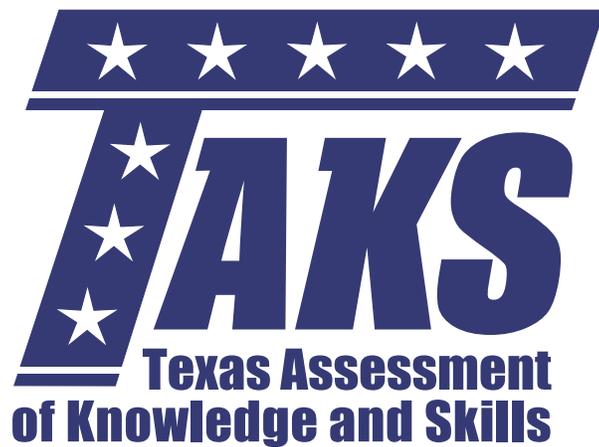


STUDENT NAME _____



**EXIT LEVEL
SCIENCE**

Administered April 2009

SCIENCE

FORMULA CHART

Density = $\frac{\text{mass}}{\text{volume}}$	$D = \frac{m}{v}$
$\left(\begin{array}{c} \text{heat gained} \\ \text{or lost} \end{array} \right) = \left(\text{mass} \right) \left(\begin{array}{c} \text{change in} \\ \text{temperature} \end{array} \right) \left(\begin{array}{c} \text{specific} \\ \text{heat} \end{array} \right)$	$Q = (m)(\Delta T)(C_p)$
Speed = $\frac{\text{distance traveled}}{\text{time}}$	$v = \frac{d}{t}$
Acceleration = $\frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$	$a = \frac{v_f - v_i}{\Delta t}$
Momentum = mass \times velocity	$p = mv$
Force = mass \times acceleration	$F = ma$
Work = force \times distance	$W = Fd$
Power = $\frac{\text{work}}{\text{time}}$	$P = \frac{W}{t}$
% efficiency = $\frac{\text{work output}}{\text{work input}} \times 100$	$\% = \frac{W_o}{W_i} \times 100$
Kinetic energy = $\frac{1}{2} (\text{mass} \times \text{velocity}^2)$	$KE = \frac{mv^2}{2}$
Gravitational potential energy = mass \times acceleration due to gravity \times height	$PE = mgh$
Energy = mass \times (speed of light) ²	$E = mc^2$
Velocity of a wave = frequency \times wavelength	$v = f\lambda$
Current = $\frac{\text{voltage}}{\text{resistance}}$	$I = \frac{V}{R}$
Electrical power = voltage \times current	$P = VI$
Electrical energy = power \times time	$E = Pt$

Constants/Conversions		
$g = \text{acceleration due to gravity} = 9.8 \text{ m/s}^2$		
$c = \text{speed of light} = 3 \times 10^8 \text{ m/s}$		
speed of sound = 343 m/s at sea level and 20°C		
$1 \text{ cm}^3 = 1 \text{ mL}$		
1 wave cycle/second = 1 hertz (Hz)		
1 calorie (cal) = 4.18 joules		
1000 calories (cal) = 1 Calorie (Cal) = 1 kilocalorie (kcal)		
newton (N) = kgm/s^2		
joule (J) = Nm		
watt (W) = J/s = Nm/s		
volt (V)	ampere (A)	ohm (Ω)

DIRECTIONS

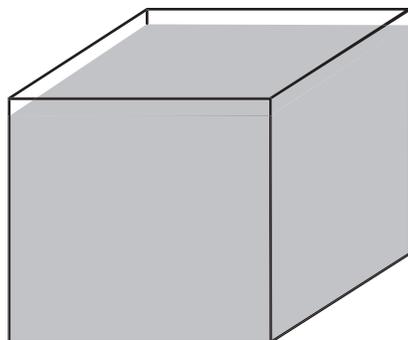
Read each question and choose the best answer. Then fill in the correct answer on your answer document.

SAMPLE A

When a 10% hydrochloric acid solution is heated in an open test tube, the test tube should always be pointed —

- A** so bubbles are visible
- B** at a 180° angle from the flame
- C** toward a ventilated area
- D** away from nearby people

SAMPLE B



Mass = 40 g

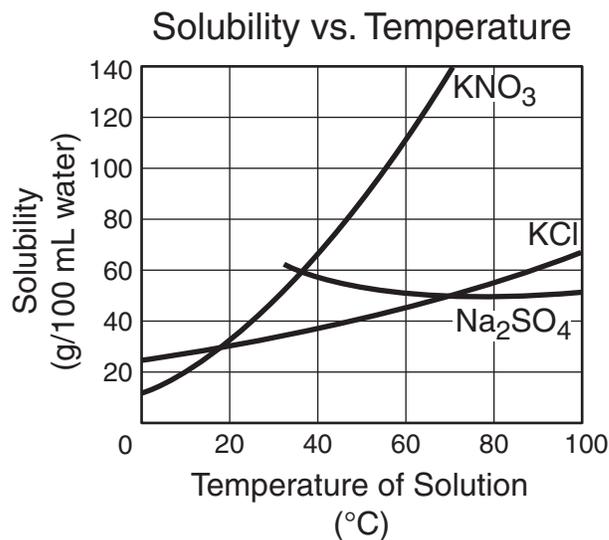
Volume = 20 mL

The picture shows a cube that contains 20 mL of a solution. The solution has a mass of 40 grams. What is the density in g/mL of this solution? Record and bubble in your answer on the answer document.

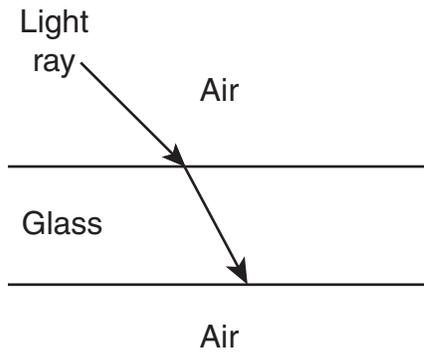


- 1 Which system in a fish allows maximum oxygen intake through contact between the fish and its environment?
- A Respiratory system
 - B Endocrine system
 - C Reproductive system
 - D Excretory system

- 2 Which of the following describes a disadvantage of using solar cells as an energy source?
- F Solar cells generate large quantities of waste.
 - G Solar cells can be used to charge batteries.
 - H Solar cells release gaseous by-products.
 - J Solar cells are dependent on available sunlight.



- 3 Which of the following describes a trend in the data shown in the graph above?
- A The solubility of all the salts increases as temperature increases.
 - B As temperature increases from 30°C to 60°C, the solubility of KNO₃ increases more than that of KCl.
 - C An increase in atmospheric pressure causes an increase in the solubility of KCl.
 - D Increasing the temperature of a KNO₃ solution from 30°C to 60°C decreases the solubility of KNO₃ by half.



- 4 The diagram shows light being refracted. Which tool should be used to measure the angle at which the light is bending?
- F Ruler
 - G Compass
 - H Protractor
 - J Thermometer

- 5 Some plants have a hard waxy coating on their leaves that helps prevent water loss. In which environment do these plants most likely grow?
- A Desert
 - B Marine
 - C Grassland
 - D Rain forest

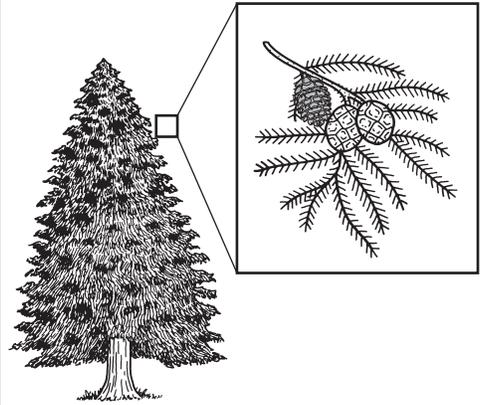
mRNA Codons and Corresponding Amino Acids

		Codon		Amino acid						
First Base	U	UUU	} Phenylalanine	UCU	} Serine	UAU	} Tyrosine	UGU	} Cysteine	U
	UUC	UCC		UAC		UGC		C		
	UUA	UCA	UAA	} STOP		UGA	} STOP	A		
	UUG	UCG	UAG			UGG		} Tryptophan	G	
C	CUU	} Leucine	CCU	} Proline	CAU	} Histidine	CGU	} Arginine	U	
CUC	CCC		CAC		CGC		C			
CUA	CCA		CAA		} Glutamine	CGA	A			
CUG	CCG		CAG			CGG	G			
A	AUU	} Isoleucine	ACU	} Threonine	AAU	} Asparagine	AGU	} Serine	U	
AUC	ACC		AAC		AGC		C			
AUA	ACA		AAA		} Arginine	AGA	A			
AUG	ACG	AAG	AGG			} Arginine	G			
G	GUU	} Valine	GCU	} Alanine	GAU	} Aspartic acid	GGU	} Glycine	U	
GUC	GCC		GAC		GGC		C			
GUA	GCA		GAA		} Glutamic acid	GGA	A			
GUG	GCG		GAG			GGG	G			
		U	C	A	G					
		Second Base								

- 6 A mutation has occurred in an mRNA fragment that was originally CUU. Which of the following mutated mRNA fragments would result in an amino acid sequence different from that produced by the CUU fragment?

- F CUC
- G CUA
- H CUG
- J CAU

Plant Group	Characteristics
Bryophytes	Contain no xylem and phloem; reproduce by spores and gametes
Psilophytes	Contain xylem and phloem; no difference between root and stem
Gymnosperms	Have naked seeds located on the cones
Angiosperms	Have enclosed seeds located in a fruit



7 In which plant group does this plant belong?

- A Bryophytes
- B Psilophytes
- C Gymnosperms
- D Angiosperms

8 An athlete sitting in a wheelchair at rest throws a basketball forward. Since the athlete and the wheelchair have greater mass than the basketball has, the athlete and the wheelchair will —

- F move backward at a lower speed than the basketball moves forward
- G travel the same distance as the basketball but in the opposite direction
- H move backward at a higher speed than the basketball moves forward
- J have the same forward momentum as the basketball

- 9** A group of researchers discovered the fossilized remains of a flying mammal that appears to have lived 130 million to 165 million years ago. Since the earliest flying birds are believed to have appeared about 150 million years ago, researchers concluded that birds and mammals began to fly at about the same time. This conclusion would be most weakened by evidence of which of the following?
- A** A 100-million-year-old fossil of a flying bird
 - B** A 120-million-year-old fossil of a flying bird
 - C** A 160-million-year-old fossil of a flying mammal
 - D** A 200-million-year-old fossil of a flying mammal

-
- 10** A sample liquid is cooled from 150°C to 30°C , causing the liquid to change into a solid. Which of the following has occurred?
- F** Chemical composition has changed.
 - G** A physical change has occurred.
 - H** A new compound has formed.
 - J** Evaporation of a solvent has occurred.

- 11** A student uses a hot plate, a thermometer, and a stopwatch to investigate the rate at which a metal object conducts heat. To ensure the most reliable results, which of the following should the student do?
- A** Perform a second investigation using different tools
 - B** Use several thermometers to measure temperature
 - C** Develop a hypothesis before starting the investigation
 - D** Repeat the entire investigation several times

Symptoms of Four Patients

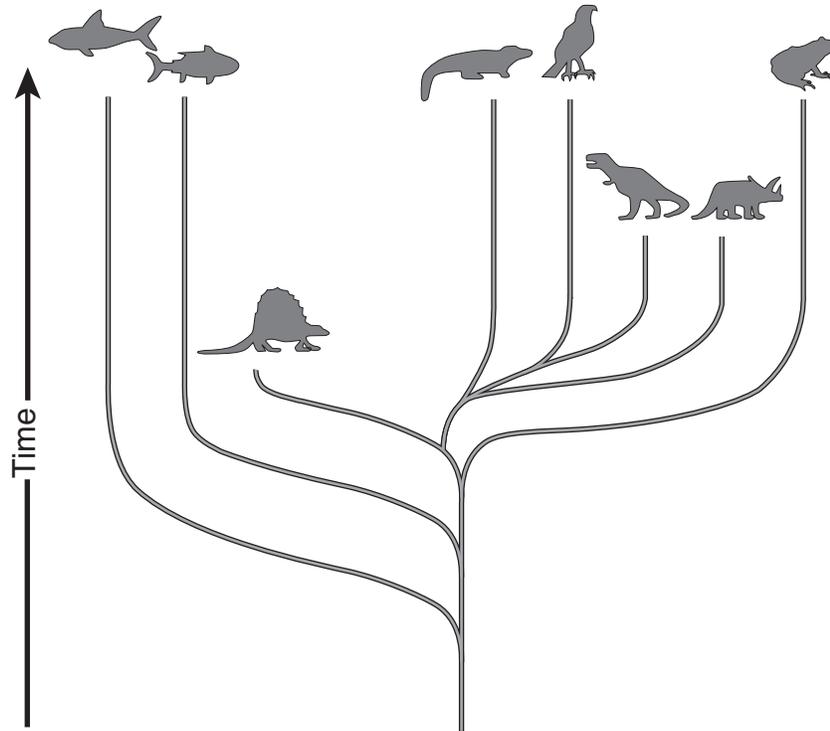
Patient	Symptom
1	Decrease in urine output
2	Decrease in metabolic rate
3	Decrease in muscle strength
4	Decrease in blood pressure

- 12** The table above shows symptoms experienced by four patients. Which of these patients most likely has a problem with the excretory system?
- F** Patient 1
 - G** Patient 2
 - H** Patient 3
 - J** Patient 4

- 13** A solution having an equal number of H^+ ions and OH^- ions will have a pH of —

- A** 3
- B** 7
- C** 9
- D** 11

Tree of Some Evolutionary Relationships



- 14 Which information would best help scientists verify the relationships among the organisms shown above?
- F The organisms' nutritional requirements
 - G The organisms' DNA sequences
 - H The organisms' migratory patterns
 - J The organisms' population sizes

- 15** A circle graph would best help a student communicate a conclusion about an investigation involving —
- A** the proportions by mass of three metals in an alloy
 - B** the amounts of heat released by three chemical reactions
 - C** the amounts of force required to accelerate three different masses
 - D** the electrical conductivity of three salt solutions

Parthenogenesis: a type of asexual reproduction in which an organism is produced from an unfertilized egg

- 16** A female spring peeper frog produces 200 eggs through parthenogenesis. If all the eggs hatch, they will produce —
- F** 50 females and 150 males
 - G** 100 females and 100 males
 - H** 150 females and 50 males
 - J** 200 females and 0 males

Use the information below and your knowledge of science to answer questions 17–20.

Fireworks

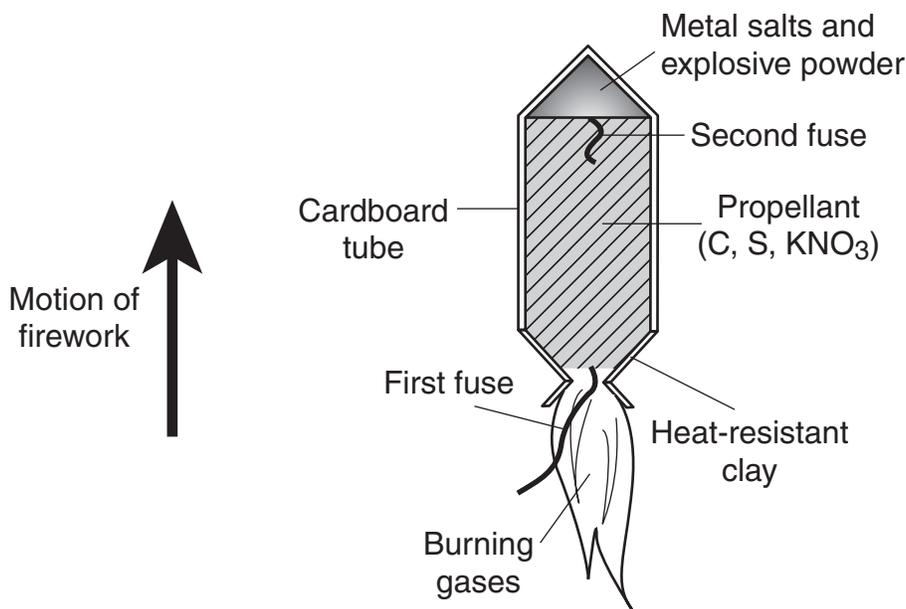
Fireworks displays are often associated with celebrations. Some fireworks are rockets that can be fired into the air, producing colorful patterns of bright light. One rocket design involves a cardboard tube, a propellant, and a fuse. A cap on the tube contains metal salts and explosive powder with a second fuse. The propellant consists of a mixture of carbon (C), sulfur (S), and potassium nitrate (KNO_3). Potassium nitrate is a potassium ion (K^+) bonded to a nitrate ion (NO_3^-).

A long cardboard tube is filled with the propellant. When a lit fuse ignites the propellant, the propellant releases oxygen, produces flames, and forces gas out the bottom of the rocket. These actions cause the rocket to rise high into the air.

As the rocket reaches its maximum height, a second fuse ignites an explosion that heats and burns the metal salts. This heating and burning of metal salts produces large colorful flashes. Many people enjoy watching these colorful displays against the night sky.

The use of fireworks can be dangerous. Professionals who use fireworks take many safety precautions while setting up and igniting the displays.

Firework Rocket Design



- 17 Which of the following information would allow the most direct calculation of the average speed of the rocket on its upward flight?
- A Thrust force and wind speed
 - B Maximum height and the time it takes the rocket to reach it
 - C Rocket mass and the time it takes the rocket to reach the highest point
 - D Thrust force and the time it takes the rocket to fall to the ground

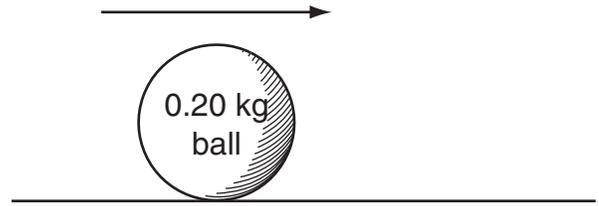
- 18 As a rocket rises, its kinetic energy changes. At the time the rocket reaches its highest point, most of the kinetic energy of the rocket has been —
- F permanently destroyed
 - G transformed into potential energy
 - H converted to friction
 - J stored in bonds between its atoms

- 19 When the fuse ignites the contents of a firework, oxygen is consumed as a result of which type of change?
- A Mass
 - B Phase
 - C Nuclear
 - D Chemical

- 20 A scientist hypothesizes that the use of a propellant other than the traditional mixture of C, S, and KNO_3 will cause a rocket to rise higher into the air. The researcher builds a rocket that uses an alternate propellant. A proper control for the experiment would be an identical rocket that uses —
- F the traditional propellant
 - G the alternate propellant
 - H no propellants
 - J a mixture of both propellants

21 Which of the following properties causes attraction between molecules of liquid water?

- A Acidity
- B Polarity
- C Density
- D Viscosity



22 The ball in the diagram is moving at a speed of 12 m/s. What is the momentum of the ball in $\text{kg} \cdot \text{m/s}$? Record and bubble in your answer to the tenths place on the answer document.

23 For safety reasons, which of these labels is the most important to have on a reagent bottle?

A

Liquid at Room
Temperature

B

500 mL

C

NaOH
pH = 11.0

D

Prepared on
April 12

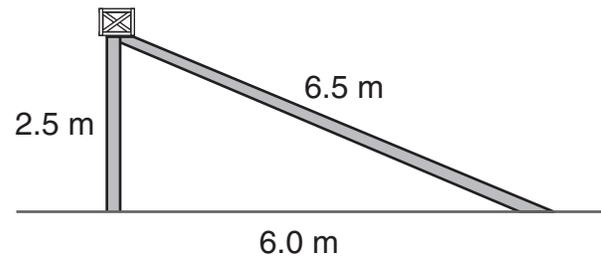
24 Which of the following is a characteristic of most bacterial infections but not of a viral infection?

F It can cause multiple symptoms.

G It can affect different people differently.

H It can be spread by inhalation.

J It can be treated with an antibiotic.



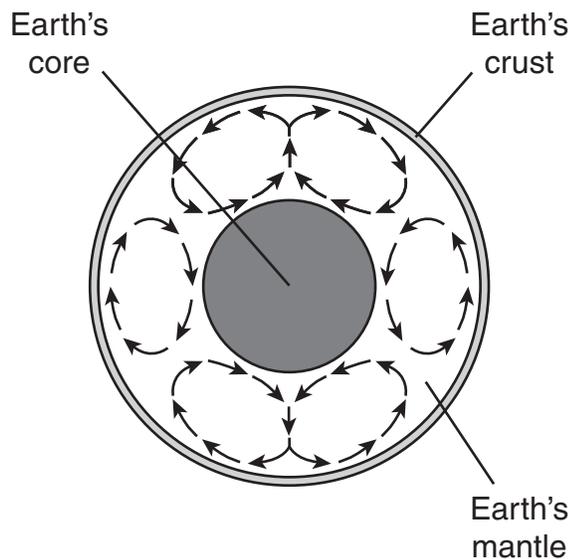
25 A person uses a force of 600 N to lift a box from the ground to the top of the ramp shown. Another worker uses a force of 300 N to push the same box up the complete length of the ramp. What is the approximate percent efficiency of the ramp?

A 17%

B 23%

C 77%

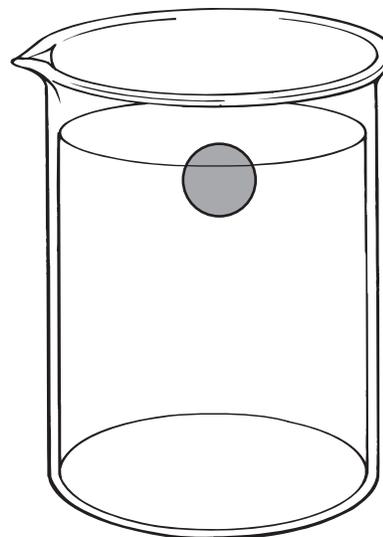
D 83%



26 Molten rock rises in Earth's mantle and then sinks back toward the core in a circular pattern, as shown in the diagram. This method of heat transfer is known as —

- F** conduction
- G** vibration
- H** radiation
- J** convection

Substance	Melting Point (°C)	Density (g/mL)
Q	460	0.72
R	650	1.74
S	81	1.00
T	142	0.94



27 The table shows some properties of four different substances. The picture shows a solid sphere of one of the four substances in a water-ethanol solution ($D = 0.9199 \text{ g/mL}$). The sphere is most likely composed of which substance?

- A** Substance Q
- B** Substance R
- C** Substance S
- D** Substance T

28 A motor produces less mechanical energy than the energy it uses because the motor —

- F** gains some energy through motion
- G** stores some energy as electrons
- H** converts some energy into heat and sound
- J** uses some energy to increase in mass

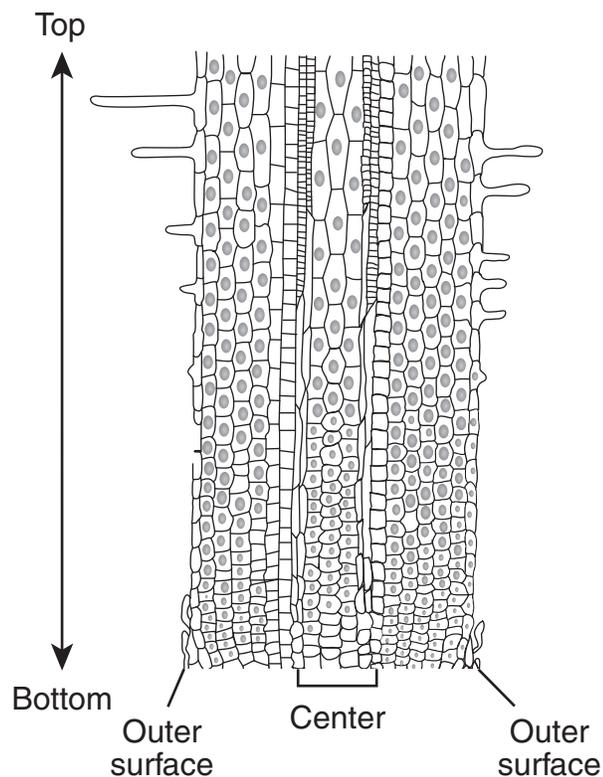
29 Cell membranes perform all the following functions except —

- A** making nutrients for cells
- B** holding cytoplasm within cells
- C** regulating substances exiting cells
- D** recognizing other cells



30 What is the balanced coefficient ratio for the reaction shown above?

- F 3:3:3:2
- G 2:1:2:2
- H 2:3:2:2
- J 1:1:1:1



- 31 The diagram shows a longitudinal section of part of a plant root tip. Which of the following statements best describes a trend that can be observed in this root tip?
- A The cells are generally longer at the top than at the bottom.
 - B The number of nuclei per cell increases toward the bottom of the root.
 - C The cells are shorter the closer they are to the outer surface of the root.
 - D The number of cells per area of the root is generally constant.

32 Which of the following best describes a difference between a mutualistic relationship and a parasitic relationship?

- F Parasitism harms both organisms, while mutualism harms only one organism.
- G Parasitism benefits only one organism, while mutualism benefits both organisms.
- H Parasitism involves only two organisms, while mutualism involves many organisms.
- J Parasitism continues for many generations, while mutualism is limited to one generation.

Diagram 1:
Original Wave

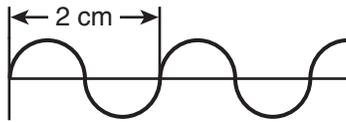
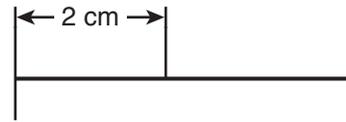
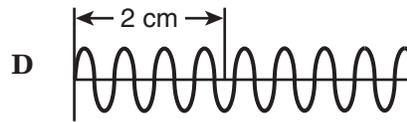
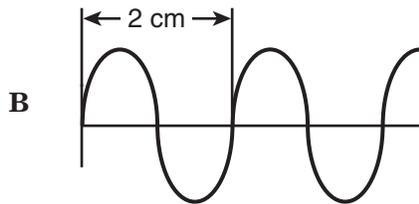
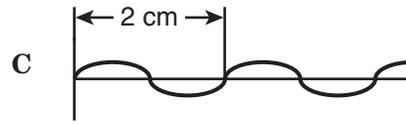
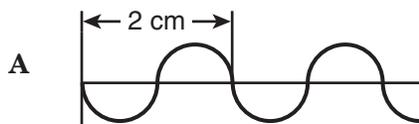


Diagram 2:
Composite Wave



33 Diagram 1 represents a wave. Diagram 2 represents the composite wave formed when a second wave interferes with the original wave. Which of the following best represents the second wave?

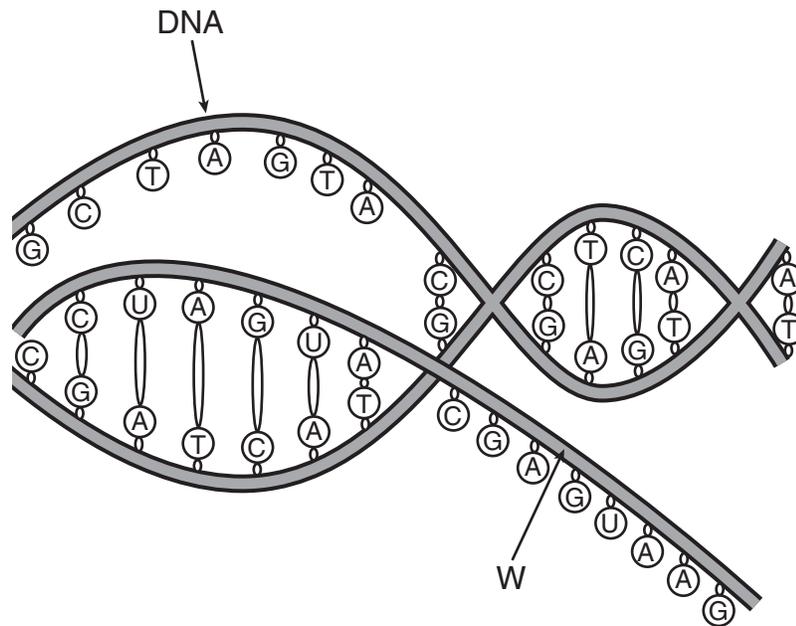


34 Water molecules generally have which effect on a soluble ionic compound mixed into water?

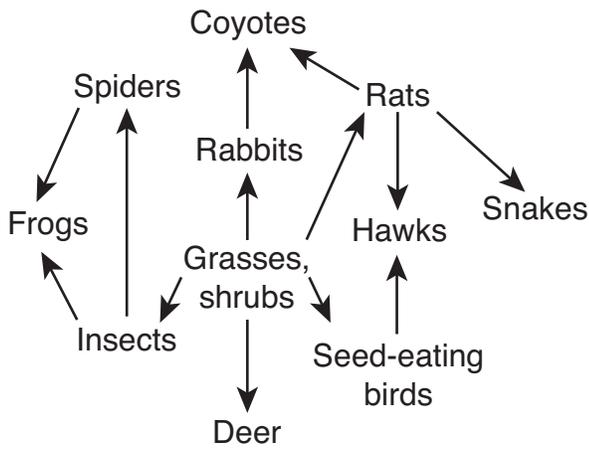
- F** They remove electrons from the compound.
- G** They break the bonds between the ions.
- H** They change the ionic bonds to covalent bonds.
- J** They add protons to the ionic nuclei.

35 A student compares the viscosities of two solutions at room temperature. The student uses a metal block and equal volumes of the two solutions in identical containers. Which procedure would provide the best comparison of the viscosities of the solutions?

- A** Determining whether the block raises or lowers the density of either solution
- B** Determining whether the block raises or lowers the temperature of either solution
- C** Measuring the volume of liquid the block displaces in each solution
- D** Measuring the time it takes the block to sink in each solution



- 36** The illustration shows the transcription process. What is the main purpose of the structure labeled W?
- F** Carrying instructions for protein synthesis
 - G** Transforming into a protein
 - H** Replacing damaged DNA
 - J** Passing traits to offspring

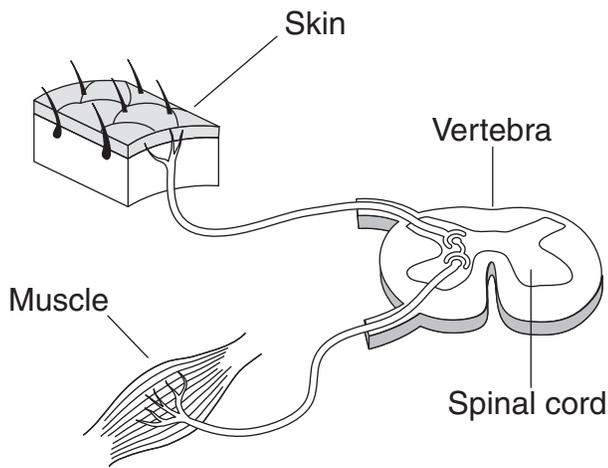


- 37 A food web is shown above. If the rabbit population increases, which of the following is most likely to happen soon afterward?
- A The deer population will increase.
 - B The plant population will decrease.
 - C Different birds will move into the area.
 - D The insect population will be eliminated.

A 100-gram tube of adhesive shoe-patching compound has 40% (by mass) adhesive dissolved in a solvent. When the compound is applied, the solvent evaporates, leaving only the adhesive.

- 38 Half of the tube of compound is applied to a pair of tennis shoes and allowed to dry completely. How much mass will the shoes gain?
- F 20 g
 - G 40 g
 - H 50 g
 - J 100 g

- 39 Some students investigate the rusting rate of four metals in saltwater. To best find the rusting rates, the students should measure the masses of the metals before the investigation and at —
- A the same time and day during each week of the investigation
 - B different times and days during each week of the investigation
 - C any time during the first week of the investigation
 - D one randomly selected time during the investigation
- 40 Many viruses released into the air survive for only short periods of time. Which of the following is the most likely reason for this?
- F Viruses attract antibodies in the atmosphere.
 - G Viruses require a low atmospheric pressure.
 - H Viruses are hosts for bacteria that eventually destroy them.
 - J Viruses are dependent on host cells of living organisms.



Reflex arc: the neural pathway from a point of stimulation to the responding organ

41 The diagram above represents a reflex arc in a human. This pathway responds when someone touches something that causes pain, such as a hot stove. Which of the following shows the correct order of the body systems involved in this response?

- A Integumentary, respiratory, digestive
- B Circulatory, respiratory, nervous
- C Integumentary, nervous, muscular
- D Circulatory, digestive, nervous

42 An advertisement for a new medication claims that patients can lower body cholesterol by 25%–45%. If the claim is accurate, patients who will benefit most from this medication are those who —

- F have high cholesterol levels
- G consume small amounts of cholesterol
- H want to eliminate cholesterol
- J are aware of cholesterol's effects

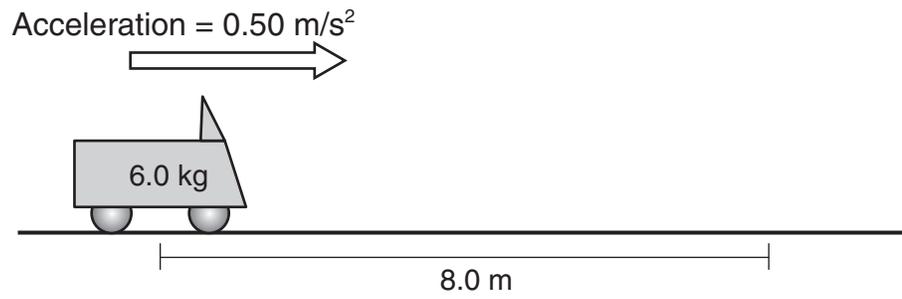
43 The long-term survival of any species of organism is possible only if the organisms can —

- A migrate when temperatures change
- B reproduce successfully
- C find protection from predators
- D locate a constant food source

Hypothesis: A 5-gram quantity of salt will dissolve faster in 30°C water than it will in 10°C water.

44 In addition to a hot plate and beakers, which of these items are needed to test the hypothesis above?

- F Test tube, barometer, thermometer
- G Balance, thermometer, hand lens
- H Stopwatch, microscope, test tube
- J Thermometer, stopwatch, balance



45 An electric toy cart has a mass of 6.0 kilograms and a constant acceleration of 0.50 m/s^2 . How much work does the net force do on the toy cart as the cart travels 8.0 meters?

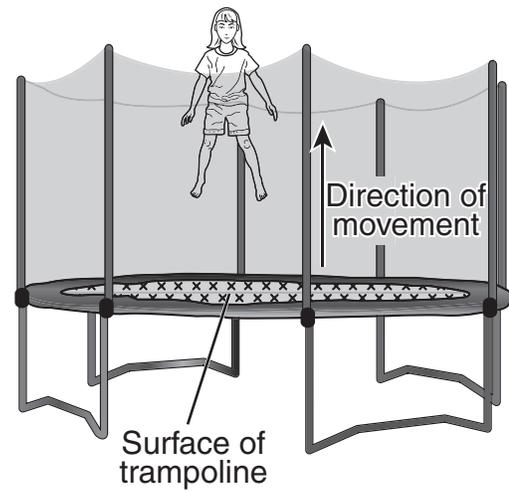
- A** 24 Nm
- B** 30 Nm
- C** 40 Nm
- D** 48 Nm

46 White-tailed deer meet their energy needs through which of these activities?

- F Drinking water
- G Absorbing sunlight
- H Eating plants
- J Exhaling carbon dioxide

47 The elements in which of these sets have chemical properties that are the most similar?

- A K, Ca, Sc
- B O, S, Se
- C Na, Ca, Y
- D P, S, Cl



48 A child jumps on a trampoline, as shown above. Which of the following causes the child to rise in the air?

- F Inertia
- G Mass
- H A reaction force
- J A gravitational force

Some Facts About Robert Koch

Fact 1: Koch directed a scientific research institute.

Fact 2: Koch developed procedures for disease control through sanitation.

Fact 3: Koch developed postulates that included four steps.

Fact 4: Koch used his four steps to identify the causes of tuberculosis and anthrax.

49 Robert Koch is known for developing Koch’s postulates, a series of steps used to identify the agents responsible for some diseases. The validity of the postulates is best supported by which fact shown above?

- A** Fact 1
- B** Fact 2
- C** Fact 3
- D** Fact 4

50 Members of the kingdom Animalia are best described as —

- F** unicellular, prokaryotic, heterotrophic
- G** unicellular, eukaryotic, autotrophic
- H** multicellular, eukaryotic, heterotrophic
- J** multicellular, eukaryotic, autotrophic

51 An advertisement for a brand of tea claims the tea “improves the immune system.” This claim implies that the tea —

- A** helps the body produce antibodies
- B** accelerates the process of digestion
- C** prevents bacteria from entering cells
- D** keeps the body from being exposed to viruses

- 52 A 2.25 kg fish swims in a pond at a constant rate of 56 meters in 96 seconds. What is the fish's approximate speed?
- F** 0.020 m/s
G 0.40 m/s
H 0.58 m/s
J 1.7 m/s

- 53 A student investigates the effects of five brands of fertilizer on plant growth and concludes that Brand X works best. Which of the following would best communicate this conclusion?
- A** A list of the ingredients in each brand of fertilizer used
B A graph showing the growth rate of plants grown with the different fertilizers
C A description of the role of different nutrients in plant growth
D A diagram showing the conditions in which each plant grew



Masses: $w \quad x \quad y \quad z$

- 54 In a single-displacement reaction, the chemical change shown above occurs. Which equation supports the law of conservation of mass?
- F** $w = y$
G $x = z$
H $w + x = y + z$
J $w + x = 2(y + z)$

- 55** Scientists recently found a fossil representing a newly discovered animal species that they named *Tiktaalik roseae*. The fossil indicates that *Tiktaalik roseae* had a fish-like jaw and scale-covered fins. The front fins had bones similar to those of a shoulder, an upper arm, an elbow, a forearm, and a wrist. This information suggests that populations of *Tiktaalik roseae* most likely lived in which two environments?
- A** In saltwater and in freshwater
 - B** In water and on land
 - C** On land and in treetops
 - D** In glaciers and in caves

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



TAKS EXIT LEVEL
SCIENCE
APRIL 2009