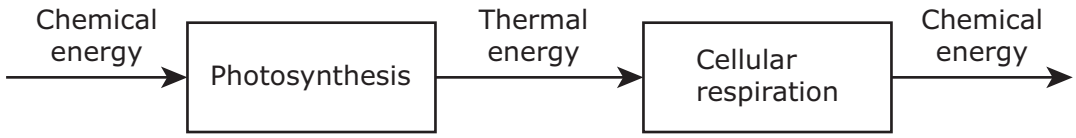
A



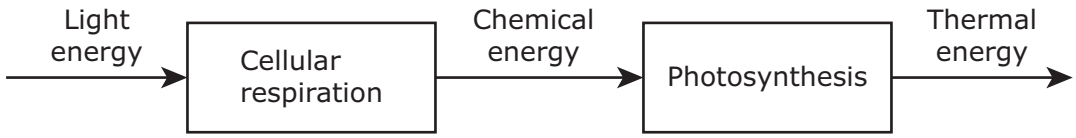
B



C



D



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10 Overfishing is causing the decline of fish populations, such as Eastern Atlantic bluefin tuna in the Mediterranean. Eastern Atlantic bluefin tuna are caught faster than they can reproduce.

Which statement describes the most likely effect that overfishing will have on this ecosystem?

F Overfishing makes the ecosystem more stable by increasing competition for limited resources.

G Overfishing decreases the stability of the ecosystem by disrupting food chains.

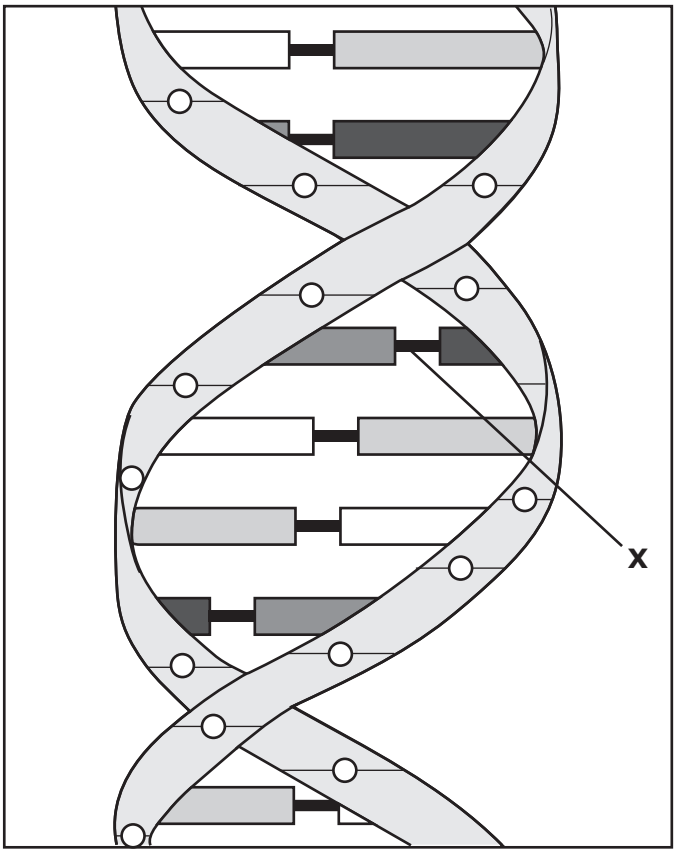
H Overfishing has no effect on ecosystem's stability because it affects one species out of many.

J Overfishing increases ecosystem stability by allowing prey populations to overproduce.

GO ON

11 A segment of DNA is shown in the diagram.

DNA Segment



Which of these identifies the part of the DNA segment labeled X?

A Nucleotide

B Phosphate group

C Hydrogen bond

D Deoxyribose

12 Which statements best compare the function of an ATP molecule to a DNA molecule?

F ATP carries and transmits the genetic information of organisms.
DNA serves as a biological catalyst that speeds up the rate of chemical reactions.

G ATP provides energy for chemical reactions in the cell.
DNA carries and transmits the genetic information of organisms.

H ATP serves as a biological catalyst that speeds up the rate of chemical reactions.
DNA acts as a structural sugar in the cell walls of plants.

J ATP acts as a structural sugar in the cell walls of plants.
DNA provides energy for chemical reactions in the cell.

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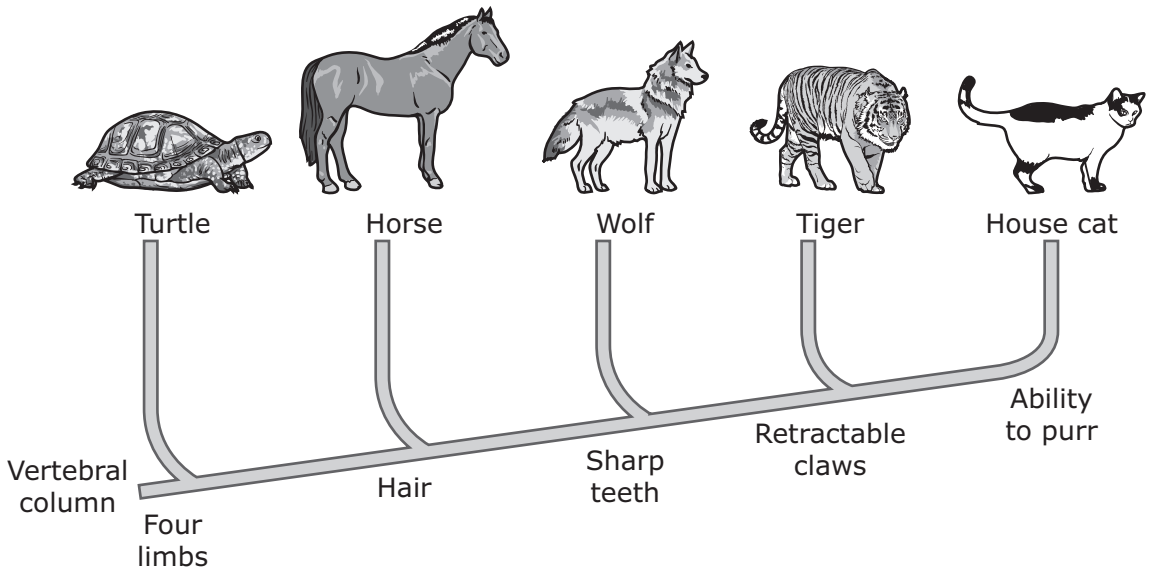
13 A cladogram of five species is shown.



Based on the cladogram, the ancestral species most likely had —

A a vertebral column

B a vertebral column and hair

C sharp teeth and retractable claws

D the ability to purr

GO ON

14 Students created note cards comparing characteristics of eukaryotic and prokaryotic cells. Which set of note cards most accurately compares these cells?

F

Eukaryotic Cells	Prokaryotic Cells
• Membrane-bound nucleus or organelles • DNA chromosomes in the nucleus	• No nucleus or other membrane-bound organelles • DNA chromosome in the cytoplasm

G

Eukaryotic Cells	Prokaryotic Cells
• Membrane-bound nucleus or organelles • DNA chromosomes in the cytoplasm	• No nucleus or other membrane-bound organelles • DNA chromosome in the cytoplasm

H

Eukaryotic Cells	Prokaryotic Cells
• No membrane-bound nucleus or organelles • DNA chromosomes in the cytoplasm	• Membrane-bound nucleus or organelles • DNA chromosome in the nucleus

J

Eukaryotic Cells	Prokaryotic Cells
• No membrane-bound nucleus or organelles • DNA chromosomes in the nucleus	• Membrane-bound nucleus or organelles • DNA chromosome in the nucleus

15 The Mexican long-nosed bat roosts in Big Bend National Park in West Texas. The bat feeds on nectar and pollen and hovers while it feeds. Additionally, its tongue can extend up to eight centimeters.

The features of Mexican long-nosed bats are evidence of natural selection because the features are adaptations that —

A lead to an increase in predation by other species of animals

B show that most DNA mutations are necessary and advantageous but do not increase survival or reproductive success

C help individuals outcompete other individuals for food resources to increase survival and reproductive success

D are the result of intentional breeding

---

16 Which statement describes the process of osmosis in an animal cell?

F Sugar molecules move across the plasma membrane until the cell has enough energy to grow in size and divide.

G Water molecules move across the plasma membrane until solute concentrations are equal on both sides of the membrane.

H Ions move across the plasma membrane until the inside of the cell has a higher concentration of positive charges.

J Enzymes move across the plasma membrane until the cell has completed metabolism.

---

17 Sand dunes along the coast are formed of bare sand. Eventually, grasses take root on the dunes. Over time, larger plants such as shrubs and trees are able to grow at the edge of the sand dune ecosystem.

This gradual change in plant communities of a sand dune ecosystem can result in —

A reduced symbiotic relationships between producers and bacteria

B reduced energy absorption by consumers

C greater erosion rates

D greater species diversity

18 A researcher determines an organism to be eukaryotic, unicellular, and autotrophic. In which taxonomic group should this organism be classified?

F Bacteria

G Protista

H Archaea

J Animalia

---

19 For an enzyme to be able to catalyze a reaction, the active site must —

A be occupied by an inhibitor

B increase the activation energy level

C have a complementary shape to the substrate

D cause the enzyme to be destroyed in the reaction

---

20 Snowshoe hares can be found living in the Rocky Mountains of New Mexico. During the summer months, when there is no snow on the ground, the snowshoe hare's coat color is typically brown. During the winter months, when the mountains are covered in snow, the snowshoe hare's coat is typically white.

Which statement describes the genetic basis for the seasonal changes in coat color?

F The snow causes mutations in the genes that regulate coat color so that snowshoe hares are adapted to their environment during the winter months.

G The genes that control coat color are regulated by hormone signals that are altered by changes in environmental factors.

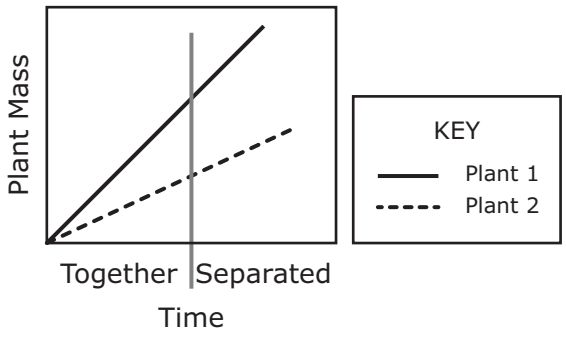
H Sunlight causes cancer cells to develop in the bodies of snowshoe hares, resulting in an apparent brown-colored coat as a result of hair loss.

J The genes that control coat color in snowshoe hares are deleted from the genome during the summer months.

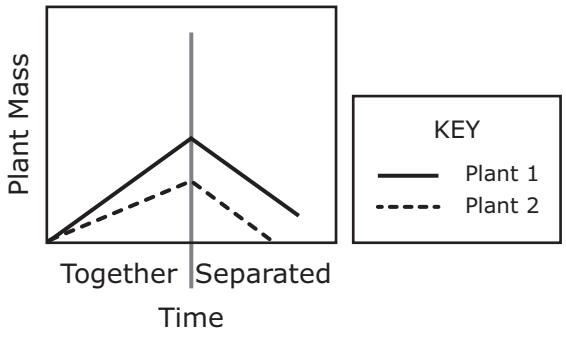
21 In an experiment, two plants are grown together for a time and then separated. Plant 2 is a parasite of Plant 1.

Which graph best predicts the growth of Plant 1 and Plant 2 during the experiment?

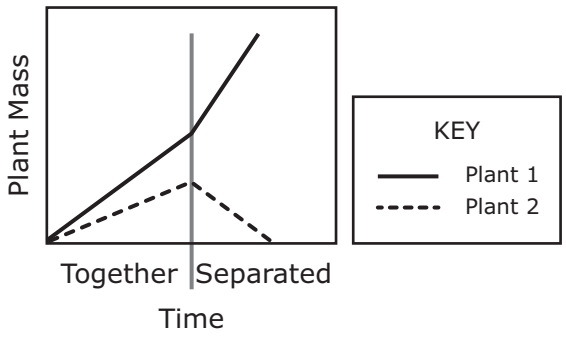
A



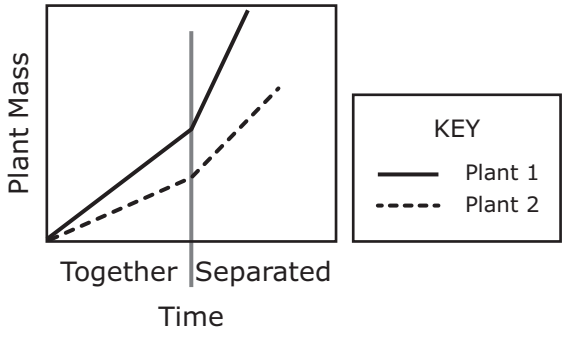
B



C



D



GO ON

22 When multiple transitional fossils are found in many rock layers, they provide evidence of —

F seasonal variation in the diet of a species

G gradual change of a species over time

H DNA functioning as the genetic material of organisms

J an unchanging environment

---

23 Environmental factors typically activate genes in a cell by causing the cell to —

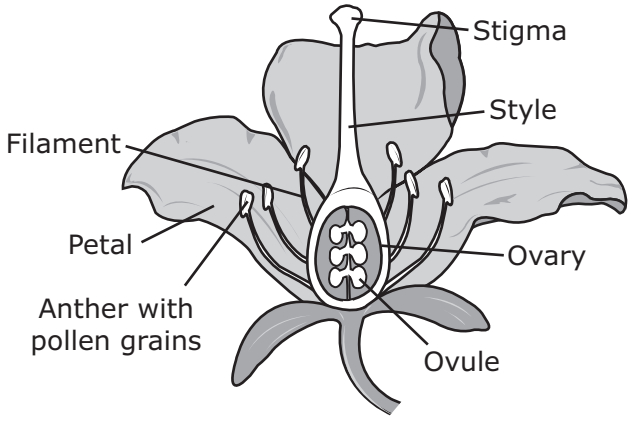
A produce identical daughter cells through mitosis

B form haploid gamete cells through meiosis

C fuse with another cell to increase the size of its genome

D transcribe specific DNA segments to mRNA for translation

24 A flower that has both male and female reproductive structures is shown.



Which statement best describes an interaction that will allow a flowering plant to reproduce by self-pollination?

F An anther is transferred from a filament to another filament within the same flower.

G An ovule is transferred from the ovary to a petal on a different flower.

H A pollen grain is transferred from an anther to the stigma of the same flower.

J An ovary is transferred from a flower on one plant to a flower on a different plant.

---

25 A genetic cross involving two unlinked genes is represented.

AaGG x aaGg

Which genotype is NOT possible in the offspring produced by the cross?

A AaGG

B Aagg

C aaGg

D aaGG

26 Breaking down food for nutrients involves many body systems. A student made a partial list of the processes that occur.

- Salivary enzymes begin to break down starch molecules in food.
- Gastrointestinal enzymes are released in response to a hormone signal.
- Nutrients are absorbed into the bloodstream from the small intestine.

Which body systems interact most directly in the three listed processes?

F Digestive
Integumentary
Muscular

G Excretory
Immune
Muscular

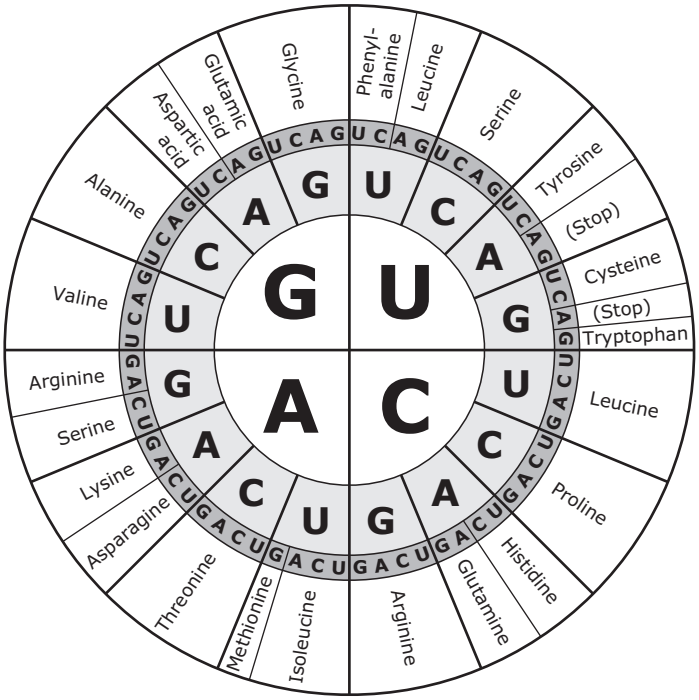
H Circulatory
Excretory
Immune

J Circulatory
Digestive
Endocrine

27 A partial DNA segment and an mRNA codon chart are shown.

3′ T C A T G C A T G 5′

mRNA Codon Chart



What amino acid sequence is encoded in the partial DNA segment?

A Serine – Threonine – Tyrosine

B Serine – Serine – Tyrosine

C Serine – Threonine – Methionine

D Serine – Alanine – Methionine

GO ON

28 A farmer is struggling to control the population of a certain insect on his farm. After researching population control techniques, he discovers that a particular bird is a predator of this insect. The farmer purchases a number of these birds and releases them onto his farm.

How might the farmer's action most likely have a negative impact on the ecosystem?

F The birds will increase biodiversity of native plant species.

G The birds will pollinate native species, increasing genetic variation.

H The birds will consume beneficial insects, as well as the pest species.

J The birds will mate with native birds and create a new species.

29 Students examine images of a certain species of bat commonly found in Texas. Using the bat dichotomous key, they conclude that the bat species is a Mexican free-tailed bat due to its large, round ears.

Bat Dichotomous Key

1a	Solitary bat	Go to 2
1b	Colonial bat	Go to 3
2a	>35-cm wingspan	Hoary bat
2b	<35-cm wingspan	Go to 4
3a	>35-cm wingspan	Big brown bat
3b	<35-cm wingspan	Go to 5
4a	Reddish brown colored fur	Seminole bat
4b	Light colored fur	Eastern red bat
5a	Large, round ears	Mexican free-tailed bat
5b	Short, pointy ears	Cave myotis bat

Based on the dichotomous key, in addition to the shape of the bat's ears, which other set of features should the students look for to confirm the identity of the bat?

A Solitary with a wingspan greater than 35 cm

B Solitary with a wingspan less than 35 cm

C Colonial with a wingspan greater than 35 cm

D Colonial with a wingspan less than 35 cm

30 Materials are provided to students to build models of a prokaryotic cell, a eukaryotic cell, and a virus. The materials and the structures they represent are listed in the table shown.

Material	Structure Represented
Gray paper hexagon	Capsid
Yellow paper oval	Cytoplasm
Purple buttons	Ribosomes
Blue yarn	Genetic material
Orange paper circle	Nucleus

Which material will students use in all three models?

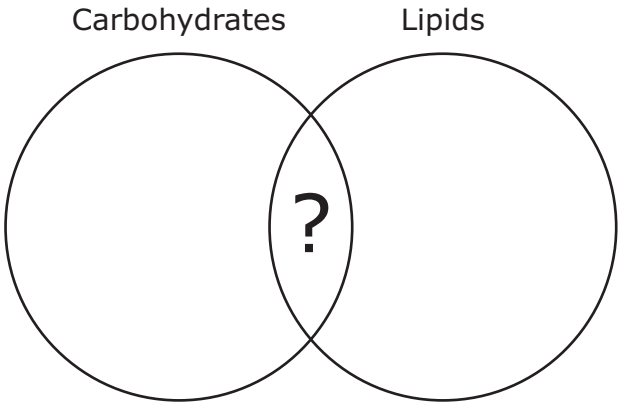
F Yellow paper oval

G Gray paper hexagon

H Blue yarn

J Purple buttons

31 A student makes a Venn diagram to compare the functions of carbohydrates and lipids.



Which cellular function of carbohydrates and lipids should be placed in the shared section of the Venn diagram?

A Hormone production

B Structural support of cell walls

C Energy storage

D Catalyst for chemical reactions

---

32 Which statement is an example of how carbon moves through a food chain as part of the carbon cycle?

F Producers release carbon dioxide, and consumers take it in.

G Producers take in carbon dioxide, and consumers release it.

H Producers take in carbon from the soil, and they release it when they decompose.

J Producers release carbon into the soil, and consumers take it in from the soil.

33 Which table correctly identifies how the plasma membrane contributes to the maintenance of cellular homeostasis?

A

Function	Yes	No
Controls materials that enter and exit the cell	X	
Converts ATP to glucose for energy storage		X
Catalyzes protein synthesis		X
Receives signals for DNA replication		X

B

Function	Yes	No
Controls materials that enter and exit the cell		X
Converts ATP to glucose for energy storage		X
Catalyzes protein synthesis	X	
Receives signals for DNA replication		X

C

Function	Yes	No
Controls materials that enter and exit the cell		X
Converts ATP to glucose for energy storage	X	
Catalyzes protein synthesis		X
Receives signals for DNA replication	X	

D

Function	Yes	No
Controls materials that enter and exit the cell		X
Converts ATP to glucose for energy storage		X
Catalyzes protein synthesis	X	
Receives signals for DNA replication	X	

34 In Texas Longhorn cattle, coat coloration is an inherited trait. What is the genetic basis of coat-color variation in Texas Longhorn cattle?

F Differences in the nucleotide sequences of genes

G Differences in the numbers of chromosomes in cells

H Differences in the diets of individual cattle

J Differences in the environmental conditions of different geographic areas

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35 The taxonomic classifications of four species of amphibians are shown.

	Northern Cricket Frog	Northern Leopard Frog	Green Treefrog	Bullfrog
Order	Anura	Anura	Anura	Anura
Family	Hylidae	Ranidae	Hylidae	Ranidae
Genus	*Acris*	*Lithobates*	*Hyla*	*Lithobates*
Species	*crepitans*	*pipiens*	*cinerea*	*catesbeianus*

Based on the information provided, which two species are most closely related?

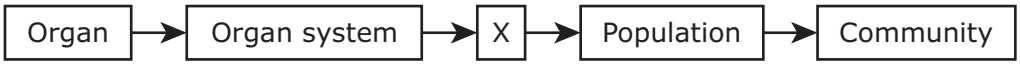
A Northern cricket frog and bullfrog

B Northern leopard frog and green treefrog

C Northern cricket frog and green treefrog

D Northern leopard frog and bullfrog

36 Students construct a graphic organizer to illustrate the different levels of biological organization.



Which term does the letter X represent in the graphic organizer?

F Cell

G Organism

H Ecosystem

J Biosphere

---

37 When a new mutation occurs in a somatic cell of a sexually reproducing organism, what percentage of the individual's offspring are likely to inherit the mutation?

A 100%

B 75%

C 25%

D 0%

38 Researchers have observed striped hyenas and gray wolves hunting together in certain areas. One hypothesis suggests that changing hunting behavior aids both species in obtaining better and more resources. In this hypothesis the hyenas benefit because the wolves chase and take down large animals, such as goats, that the hyenas usually cannot catch alone. The wolves benefit from hyenas using their jaw strength to crack open large bones of prey to access additional nutrients from bone marrow.

Which table best identifies the ecological relationships among the gray wolf, hyena, and goats?

F

Organisms Involved	Relationship
Hyenas and gray wolves	Predator-prey
Gray wolves and goats	Commensalism

G

Organisms Involved	Relationship
Hyenas and gray wolves	Mutualism
Gray wolves and goats	Predator-prey

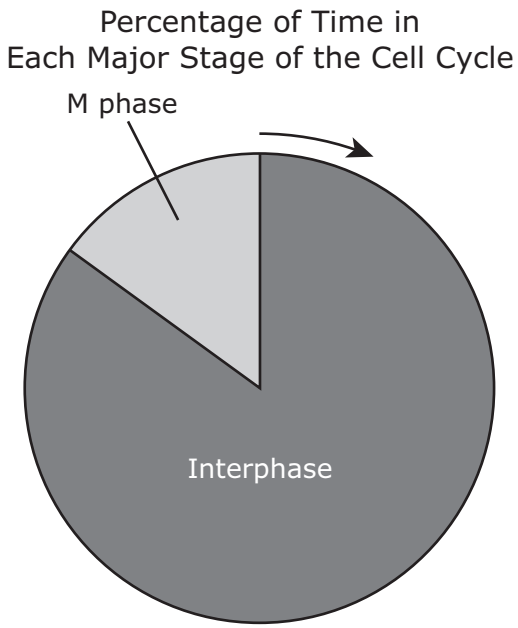
H

Organisms Involved	Relationship
Hyenas and gray wolves	Parasitism
Gray wolves and goats	Mutualism

J

Organisms Involved	Relationship
Hyenas and gray wolves	Commensalism
Gray wolves and goats	Parasitism

39 The diagram shows the major stages of the cell cycle and the percentage of time spent in each phase.



Which statement best describes why a cell spends the majority of its time in interphase?

A The cell is growing and carrying out processes such as metabolism and DNA replication.

B The cell is aging and processes are stopping as lysosomes clear dead cell matter away.

C The cell needs time to synthesize spindle fibers to complete mitosis.

D The cell needs time to complete cytokinesis.

---

40 The giant octopus lays 20,000 to 100,000 fertilized eggs. After hatching, most octopuses become prey to larger marine organisms, and less than 5% will reach adulthood to reproduce.

One benefit of the giant octopus laying many eggs is to —

F increase the average body size for surviving individuals to avoid predation

G decrease competition between different octopus species to maintain resources in the population

H increase the chance that more individuals will survive to maintain the population

J decrease the likelihood of offspring being consumed by predators

41 Some angelfish colors are determined by codominance. Possible phenotypes and genotypes of angelfish colors are shown.

Phenotype	Genotype
 Silver	LL
 Black	BB
 Black lace	BL

Which table shows the expected phenotypes of offspring resulting from a cross between a black angelfish and a black-lace angelfish?

A

Phenotype	Silver	Black	Black Lace
Phenotypic probability of offspring	—	50%	50%

B

Phenotype	Silver	Black	Black Lace
Phenotypic probability of offspring	50%	50%	—

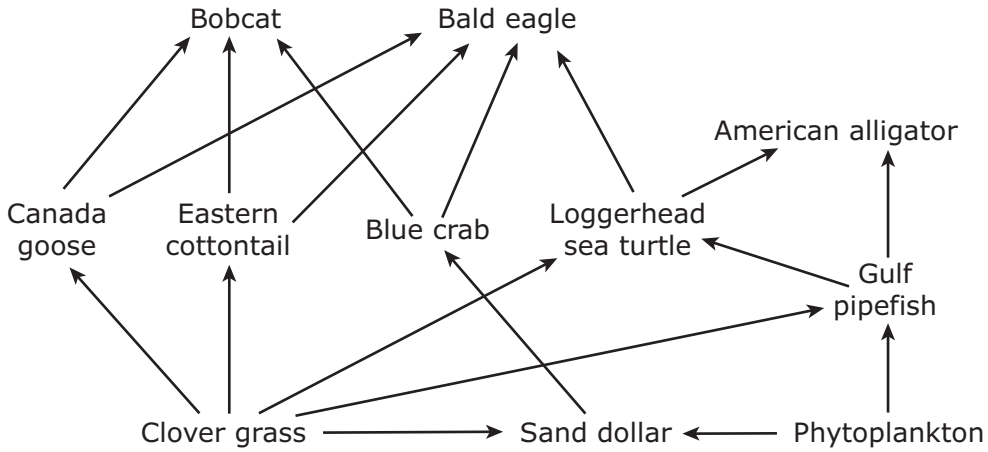
C

Phenotype	Silver	Black	Black Lace
Phenotypic probability of offspring	25%	25%	50%

D

Phenotype	Silver	Black	Black Lace
Phenotypic probability of offspring	25%	50%	25%

42 A food web representing a Gulf Coast ecosystem is shown.



Based on this food web, which organism occupies multiple trophic levels?

F Canada goose

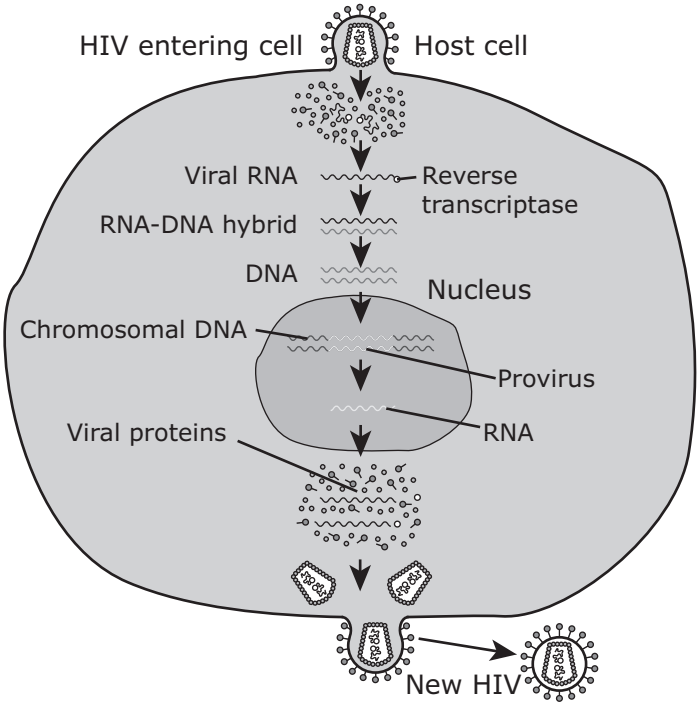
G Eastern cottontail

H Loggerhead sea turtle

J Sand dollar

GO ON

43 A diagram of an HIV infection is shown.



Which conclusion about the HIV infection of a host cell is best supported by the diagram?

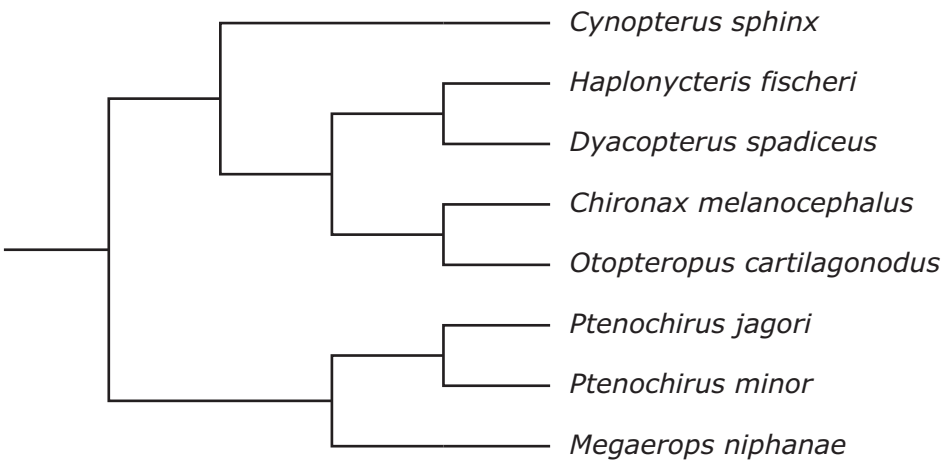
A It takes place outside of living cells.

B It relies on the host cell to reproduce.

C It involves the process of meiosis.

D It requires carbon dioxide.

44 Researchers analyzed a mitochondrial gene of different bat species to determine relatedness. A cladogram of their results is shown.



Based on the cladogram, which set of bat species is the least related?

F *Ptenochirus minor and Megaerops niphanae*

G *Dyacopterus spadiceus and Otopteropus cartilagonodus*

H *Haplonycteris fischeri and Ptenochirus jagori*

J *Cynopterus sphinx and Chironax melanocephalus*

---

45 Which statement best describes how bacteria recycle matter in an ecosystem?

A Bacteria are producers that create energy for second-order consumers.

B Bacteria produce toxins to prevent the growth of invasive species.

C Bacteria cause diseases that limit the reproduction of organisms in a population.

D Bacteria are decomposers that help to transfer organic material to the soil.

46 Students set up a controlled experiment by growing the same type of seedlings in two different locations. After a period of time, the students observed the seedlings and recorded their observations in the table shown.

	Group #1	Group #2
Growth Location	Enclosed in a box with a lamp on top of seedlings	On the windowsill
Observation	Shoots grow straight and upright	Shoots bend in the direction of the window

What caused the shoots of the seedlings on the windowsill to bend toward the window?

F Hormones produced in response to a light stimulus

G Sugars produced in response to a gravity stimulus

H Carbon dioxide produced in response to a water stimulus

J Water produced in response to a nitrogen stimulus

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47 An illness caused by a certain virus includes fever, rash, joint pain, red eyes, and headache. The virus is transmitted to people by infected mosquitoes. Symptoms quickly occur within three to twelve days after contracting the virus. There is no vaccine for this virus.

Which description best explains the reproductive cycle of this virus?

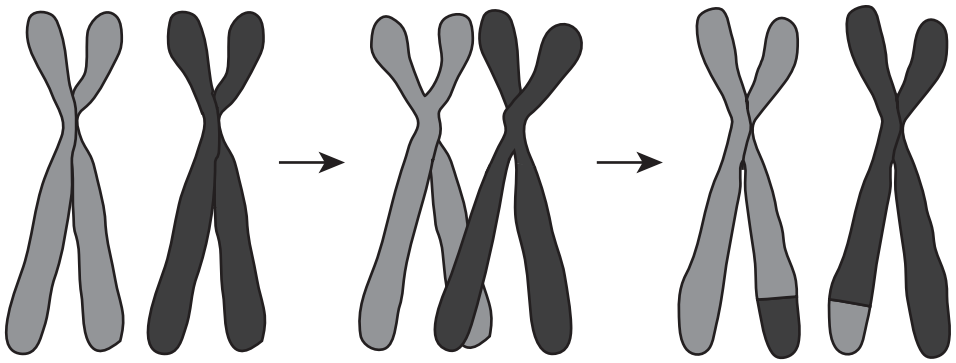
A Lytic, because the virus is transmitted by mosquitoes

B Lysogenic, because there is no way to vaccinate against it

C Lytic, because of the quick incubation time

D Lysogenic, because the virus causes a fever

48 A cellular process is shown.



Which statement best describes the significance of this process?

F The process allows organisms to grow and heal.

G The process produces clones of the parent organism.

H The process copies DNA before cell division.

J The process creates genetic variation in the resulting cells.

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49 Which statement best describes an interaction between the muscular system and the respiratory system?

A The hormone adrenaline causes blood vessels to contract and send more blood to major muscles.

B Metabolic wastes generated by muscle cells are eliminated in urine.

C The diaphragm contracts causing the chest cavity to expand, which draws air into the lungs.

D Nutrients absorbed in the small intestine are transported in blood to the brain.

50 Two scientists want to compare their research of fireflies. Which information must the two scientists provide to each other to determine if they studied the same type of fireflies?

F Size of the firefly populations

G Type of habitat in which the fireflies live

H Color of light produced by the fireflies

J Species name of the fireflies studied

BE SURE YOU HAVE RECORDED ALL OF YOUR ANSWERS ON THE ANSWER DOCUMENT.

STAAR
Biology
May 2021