Tennessee Comprehensive Assessment Program

TCAP

TNReady—EOC Science Item Release
Biology-Chemistry

TN Department of Education

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TNReady—Biology
Item Release

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Metadata Interpretation Guide – Biology

Item Information

Item Code:	TNS10220	Passage Title:	
Standard Code:	0307.1.1	Passage Code:	
Standard Text:	Identify specific parts of a plant and describe their function.		
Reporting Category:	Cells, Flow of Matter & Energy, Heredity		
Correct Answer:	B	DOK Level:	2

Item Code: Unique letter/number code used to identify the item.	**Passage Title:** (if listed): Title of the passage(s) associated with this item.
Standard Code: Primary educational standard assessed.	**Passage Code:** (if listed): Unique letter/number code used to identify the passage(s) that go with this item.
Standard Text: Text of the educational standard assessed.	
Reporting Category: Text of the Reporting Category the standard assesses.	
Correct Answer: Correct answer. This may be blank for constructed response items where students write or type their responses.	**DOK Level** (if listed): Depth of Knowledge (cognitive complexity) is measured on a four-point scale. 1= Recall; 2= Skill/Concepts; 3= Strategic Thinking; 3-4 = Strategic/Extended Thinking

Item Information

Item Code:	TEB120274	Passage Title:	
Standard Code:	3210.1.2	Passage Code:	
Standard Text:	Distinguish between prokaryotic and eukaryotic cells.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

Which characteristic is observed in both prokaryotic and eukaryotic cells?

A presence of cytoplasm

B reproduction by binary fission

C presence of membrane-bound organelles

D reproduction requires a host

Item Information

Item Code:	TEB120300	Passage Title:	
Standard Code:	3210.1.2	Passage Code:	
Standard Text:	Distinguish between prokaryotic and eukaryotic cells.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	1

Which statement describes the major difference between prokaryotic and eukaryotic cells?

A Prokaryotic cells have a cell membrane; eukaryotic cells have a cell wall.

B Prokaryotic cells contain chloroplasts; eukaryotic cells contain mitochondria.

C Eukaryotic cells have a membrane-bound nucleus; prokaryotic cells do not.

D Eukaryotic cells contain ribosomes; prokaryotic cells do not.

Item Information

Item Code:	GS050081	Passage Title:	
Standard Code:	3210.1.3	Passage Code:	
Standard Text:	Distinguish among proteins, carbohydrates, lipids, and nucleic acids.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	1

What is the primary function of a carbohydrate molecule within a cell?

A store energy

B produce amino acids

C regulate hormones

D express genetic information

Item Information

Item Code:	GS050163	Passage Title:	
Standard Code:	3210.1.3	Passage Code:	
Standard Text:	Distinguish among proteins, carbohydrates, lipids, and nucleic acids.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

Cholesterol is a major component of cell membranes. The function of cholesterol is to prevent the fatty acid chains from sticking together, making the bilayer more stable. To which group of macromolecules does cholesterol belong?

A lipids

B proteins

C amino acids

D carbohydrates

Item Information

Item Code:	GS050186	Passage Title:	
Standard Code:	3210.1.3	Passage Code:	
Standard Text:	Distinguish among proteins, carbohydrates, lipids, and nucleic acids.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	1

Which element is necessary to form a protein molecule but not a carbohydrate molecule?

A carbon

B oxygen

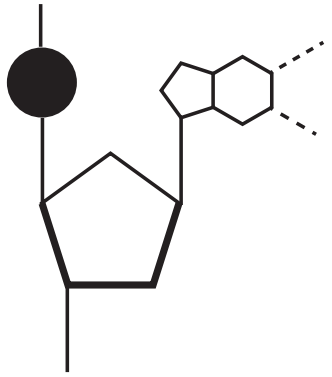
C nitrogen

D hydrogen

Item Information

Item Code:	TEB120035	Passage Title:	
Standard Code:	3210.1.3	Passage Code:	
Standard Text:	Distinguish among proteins, carbohydrates, lipids, and nucleic acids.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	3-4

The diagram below represents one type of monomer unit that makes up a macromolecule that stores and transmits genetic information.



Which type of macromolecule is represented in the diagram?

A protein

B lipid

C nucleic acid

D carbohydrate

Item Information

Item Code:	TEB120036	Passage Title:	
Standard Code:	3210.1.3	Passage Code:	
Standard Text:	Distinguish among proteins, carbohydrates, lipids, and nucleic acids.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

Glucose, galactose, and fructose are all monosaccharides with the formula $C_6H_{12}O_6$. They are distinguished from one another by the arrangement of the individual atoms. To which group of macromolecules do they belong?

A lipids

B proteins

C carbohydrates

D nucleic acids

Item Information

Item Code:	GS050190	Passage Title:	
Standard Code:	3210.1.4	Passage Code:	
Standard Text:	Identify positive tests for carbohydrates, lipids, and proteins.		
Reporting Category:	Cells		
Correct Answer:	B	DOK Level:	2

Students tested different substances for the presence of certain organic molecules. The chart below shows their results.

Test for Organic Molecules

Substance	Iodine Result	Biuret Reagent Result	Sudan III Result
1	Blue-black	————	————
2	————	Violet/purple	————
3	————	————	Red
4	Blue-black	————	————

Based on the students' results, which substance contains proteins?

A Substance 1

B Substance 2

C Substance 3

D Substance 4

Item Information

Item Code:	TEB120139	Passage Title:	
Standard Code:	3210.1.4	Passage Code:	
Standard Text:	Identify positive tests for carbohydrates, lipids, and proteins.		
Reporting Category:	Cells		
Correct Answer:	B	DOK Level:	1

A clear solution will test positive for the presence of protein when the solution turns

A dark purple-black when iodine is added.

B purple when biuret solution is added.

C brownish orange when Benedict's solution is added.

D red when Sudan III is added.

Item Information

Item Code:	GS050056	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

Which of the following does the enzyme carbonic anhydrase most likely do to a metabolic reaction?

A The enzyme increases the rate of the reaction.

B The enzyme reverses the direction of the reaction.

C The enzyme releases carbon molecules to be used later.

D The enzyme releases oxygen atoms to balance the reaction.

Item Information

Item Code:	GS050192	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	3-4

In the leaf cells of a plant, enzymes control the rate at which carbon dioxide is converted into glucose. Which environmental factor would most affect the action of the enzyme?

A wind

B rainfall

C air pressure

D temperature

Item Information

Item Code:	GS050250	Passage Title:	
Standard Code:	3210.1.6	Passage Code:	
Standard Text:	Determine the relationship between cell growth and cell reproduction.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	3-4

An early sign that a eukaryotic cell has begun cell reproduction is when

A it chemically bonds with a coenzyme.

B the cell engulfs new material, absorbing it.

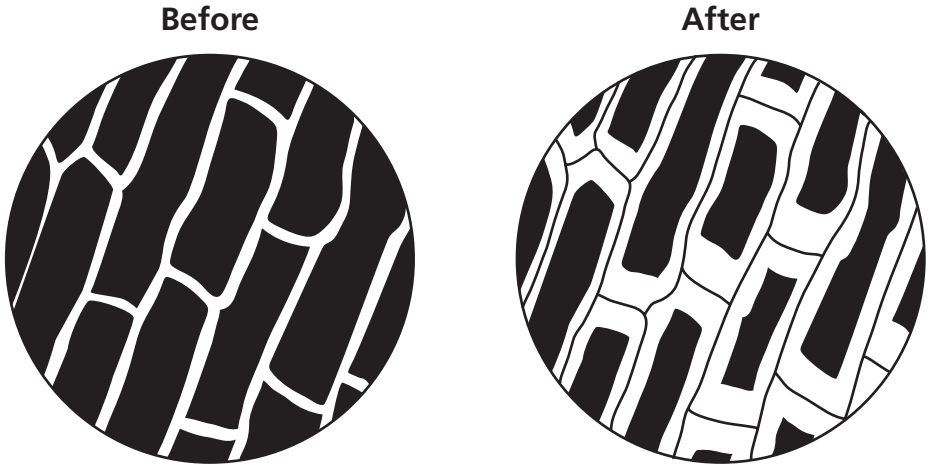
C DNA replication occurs in the nucleus.

D the plasma membrane thins considerably.

Item Information

Item Code:	GS050106	Passage Title:	
Standard Code:	3210.1.7	Passage Code:	
Standard Text:	Predict the movement of water and other molecules across selectively permeable membranes.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	2

The diagrams below show skin cells of a red onion before and after they were exposed to an unknown solution.



The onion cells were <u>most</u> likely exposed to what type of solution?

A hydrophobic

B isotonic

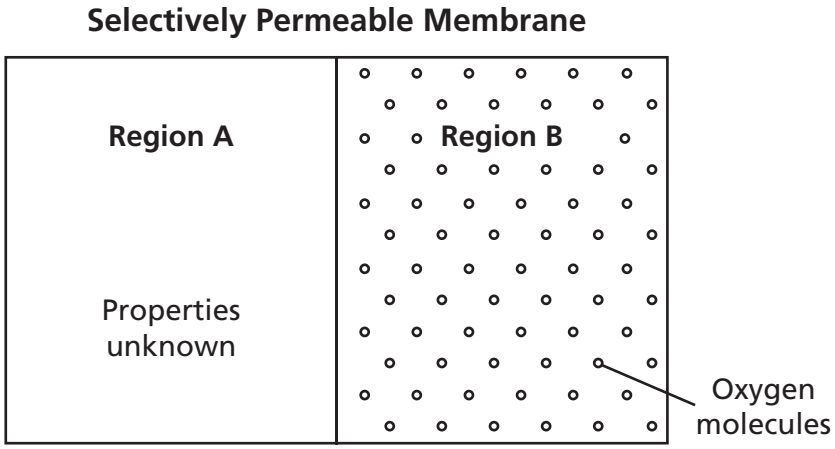
C hypotonic

D hypertonic

Item Information

Item Code:	GS050153	Passage Title:	
Standard Code:	3210.1.7	Passage Code:	
Standard Text:	Predict the movement of water and other molecules across selectively permeable membranes.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	2

The diagram below represents a selectively permeable membrane that separates Region A from Region B.



Under which condition will oxygen cross the membrane?

A when the membrane has a strong electrical charge

B when the membrane uses energy to transport oxygen molecules

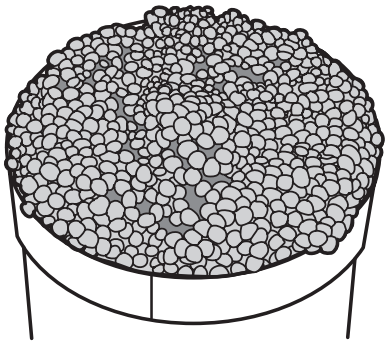
C when the temperature in Region B is sufficiently higher than in Region A

D when the concentration of oxygen in Region A is lower than that in Region B

Item Information

Item Code:	TEB120012	Passage Title:	
Standard Code:	3210.1.7	Passage Code:	
Standard Text:	Predict the movement of water and other molecules across selectively permeable membranes.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	3-4

Caviar are the eggs of fish. The eggs are stored in brine, or a saltwater solution.



Which statement describes the importance of storing the caviar in brine instead of distilled water?

A Distilled water would cause an isotonic environment for the eggs.

B Brine keeps the salt levels in the eggs higher than outside of the eggs.

C Distilled water would cause water to move outside of the egg membrane.

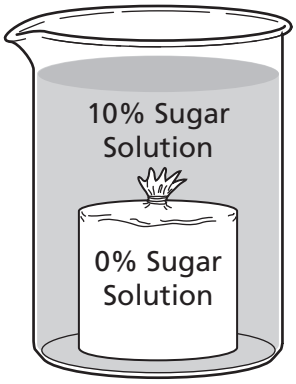
D Brine maintains equilibrium of water movement across the egg membrane.

Item Information

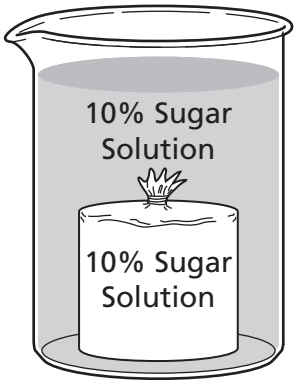
Item Code:	TEB120049	Passage Title:	
Standard Code:	3210.1.7	Passage Code:	
Standard Text:	Predict the movement of water and other molecules across selectively permeable membranes.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	3-4

Students were studying the movement of molecules across selectively permeable membranes. They placed 25 mL each of solutions of varying sugar concentrations in bags of dialysis tubing. Each bag of dialysis tubing was placed in a beaker containing a 10% sugar solution. The dialysis tubing is permeable to water but not to sugar. Which dialysis bag will lose the <u>most</u> volume?

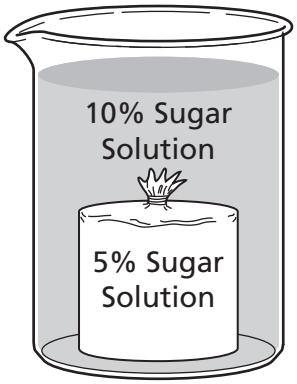
A



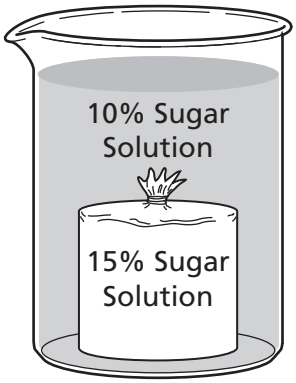
C



B



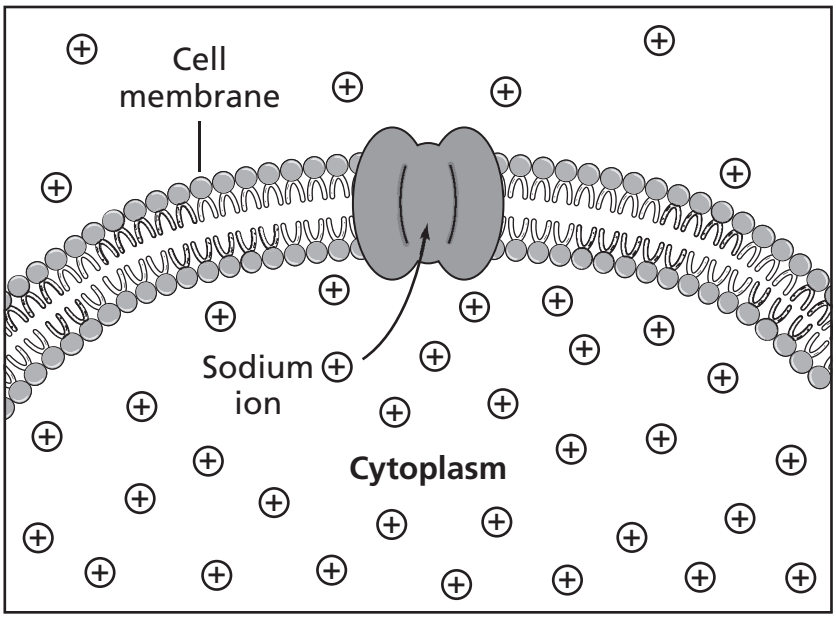
D



Item Information

Item Code:	GS050203	Passage Title:	
Standard Code:	3210.1.8	Passage Code:	
Standard Text:	Compare and contrast active and passive transport.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	2

The movement of a sodium ion through a cell membrane is shown.



This sodium ion passes through the cell membrane by which process?

A respiration

B osmosis

C active transport

D facilitated diffusion

Item Information

Item Code:	TEB120013	Passage Title:	
Standard Code:	3210.1.8	Passage Code:	
Standard Text:	Compare and contrast active and passive transport.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

Which statement describes a characteristic common to both active and passive transport?

A Both use protein channels as passageways.

B Both require energy to move large molecules.

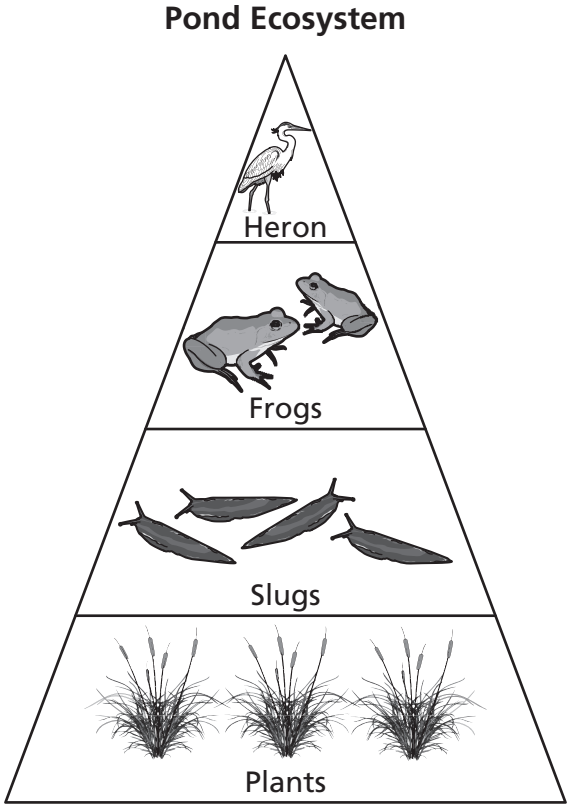
C Both move solute molecules against the concentration gradient.

D Both need hormones or activator molecules to move molecules.

Item Information

Item Code:	GS050204	Passage Title:	
Standard Code:	3210.2.1	Passage Code:	
Standard Text:	Predict how population changes of organisms at different trophic levels affect an ecosystem.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

The diagram below illustrates populations at various trophic levels of a pond ecosystem.



(This item continues on the next page.)

(***Item 20****, continued from the previous page*)

What effect will a decrease in the frog population most likely have on the other trophic levels?

A The slug population will decrease, and the heron population will increase.

B The slug population will increase, and the heron population will decrease.

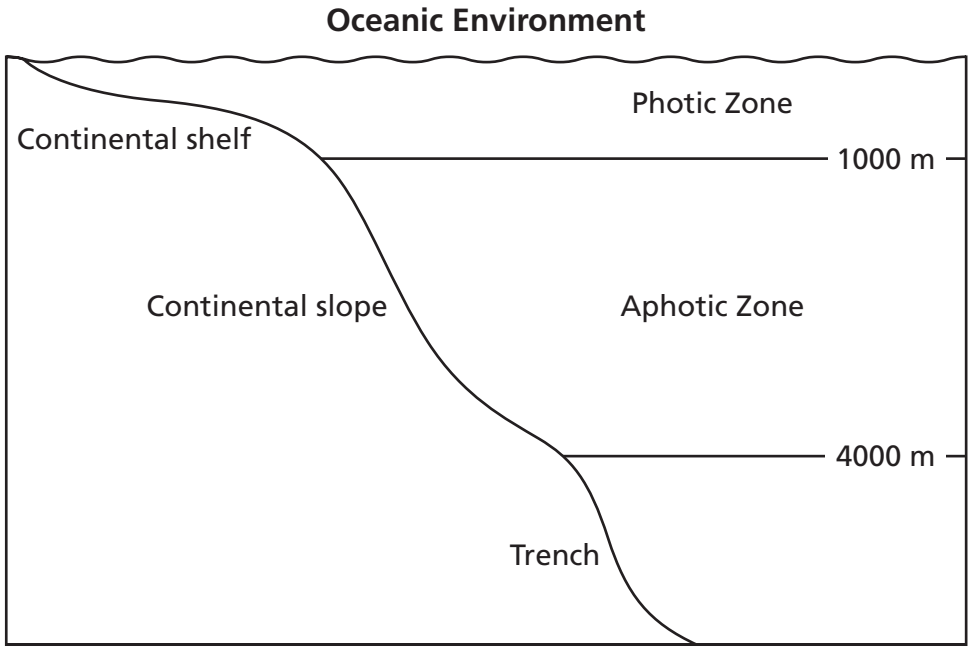
C The slug and heron populations will increase, and the plant population will decrease.

D The slug and heron populations will decrease, and the plant population will increase.

Item Information

Item Code:	GS050140	Passage Title:	
Standard Code:	3210.2.2	Passage Code:	
Standard Text:	Interpret the relationship between environmental factors and fluctuations in population size.		
Reporting Category:	Interdependence		
Correct Answer:	C	DOK Level:	3-4

In an oceanic environment, most photosynthetic organisms are found near the surface in the photic zone. The aphotic zone can be found at a depth of 1000 m to approximately 4000 m as shown below.



The lack of sunlight in the aphotic zone <u>most</u> likely determines

A the number of scavengers.

B pollution entering the ecosystem.

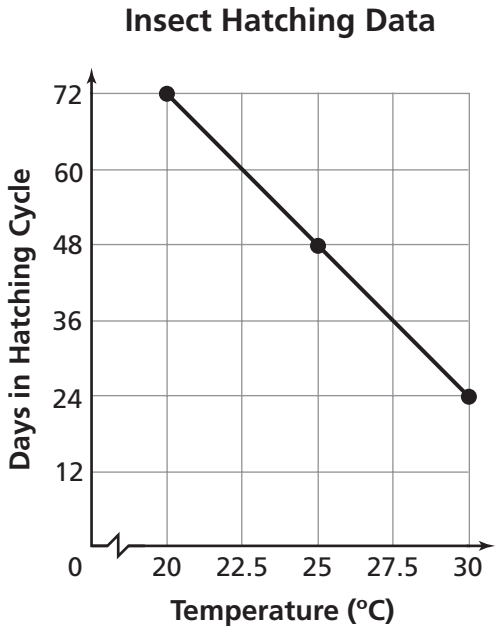
C the carrying capacity of producers.

D ocean currents carrying nutrients to the surface.

Item Information

Item Code:	TEB120366	Passage Title:	
Standard Code:	3210.2.2	Passage Code:	
Standard Text:	Interpret the relationship between environmental factors and fluctuations in population size.		
Reporting Category:	Interdependence		
Correct Answer:	A	DOK Level:	2

An increase in average atmospheric temperature in an ecosystem could result in increased populations for certain pest insects.



According to the data presented, which statement best explains the increase in the pest insect population?

A Increases in temperature decrease the time it takes eggs to hatch.

B Decreases in temperature increase the frequency of mating.

C Increases in temperature decrease the number of eggs produced.

D Decreases in temperature increase the size of individual eggs.

Item Information

Item Code:	GS050187	Passage Title:	
Standard Code:	3210.2.3	Passage Code:	
Standard Text:	Determine how the carrying capacity of an ecosystem is affected by interactions among organisms.		
Reporting Category:	Interdependence		
Correct Answer:	C	DOK Level:	2

Which statement <u>best</u> explains how the carrying capacity of a population is affected by another population in its ecosystem?

A A decrease in the tertiary consumer population will increase the producer population.

B An increase in the tertiary consumer population will decrease the producer population.

C A decrease in the producer population will limit the consumer population.

D An increase in the producer population will limit the consumer population.

Item Information

Item Code:	TEB120235	Passage Title:	
Standard Code:	3210.2.3	Passage Code:	
Standard Text:	Determine how the carrying capacity of an ecosystem is affected by interactions among organisms.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

The carrying capacity of an ecosystem will <u>most</u> likely become unbalanced when

A a seasonal migration of birds occurs.

B a new species immigrates into the area.

C the climate remains favorable for growth.

D the diversity of local trees and vegetation remains stable.

Item Information

Item Code:	GS040091	Passage Title:	
Standard Code:	3210.2.5	Passage Code:	
Standard Text:	Make inferences about how a specific environmental change can affect the amount of biodiversity.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	3-4

The number of plants along part of a riverbank decreased over time, resulting in less shade along the edges of the river and higher surface water temperatures. Over a one-year period, the number of fish species that inhabited that section of the river declined. Which statement best describes the fish species that remained in the area?

A They spend more time near the surface of the water.

B They can tolerate a wider range of temperatures.

C They rely on camouflage as a cover from predators.

D They require a wider variety of prey species.

Item Information

Item Code:	GS050315	Passage Title:	
Standard Code:	3210.2.5	Passage Code:	
Standard Text:	Make inferences about how a specific environmental change can affect the amount of biodiversity.		
Reporting Category:	Interdependence		
Correct Answer:	A	DOK Level:	2

Hard corals have a symbiotic relationship with species of microalgae that give the corals their color and provide up to 95% of the corals' energy needs by photosynthesis. Corals get the rest of their food by consuming plankton. These microalgae are damaged by changes in water temperatures of 2 – 3°C lasting five weeks or more, causing a phenomenon called coral bleaching. What will most likely be the result of increased global temperature on the diversity of hard coral species?

A The number of different hard coral species will decrease.

B The hard corals will make all of their own food.

C The rate of photosynthesis in hard corals will increase.

D The hard corals will migrate to warmer waters.

Item Information

Item Code:	GS050229	Passage Title:	
Standard Code:	3210.2.6	Passage Code:	
Standard Text:	Predict how a specific environmental change may lead to the extinction of a particular species.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

How might a gradual increase in temperature affect the Arctic polar bear population?

A Reproductive rates will increase.

B Hunting grounds will decrease in size.

C Fresh water supplies will increase.

D Prey species will lose camouflage colors.

Item Information

Item Code:	TEB110160	Passage Title:	
Standard Code:	3210.2.6	Passage Code:	
Standard Text:	Predict how a specific environmental change may lead to the extinction of a particular species.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

Before the early 1950s, the only snake that inhabited the island of Guam was a small, blind, wormlike snake, *Ramphotyphlops braminus*, which lived in termite nests and loose soil. When the brown tree snake, *Boiga irregularis*, which can reach 3 meters in length, was introduced to Guam, it had no predators and quickly populated the island. Scientists predicted that if the brown tree snake population was not controlled, the biodiversity of the island would be dramatically changed because of

A an increase in the variety of producer species on the island.

B an increase in the extinction rate of many native bird species.

C a decrease in the ability of other snakes to migrate to the island.

D a decrease in the carrying capacity for herbivores.

Item Information

Item Code:	TEB120110	Passage Title:	
Standard Code:	3210.2.7	Passage Code:	
Standard Text:	Analyze factors responsible for the changes associated with biological succession.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	3-4

Which statement best explains why secondary succession has a higher level of production of biological material than primary succession?

A There are more producers that break down nutrients.

B The deposition of sediment provides new habitats for plants and animals.

C The accumulation of soil occurs more quickly for plants to grow.

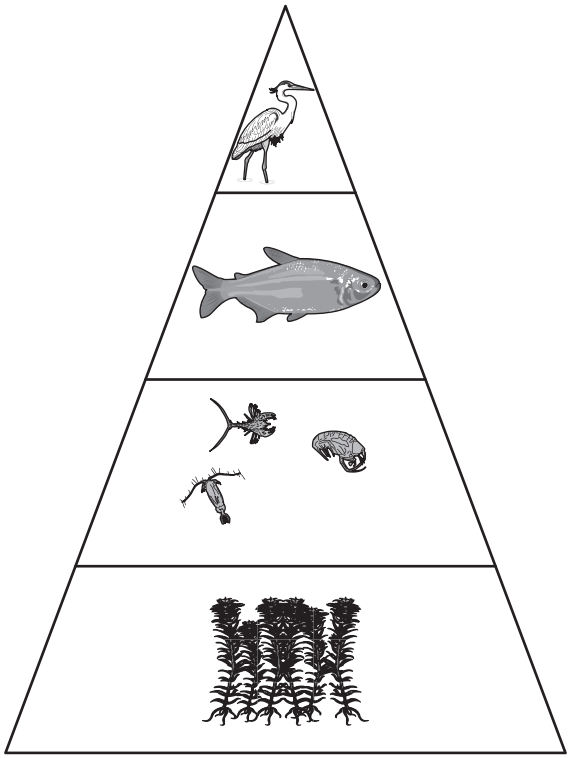
D There are more established available resources for plants and animals.

Item Information

Item Code:	GS040133	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	3-4

The diagram below represents an energy pyramid for a pond ecosystem.

Pond Ecosystem Energy Pyramid



What percentage of the energy found in the algae is <u>most</u> likely available to the tertiary consumer?

A 0.001%

B 0.01%

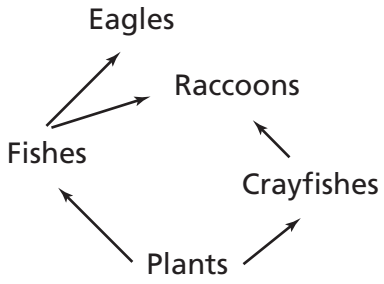
C 0.1%

D 1.0%

Item Information

Item Code:	GS040139	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	2

A food web is shown below.



Which organisms in this ecosystem receive energy from more than one source?

A Eagles

B Plants

C Crayfishes

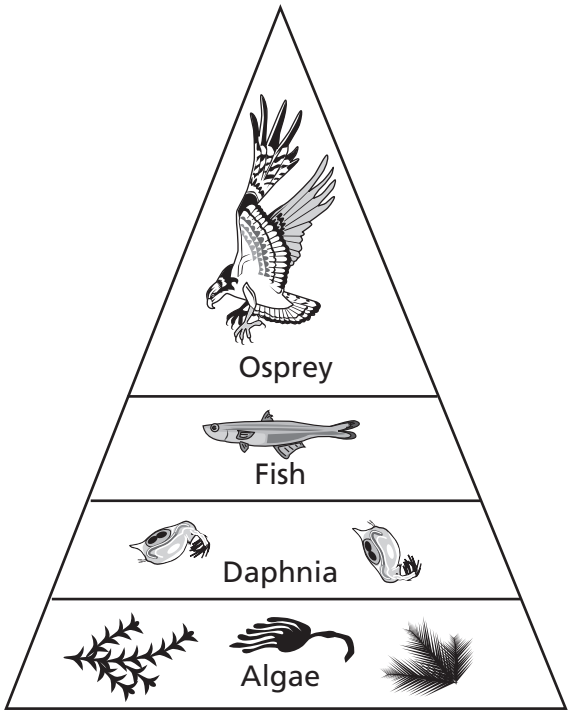
D Raccoons

Item Information

Item Code:	GS050032	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	2

A diagram of an energy pyramid is shown below.

Energy Pyramid



Which population in the energy pyramid contains the largest amount of stored energy?

A Algae

B Daphnia

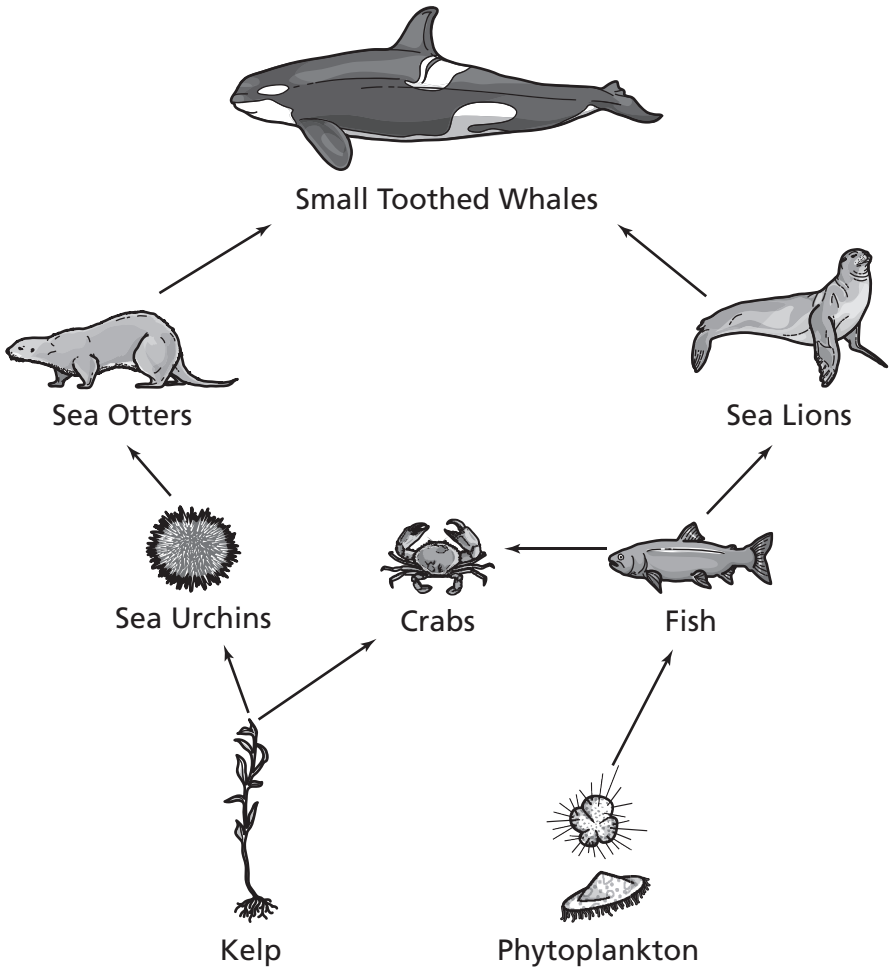
C Fish

D Osprey

Item Information

Item Code:	GS050092	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	3-4

The diagram shown represents part of a food chain found in the Pacific Ocean.



(*This item continues on the next page.*)

(***Item 34****, continued from the previous page*)

What will <u>most</u> likely occur first if there is a decline in the sea otter population?

A The sea urchin population will increase.

B The crab population will decrease.

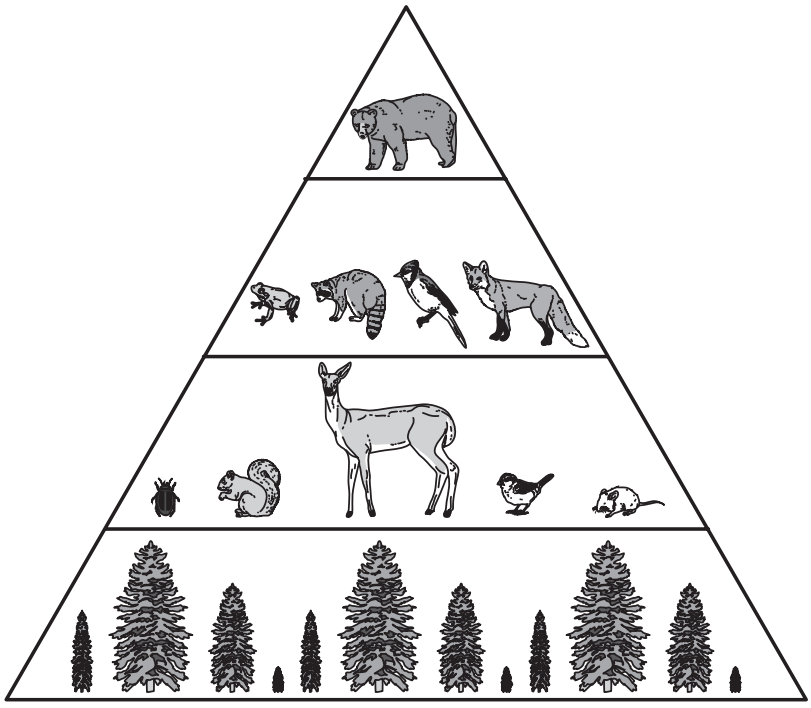
C The small toothed whale population will increase.

D The phytoplankton population will decrease.

Item Information

Item Code:	TEB120017	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	2

Energy is constantly flowing through environments.



Which trophic level contains the most energy?

A primary producers

B primary consumers

C secondary consumers

D tertiary consumers

Item Information

Item Code:	TEB120050	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	2

Which statement best describes the energy flow as it passes from producers to tertiary consumers?

A Ten percent of the energy is transferred through each trophic level.

B One hundred percent of the energy produced passes to each trophic level.

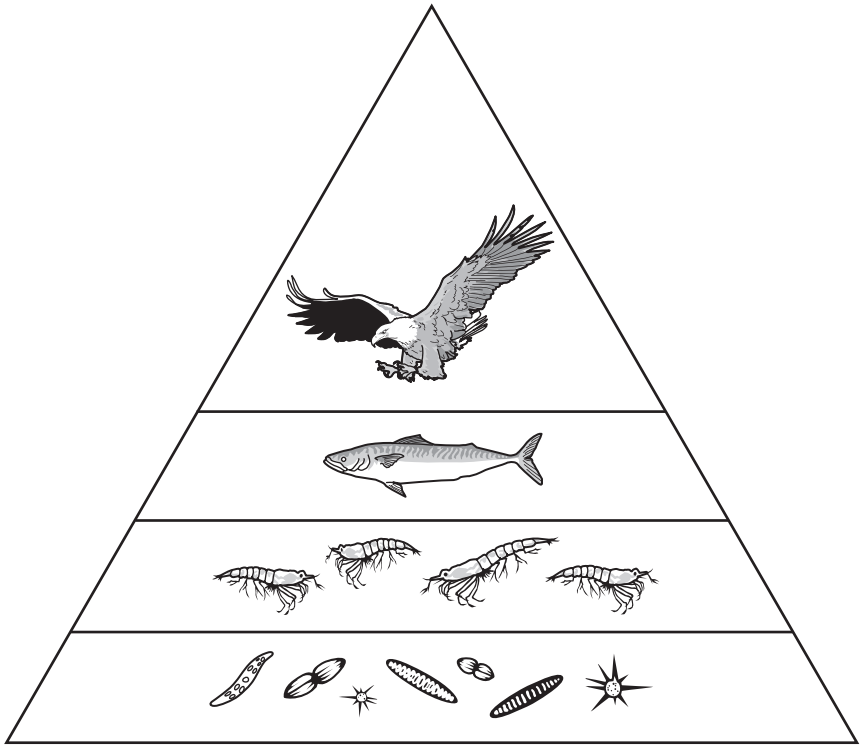
C Fifty percent of the energy produced is transferred through each trophic level.

D One percent of the energy is lost as it is transferred through each trophic level.

Item Information

Item Code:	TEB120070	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	3-4

The diagram below represents a marine ecosystem energy pyramid.



Which statement describes the flow of energy between the producers and tertiary consumers?

A Most of the energy is lost to the environment as heat.

B All of the energy produced is transferred through each level.

C The amount of energy increases by fifty percent from one level to the next.

D The amount of energy increases by ninety percent from one level to the next.

Item Information

Item Code:	GS050126	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	2

Which is a product of both aerobic and anaerobic respiration?

A O_2

B CO_2

C NAD^+

D $C_6H_{12}O_6$

Item Information

Item Code:	GS050237	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	2

Fermentation and cellular respiration are both processes that break down glucose and

A store lactic acid in bonds.

B release energy from bonds.

C require O_2 as a reactant.

D produce ethyl alcohol.

Item Information

Item Code:	TEB120044	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	2

Which is a characteristic of aerobic respiration?

A Only two ATP molecules are produced.

B ATP, CO_2, and alcohol are the end products.

C Glucose is broken down in the absence of oxygen to release energy.

D Glucose is converted to CO_2, ATP, and H_2O in the presence of oxygen.

Item Information

Item Code:	TEB120181	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	2

The complete breakdown of glucose through aerobic respiration in muscle cells results in the net production of a maximum of

A 36 O_2 molecules.

B 36 CO_2 molecules.

C 36 ATP molecules.

D 36 ADP molecules.

Item Information

Item Code:	GS050118	Passage Title:	
Standard Code:	3210.3.3	Passage Code:	
Standard Text:	Compare and contrast photosynthesis and cellular respiration in terms of energy transformation.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	2

What statement accurately compares the chemical processes of cellular respiration and photosynthesis?

A Both processes use ATP as an energy carrier.

B Both processes require water.

C Both processes require light energy to form products.

D Both processes are aerobic reactions only.

Item Information

Item Code:	TEB120079	Passage Title:	
Standard Code:	3210.3.3	Passage Code:	
Standard Text:	Compare and contrast photosynthesis and cellular respiration in terms of energy transformation.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	3-4

Which organelle is correctly paired with the function it performs in the process of producing energy for organisms?

A chloroplast – converts food energy into chemical energy

B chloroplast – breaks down chemical compounds into carbon dioxide and water

C mitochondrion – breaks down carbon dioxide to release glucose and oxygen

D mitochondrion – converts energy found in glucose into energy used by the cell

Item Information

Item Code:	TEB120099	Passage Title:	
Standard Code:	3210.3.3	Passage Code:	
Standard Text:	Compare and contrast photosynthesis and cellular respiration in terms of energy transformation.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	3-4

Which statement best explains the function of ATP as an important component of normal cellular functions?

A It provides the oxygen necessary for cells to undergo photosynthesis.

B It provides the energy necessary for processes to occur within the cell.

C It provides the carbon necessary for the cell to produce DNA.

D It provides the code necessary for the manufacture of proteins in the cell.

Item Information

Item Code:	GS040086	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	2

In surface waters, an excessive concentration of phosphorus is considered to be a pollutant. Phosphorus stimulates the growth of plankton and plants that eventually die and decompose. Bacteria consume the decomposing material, causing a decrease in the amount of dissolved oxygen. What will most likely occur in a lake ecosystem that has an overabundance of phosphorus?

A There will be an increase in other available nutrients.

B The lake will begin to undergo eutrophication.

C There will be a decrease in food for other organisms.

D The water flow in the lake will increase.

Item Information

Item Code:	GS050165	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	1

An increase in the amount of carbon dioxide in the atmosphere will <u>most</u> likely

A decrease precipitation.

B increase wind speeds.

C decrease temperatures.

D increase plant productivity.

Item Information

Item Code:	TEB120182	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	2

An increase in the phosphorus content of soil affects an ecosystem's total biomass by directly

A supplying shelter for decomposers.

B replacing the need for herbivores.

C increasing the carrying capacity for producers.

D reducing competition between top predators.

Item Information

Item Code:	TEB120325	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	2

Every few years farmers plant rotational crops such as legumes during off seasons. Which resource increases as a result of this farming practice?

A the amount of oxygen in the atmosphere

B the amount of usable nitrogen in the soil

C the amount of carbon dioxide in the atmosphere

D the amount of water that seeps through the soil

Item Information

Item Code:	GS050114	Passage Title:	
Standard Code:	3210.4.1	Passage Code:	
Standard Text:	Identify the structure and function of DNA.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	2

The double strands of a DNA molecule are connected to one another by bonds between

A complex sugars.

B simple fatty acids.

C phosphate groups.

D nitrogen bases.

Item Information

Item Code:	GS050231	Passage Title:	
Standard Code:	3210.4.1	Passage Code:	
Standard Text:	Identify the structure and function of DNA.		
Reporting Category:	Heredity		
Correct Answer:	C	DOK Level:	1

Which best describes the function of a DNA molecule?

A regulates cellular metabolism

B provides quick energy

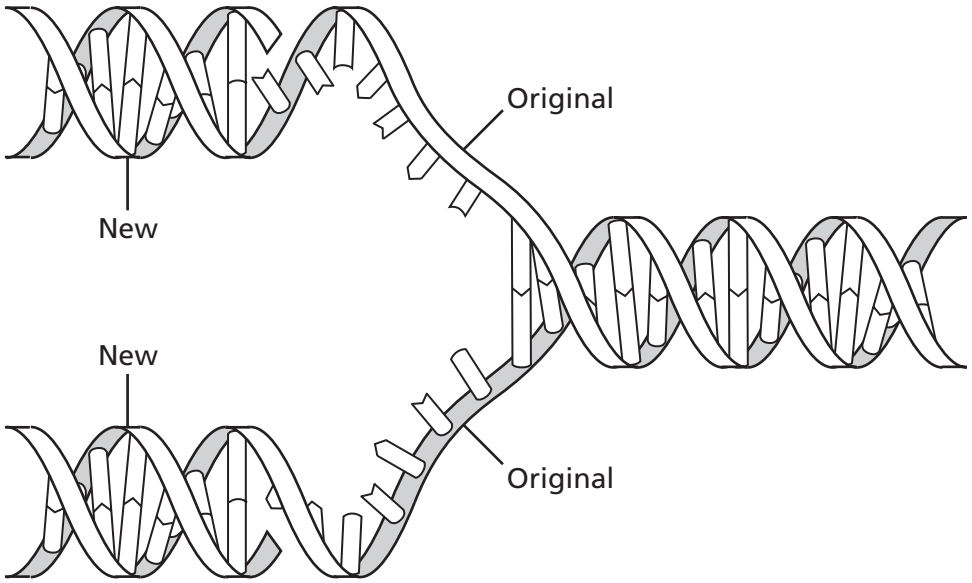
C stores hereditary information

D delivers nutrients to the body

Item Information

Item Code:	TEB120383	Passage Title:	
Standard Code:	3210.4.1	Passage Code:	
Standard Text:	Identify the structure and function of DNA.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	1

The diagram below represents a process that occurs in a DNA molecule.



Which <u>best</u> identifies this process?

A replication

B mutation

C translation

D transcription

Item Information

Item Code:	GS040311	Passage Title:	
Standard Code:	3210.4.2	Passage Code:	
Standard Text:	Associate the process of DNA replication with its biological significance.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	1

What must occur in order for genetic material to be passed to cells during cell division?

A DNA replication

B RNA synthesis

C osmosis

D diffusion

Item Information

Item Code:	GS050254	Passage Title:	
Standard Code:	3210.4.2	Passage Code:	
Standard Text:	Associate the process of DNA replication with its biological significance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	1

Which process is necessary for daughter cells to contain genetic material identical to that of the parent cell?

A DNA transcription

B DNA replication

C RNA translation

D RNA synthesis

Item Information

Item Code:	TEB120385	Passage Title:	
Standard Code:	3210.4.2	Passage Code:	
Standard Text:	Associate the process of DNA replication with its biological significance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	1

Traits are determined by the proteins that are synthesized according to instructions coded in DNA. Which sequence of biomolecules is responsible for the coded instructions?

A enzymes

B nucleotides

C glycoproteins

D carbohydrates

Item Information

Item Code:	GS050042	Passage Title:	
Standard Code:	3210.4.3	Passage Code:	
Standard Text:	Recognize the interactions between DNA and RNA during protein synthesis.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	2

Which represents the correct sequential flow of information during protein synthesis?

A DNA→RNA→protein

B RNA→DNA→protein

C DNA→protein→RNA

D RNA→protein→DNA

Item Information

Item Code:	TEB120387	Passage Title:	
Standard Code:	3210.4.3	Passage Code:	
Standard Text:	Recognize the interactions between DNA and RNA during protein synthesis.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	1

RNA contains instructions to make a specific protein and is produced from genetic information in the nucleus of the cell. Which best identifies this process?

A mutation

B replication

C translation

D transcription

Item Information

Item Code:	TEB120094	Passage Title:	
Standard Code:	3210.4.4	Passage Code:	
Standard Text:	Determine the probability of a particular trait in an offspring based on the genotype of the parents and the particular mode of inheritance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	3-4

The Punnett square shown represents a cross between a Holstein bull and a Holstein cow.

B = Black Coat Color
b = Red Coat Color

?	BB	Bb
?	Bb	bb

According to the Punnett square, what must be the genotypes of the parents?

A heterozygous × homozygous

B heterozygous × heterozygous

C homozygous dominant × homozygous recessive

D homozygous dominant × homozygous dominant

Item Information

Item Code:	TEB120143	Passage Title:	
Standard Code:	3210.4.4	Passage Code:	
Standard Text:	Determine the probability of a particular trait in an offspring based on the genotype of the parents and the particular mode of inheritance.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	3-4

A cross between a snapdragon with white flowers (WW) and a snapdragon with red flowers (RR) produces offspring that have pink flowers (RW). Based on this cross, which form of inheritance leads to the expression of pink flowers?

A codominance

B polygenic traits

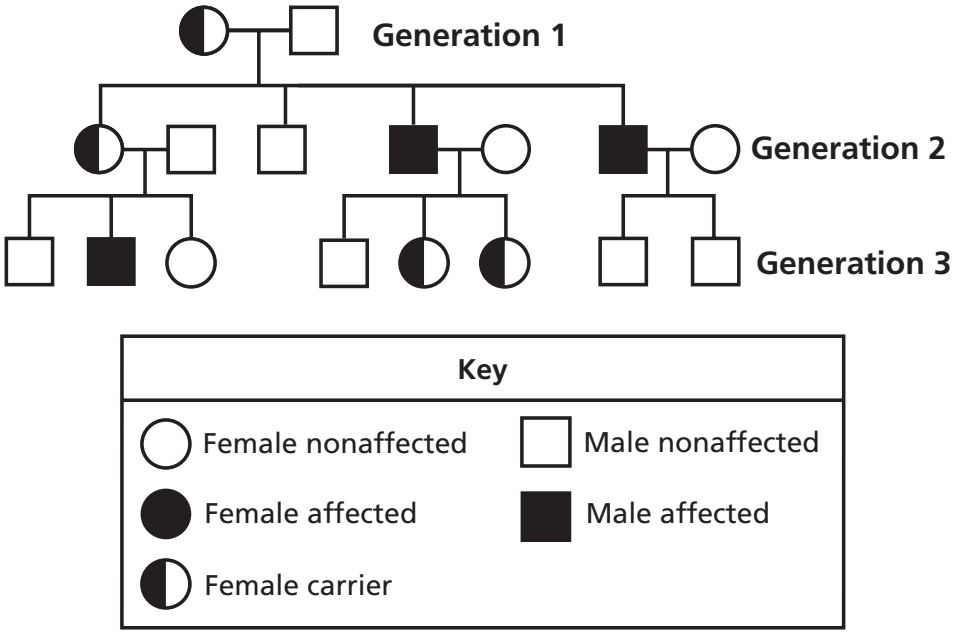
C multiple alleles

D incomplete dominance

Item Information

Item Code:	TEB110204	Passage Title:	
Standard Code:	3210.4.5	Passage Code:	
Standard Text:	Apply pedigree data to interpret various modes of genetic inheritance.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	3-4

The pedigree shows the inheritance of a genetic disorder through three generations.



Which statement <u>best</u> explains the mode of inheritance?

A The disorder affects only the sons.

B The disorder affects only the daughters.

C The allele for the disorder is carried on the Y-chromosome.

D The allele for the disorder is carried on the X-chromosome.

Item Information

Item Code:	GS050263	Passage Title:	
Standard Code:	3210.4.6	Passage Code:	
Standard Text:	Describe how meiosis is involved in the production of egg and sperm cells.		
Reporting Category:	Heredity		
Correct Answer:	C	DOK Level:	2

In order to successfully produce gametes by the end of meiosis, a cell must undergo

A genetic mutation.

B cellular respiration.

C two meiotic divisions.

D one stage of cytokinesis.

Item Information

Item Code:	TEB120048	Passage Title:	
Standard Code:	3210.4.6	Passage Code:	
Standard Text:	Describe how meiosis is involved in the production of egg and sperm cells.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

During the process of meiosis, a diploid cell produces

A nerve cells.

B sex cells.

C muscle cells.

D somatic cells.

Item Information

Item Code:	TEB120307	Passage Title:	
Standard Code:	3210.4.6	Passage Code:	
Standard Text:	Describe how meiosis is involved in the production of egg and sperm cells.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	3-4

How do the contents of a gamete's nucleus change as a result of meiosis?

A The number of chromosomes is divided in half, and the amount of DNA is divided in half.

B The number of chromosomes stays the same, but the amount of DNA is divided in half.

C The number of chromosomes is divided in half, but the amount of DNA is reduced to one-fourth.

D The number of chromosomes is reduced to one-fourth, and the amount of DNA is reduced to one-fourth.

Item Information

Item Code:	GS050089	Passage Title:	
Standard Code:	3210.4.7	Passage Code:	
Standard Text:	Describe how meiosis and sexual reproduction contribute to genetic variation in a population.		
Reporting Category:	Heredity		
Correct Answer:	C	DOK Level:	1

In the process of reproduction, meiosis contributes to genetic variation within a population by producing cells

A that are genetically identical to one parent.

B with genetic traits identical to those of both parents.

C with a combination of traits from each parent.

D that are genetically unlike either parent.

Item Information

Item Code:	TEB120126	Passage Title:	
Standard Code:	3210.4.7	Passage Code:	
Standard Text:	Describe how meiosis and sexual reproduction contribute to genetic variation in a population.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	2

Researchers were studying a family pedigree in which a genetic disorder was present in only some of the offspring. Which process contributes to this variation among offspring?

A meiosis

B transcription

C protein synthesis

D asexual reproduction

Item Information

Item Code:	GS050072	Passage Title:	
Standard Code:	3210.4.8	Passage Code:	
Standard Text:	Determine the relationship between mutations and human genetic disorders.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

The genetic disorder that causes hemophilia is most likely a result of

A the size of the individual.

B a mutation in the DNA of the parents.

C the diet of the individual.

D a change in the habitat of the parents.

Item Information

Item Code:	GS050238	Passage Title:	
Standard Code:	3210.4.8	Passage Code:	
Standard Text:	Determine the relationship between mutations and human genetic disorders.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	3-4

Chromosomal disorders occur when an abnormal number of chromosomes are found in gametes. Down syndrome, Turner's syndrome, and Klinefelter's syndrome are examples of chromosomal disorders resulting from which process?

A replication

B translation

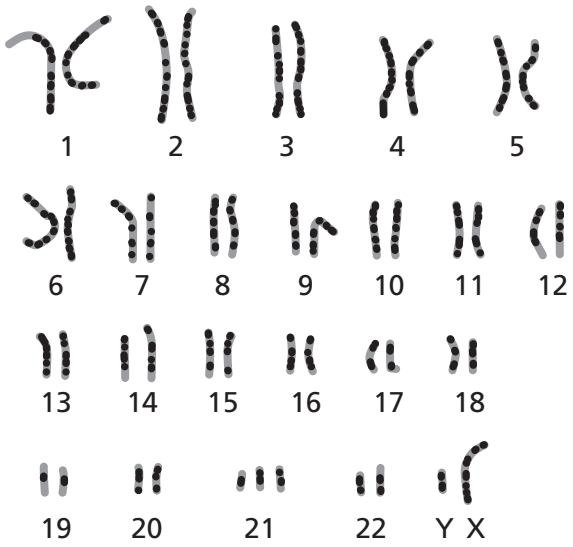
C crossing-over

D nondisjunction

Item Information

Item Code:	TEB120388	Passage Title:	
Standard Code:	3210.4.8	Passage Code:	
Standard Text:	Determine the relationship between mutations and human genetic disorders.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

The diagram below represents a human karyotype that contains a genetic disorder.



According to this karyotype, what genetic disorder is the result of this mutation?

A cystic fibrosis

B Down syndrome

C sickle cell disease

D Tay-Sachs disease

Item Information

Item Code:	GS050025	Passage Title:	
Standard Code:	3210.4.9	Passage Code:	
Standard Text:	Evaluate the scientific and ethical issues associated with gene technologies: genetic engineering, cloning, transgenic organism production, stem cell research, and DNA fingerprinting.		
Reporting Category:	Heredity		
Correct Answer:	C	DOK Level:	2

Genetically modified foods may contain high amounts of essential vitamins and minerals; however, genetically modified foods are not always labeled as such. Why is the use of genetically modified foods a concern?

A Most foods contain enough vitamins and minerals already.

B Important nutrients will be more available to all people.

C New allergens of which people are unaware may be introduced.

D Harmful mutations will be prevented by consuming these foods.

Item Information

Item Code:	TEB110325	Passage Title:	
Standard Code:	3210.4.9	Passage Code:	
Standard Text:	Evaluate the scientific and ethical issues associated with gene technologies: genetic engineering, cloning, transgenic organism production, stem cell research, and DNA fingerprinting.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	3-4

Much research has been done in the cloning of animals; a tadpole in 1954, Dolly the sheep in 1997, and the endangered gaur are just a few of the "famous" cloned animals. However, cloning of animals has met with limited success. Which statement is a scientific argument against the cloning of animals?

A Animals on the endangered species list could be cloned, and their populations would increase.

B Most cloned animals have a compromised immune system and have a low survival rate.

C Cloning of animals can be beneficial in the treatment and prevention of many diseases.

D New technologies and scientific equipment have made cloning of animals safe.

Item Information

Item Code:	GS050219	Passage Title:	
Standard Code:	3210.5.1	Passage Code:	
Standard Text:	Compare and contrast the structural, functional, and behavioral adaptations of animals or plants found in different environments.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	3-4

Many tropical rain forest plants are structured to allow rapid draining of excess moisture. Which adaptation do cacti have in order to survive a desert environment?

A increased number of flowers to ensure pollination

B different-sized spines to defend against herbivores

C specialized stems to channel water to the roots of the plant

D dark green leaves to maximize photosynthesis

Item Information

Item Code:	GS050285	Passage Title:	
Standard Code:	3210.5.1	Passage Code:	
Standard Text:	Compare and contrast the structural, functional, and behavioral adaptations of animals or plants found in different environments.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	3-4

Hibernation is one of the main adaptations that allows certain mammals to survive long, cold winters by conserving their body energy. Why is hibernation among mammal species more common in arctic biomes than in tropical biomes?

A Arctic mammals have adapted to longer nights by sleeping for longer periods than tropical mammals.

B Tropical biomes tend to have fewer predators than arctic biomes, so hibernation is not necessary.

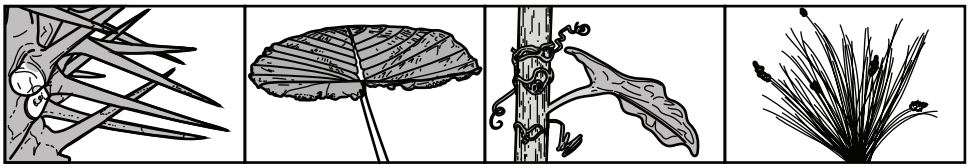
C Tropical biomes are much warmer than arctic biomes, allowing warm-blooded animals to sleep for long periods.

D Arctic biomes have greater seasonal variations in food supplies and temperature changes than tropical biomes.

Item Information

Item Code:	TEB120296	Passage Title:	
Standard Code:	3210.5.1	Passage Code:	
Standard Text:	Compare and contrast the structural, functional, and behavioral adaptations of animals or plants found in different environments.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	A	DOK Level:	2

The illustration represents 4 different plant species, each with specific adaptations for survival in certain environments.



Plant 1 **Plant 2** **Plant 3** **Plant 4**

Which plant is <u>best</u> adapted to protect itself from herbivores?

A Plant 1 because it has specialized thorns to evade predators

B Plant 2 because its surface area increases its photosynthetic rate

C Plant 3 because the plant is able to climb tall trees to reach sunlight

D Plant 4 because water loss is decreased due to a decrease in surface area

Item Information

Item Code:	GS050102	Passage Title:	
Standard Code:	3210.5.2	Passage Code:	
Standard Text:	Recognize the relationship between form and function in living things.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	2

Which adaptive characteristic has most helped mammals survive in a desert habitat?

A flexible backbone to allow easy, quick movements

B specialized enzymes to break down plant materials

C highly developed kidneys to regulate water reabsorption

D powerful diaphragm muscles to aid in respiration

Item Information

Item Code:	GS050220	Passage Title:	
Standard Code:	3210.5.3	Passage Code:	
Standard Text:	Recognize the relationships among environmental change, genetic variation, natural selection, and the emergence of a new species.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	1

Individual organisms have traits that help them survive in their habitat and reproduce, resulting in increased numbers of individuals with similar traits. Which process is responsible for the increased presence of these traits over several generations?

A mutation

B variation

C cell division

D natural selection

Item Information

Item Code:	TEB120028	Passage Title:	
Standard Code:	3210.5.3	Passage Code:	
Standard Text:	Recognize the relationships among environmental change, genetic variation, natural selection, and the emergence of a new species.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	2

A drastic environmental change, such as an earthquake forming a new mountain range, results in selective pressures on a population. Only members of a population with the phenotypes to adapt to the new environment will survive to pass on their genes. Over time, this population becomes genetically different from the original population. Which term describes this process?

A biodiversity

B inbreeding

C hybridization

D natural selection

Item Information

Item Code:	TEB120203	Passage Title:	
Standard Code:	3210.5.4	Passage Code:	
Standard Text:	Describe the relationship between the amount of biodiversity and the ability of a population to adapt to a changing environment.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	2

The Tasmanian devil is a marsupial that is vulnerable to environmental change. Its numbers have declined greatly due to cancerous facial tumors that can be fatal. The most likely reason many Tasmanian devils have the same type of cancerous tumors is because

A they are separate species.

B they are in the same habitat.

C populations have low genetic diversity.

D populations occupy a large territory.

Item Information

Item Code:	GS050041	Passage Title:	
Standard Code:	3210.5.5	Passage Code:	
Standard Text:	Apply evidence from the fossil record, comparative anatomy, amino acid sequences, and DNA structure that support modern classification systems.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	A	DOK Level:	3-4

A researcher was studying the DNA of four different salamander species. A segment of a DNA strand taken from one of the salamander species is shown below.

ACC GGT CCA AGG ACC

Based on the segment shown, which species of salamander is <u>most</u> closely related?

A salamander species 1: ACC GGT TCC AAG GAC

B salamander species 2: ACC CGC TTC CAA AGG

C salamander species 3: ACC GGT TCC AAA GGA

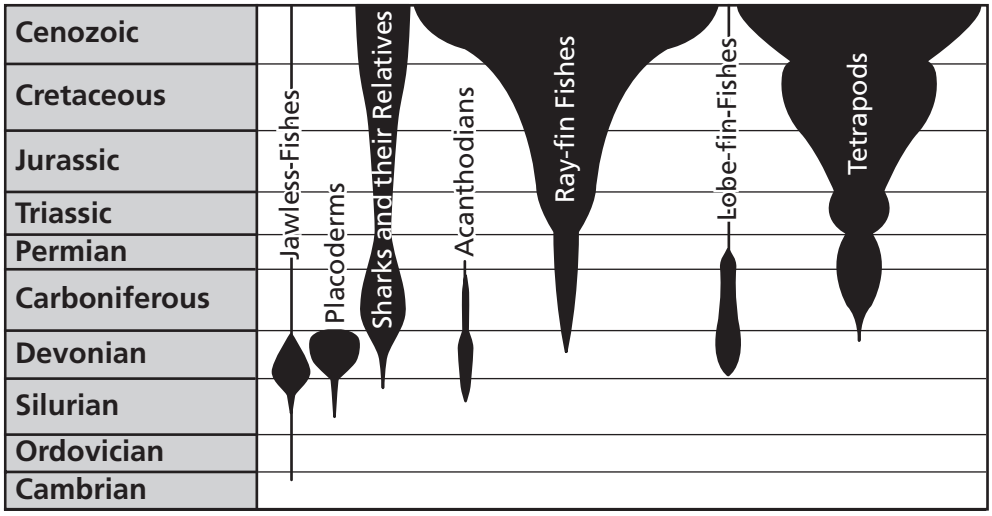
D salamander species 4: ACC CGG TTC CAA AGG

Item Information

Item Code:	GS050174	Passage Title:	
Standard Code:	3210.5.5	Passage Code:	
Standard Text:	Apply evidence from the fossil record, comparative anatomy, amino acid sequences, and DNA structure that support modern classification systems.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	B	DOK Level:	2

The diagram shown illustrates the history of species diversity among various fish groups.

Geological Time Chart for Various Fish Groups



This diagram was constructed primarily on the basis of which evidence?

A evaluation of species extinction rate

B comparative anatomy of fossils

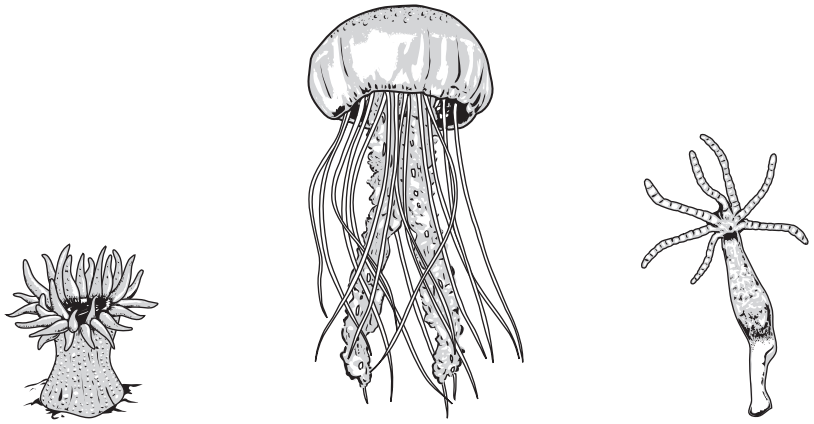
C analysis of fish feeding habits

D field observations of aquatic ecosystems

Item Information

Item Code:	TEB120204	Passage Title:	
Standard Code:	3210.5.5	Passage Code:	
Standard Text:	Apply evidence from the fossil record, comparative anatomy, amino acid sequences, and DNA structure that support modern classification systems.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	2

The organisms shown belong to the phylum Cnidaria.



Sea Anemone Sea Jelly Hydra

Based on the diagrams, which statement best explains the classification of organisms within this phylum?

A All organisms evolved at the same time.

B Each organism undergoes the same type of reproduction.

C They display a similar structure.

D They occupy the same ecological niche.

Item Information

Item Code:	GS050049	Passage Title:	
Standard Code:	3210.5.6	Passage Code:	
Standard Text:	Infer relatedness among different organisms using modern classification systems.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	1

The scientific names of four organisms are listed below.

- ***Selenarctos thibetanus***
- ***Ursus americanus***
- ***Lepus americanus***
- ***Ursus maritimus***

Which two organisms are <u>most</u> closely related?

A *Lepus americanus* and *Ursus americanus*

B *Ursus maritimus* and *Selenarctos thibetanus*

C *Selenarctos thibetanus* and *Lepus americanus*

D *Ursus americanus* and *Ursus maritimus*

Item Information

Item Code:	TEB120313	Passage Title:	
Standard Code:	3210.5.6	Passage Code:	
Standard Text:	Infer relatedness among different organisms using modern classification systems.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	3-4

The scientific names of four trees are listed below.

- ***Cryptomeria japonica***
- ***Alnus japonica***
- ***Fraxinus americana***
- ***Alnus hirsuta***

Which two trees are <u>most</u> closely related?

A *Cryptomeria japonica* and *Alnus japonica*

B *Fraxinus americana* and *Alnus hirsuta*

C *Alnus japonica* and *Alnus hirsuta*

D *Alnus hirsuta* and *Cryptomeria japonica*

Item Information

Item Code:	TEB120316	Passage Title:	
Standard Code:	3210.Inq.2	Passage Code:	
Standard Text:	Analyze the components of a properly designed scientific investigation.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	1

A student conducts an investigation exposing pea plants to different colors of light to determine their percent change in height over a one-month period. The data are shown below.

Pea Plant Investigation

	Type of Plant	Color of Light	Hours of Exposure to Light per Day	Percent Change in Height
Group 1	Pea Plant	Red	12	32%
Group 2	Pea Plant	Blue	10	25%
Group 3	Pea Plant	Green	8	5%
Group 4	Pea Plant	White	6	15%

What should the student do to collect more accurate data?

A expose the plants to light for the same amount of time each day

B change the amount of water the plants receive each day

C use more than one type of plant

D test only two colors of light

Item Information

Item Code:	GS050215	Passage Title:	
Standard Code:	3210.Inq.3	Passage Code:	
Standard Text:	Determine appropriate tools to gather precise and accurate data.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	2

A biology class collected samples of water from a pond ecosystem. The data they collected are shown in the table below.

Organisms Found in Pond Water

Sample	Number of Plant-like Organisms	Number of Animal-like Organisms
1	18	11
2	20	13
3	16	9

Which tool was <u>most</u> helpful in identifying the unicellular organisms collected?

A pH meter

B oxygen probe

C magnifying glass

D compound microscope

Item Information

Item Code:	TEB120145	Passage Title:	
Standard Code:	3210.Inq.3	Passage Code:	
Standard Text:	Determine appropriate tools to gather precise and accurate data.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	1

During a field trip to a local stream, a group of students collected several water samples containing aquatic insects and plants. Which tools should the students use to identify the collected organisms?

A a textbook chapter on aquatic organisms and a thermometer

B a research paper on aquatic organisms and a pH meter

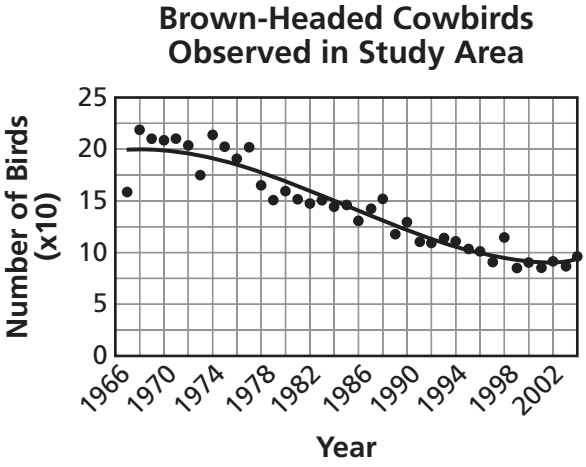
C a published scientific journal on aquatic organisms and an oxygen probe

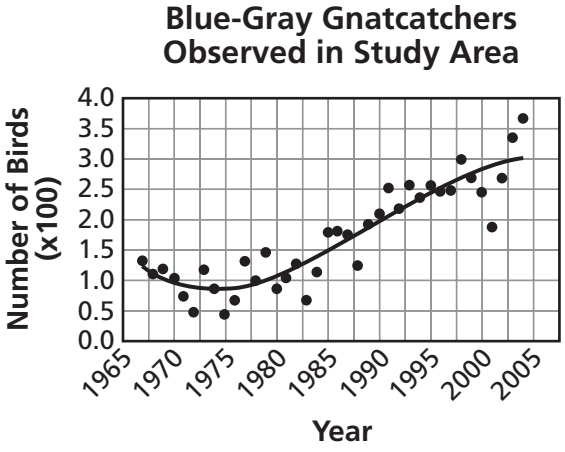
D a field guide to aquatic organisms and a hand lens

Item Information

Item Code:	GS050138	Passage Title:	
Standard Code:	3210.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	3-4

Brown-headed cowbirds are nest parasites that lay their eggs in the nests of other birds. This can contribute to the decline of bird species whose nests are parasitized by the cowbirds. In some states, efforts have been made to reduce the population of the brown-headed cowbird to help stop the decline of other songbird species. The graphs below show changes in the population of two species: the brown-headed cowbird and the blue-gray gnatcatcher.





(*This item continues on the next page.*)

(***Item 89****, continued from the previous page*)

Wildlife biologists have concluded that the removal of the brown-headed cowbird has resulted in an increase in the population of the blue-gray gnatcatcher. Which best supports their conclusion?

A Over a 35-year period, the population of brown-headed cowbirds decreased, while the population of blue-gray gnatcatchers increased.

B The population of brown-headed cowbirds is decreasing due to competition with the blue-gray gnatcatcher.

C The blue-gray gnatcatcher population is increasing due to habitat changes, resulting in more available food.

D The population of blue-gray gnatcatchers is increasing due to increased fertility.

Item Information

Item Code:	TEB120160	Passage Title:	
Standard Code:	3210.Inq.6	Passage Code:	
Standard Text:	Determine why a conclusion is free of bias.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	2

A research unit for a pharmaceutical company is testing a new heart disease medicine with a large potential market. A test group of patients is given the medicine, while a control group is given an inactive pill that resembles the medicine. During the trial, neither patients nor testers know which patients are receiving the medicine. The research unit concludes that the medicine is effective. Which is the strongest support that the conclusion is unbiased?

A The potential market for the drug was large.

B A control group was included in the experiment.

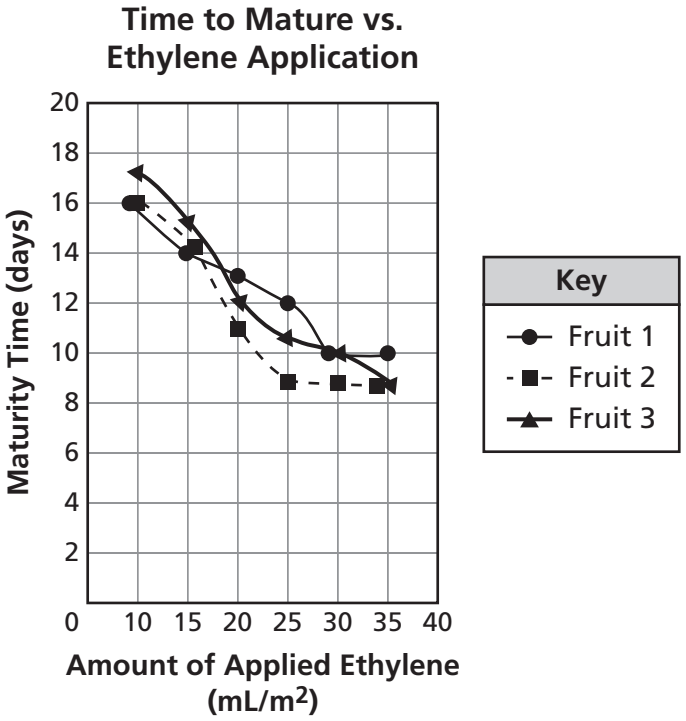
C Researchers and patients did not know who received the medicine.

D The purpose of medical research is to produce effective new treatments.

Item Information

Item Code:	GS050182	Passage Title:	
Standard Code:	3210.Math.1	Passage Code:	
Standard Text:	Interpret a graph that depicts a biological phenomenon.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

Ethylene is a plant hormone that causes fruit to mature. The graph below shows the amount of time it takes 3 types of fruit to mature after a first application of ethylene is sprayed on the fruit trees.



Which statement is <u>best</u> supported by the information shown in the graph?

A The rate of maturity for all three fruits stayed the same as the amount of ethylene changed.

B The rate of maturity increased for all three fruits as the amount of ethylene increased.

C All three fruits matured the fastest when 14 mL/m^2 of ethylene was applied.

D All three fruits matured the fastest on day 10.

Item Information

Item Code:	GS050249	Passage Title:	
Standard Code:	3210.Math.2	Passage Code:	
Standard Text:	Predict the outcome of a cross between parents of known genotype.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

A dog that is homozygous for a short tail (gg) is crossed with a carrier that has a recessive gene for short tail (Gg). What is the probability of one of their offspring having a short tail?

A 25%

B 50%

C 75%

D 100%

Item Information

Item Code:	TEB120092	Passage Title:	
Standard Code:	3210.Math.2	Passage Code:	
Standard Text:	Predict the outcome of a cross between parents of known genotype.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	2

If both parents are carriers for phenylketonuria (PKU), an autosomal recessive disorder, what is the probability that their child will inherit PKU?

A 1 : 4

B 1 : 2

C 3 : 4

D 4 : 4

Item Information

Item Code:	GS050270	Passage Title:	
Standard Code:	3210.TE.3	Passage Code:	
Standard Text:	Evaluate the overall benefit to cost ratio of a new technology.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	1

Which should be considered <u>first</u> in evaluating the cost of implementing a new technology to increase crop production?

A the amount of seeds that will be produced by the next generation of crops

B possible negative effects of the new crop technology on the environment

C reduction in the number of hours needed to harvest the crops

D the amount of crops already produced by farms

Read the passage and answer questions 95 and 96.

Of the 2,350 million tons of dust that enter the atmosphere each year, 35% comes from the Saharan region of Africa. Storm activity occurring in the Sahara desert region stirs up fine particles in the dry topsoil. These dust particles are carried on easterly winds across the Atlantic Ocean, reaching the Caribbean and the Americas in about one week. According to the National Weather Service, it is estimated that 13 million tons of dust are carried by the winds across the Atlantic annually.

These dust clouds contain large amounts of iron, phosphorus, and other materials which are deposited in the waters off the coast of Florida. An increase in these nutrients causes plant-like bacteria, *Trichodesmium*, to fix nitrogen in the water into a usable form for marine life. The bacteria use an enzyme called nitrogenase to do this. However, an increase in nutrients also increases the risk for harmful algal blooms to occur. One of these algal species causes a condition called red tide, releasing toxins that kill fish. Scientists are working on new technologies to predict when these blooms may occur, due to the impact they have on natural resources and human health.

Item Information

Item Code:	TEB120083	Passage Title:	
Standard Code:	3210.2.1	Passage Code:	
Standard Text:	Predict how population changes of organisms at different trophic levels affect an ecosystem.		
Reporting Category:	Interdependence		
Correct Answer:	C	DOK Level:	3-4

As Saharan dust deposits nutrients in the Atlantic that support the growth of *Trichodesmium*, how would this increased growth most likely affect fish populations?

A There will be a decrease in available nutrients for fish and other organisms in the ecosystem.

B The fish will rapidly increase in size due to the availability of iron and phosphorus.

C Fish populations will decline due to the release of toxins by algae.

D There will be a decrease in dissolved oxygen content due to increased photosynthesis of algae.

Item Information

Item Code:	TEB120081	Passage Title:	
Standard Code:	3210.Inq.1	Passage Code:	
Standard Text:	Select a description or scenario that reevaluates and/or extends a scientific finding.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	3-4

The amount of Saharan dust in the atmosphere has been steadily increasing since 1965. One explanation for this is an increase in the clearing of land to use for growing annual crops. What is an alternate explanation for this increase in Saharan dust in the atmosphere?

A Rainy seasons have lengthened, promoting plant growth in the Saharan region.

B Grazing by livestock in the Saharan region has decreased due to lack of vegetation.

C The clearing of land has caused a decrease in wildlife diversity in the Saharan region.

D Climate change has caused an increase in wind storms in the Saharan region.

Read the passage and answer questions 97 and 98.

In 2007, researchers from the United States and Sweden discovered an enzyme in yeast cells, which they named DNA polymerase epsilon. This enzyme has also been identified in humans. The researchers ruled out discovering it in bacteria like *E. coli* because bacteria do not require enzymes with the precise function of DNA polymerase epsilon to perform life functions.

These enzymes act on a DNA substrate to allow DNA replication to take place. DNA polymerase epsilon in yeast cells acts on the leading strand, helping to stabilize it and to regulate cellular response to DNA damage.

Item Information

Item Code:	TEB120215	Passage Title:	
Standard Code:	3210.1.1	Passage Code:	
Standard Text:	Identify the cellular organelles associated with major cell processes.		
Reporting Category:	Cells		
Correct Answer:	B	DOK Level:	2

In which organelle does the activity of DNA polymerase epsilon take place?

A ribosome

B nucleus

C Golgi complex

D smooth endoplasmic reticulum

Item Information

Item Code:	TEB120213	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

Which change in the substrate allows for DNA polymerase epsilon to function?

A reducing the masses of products

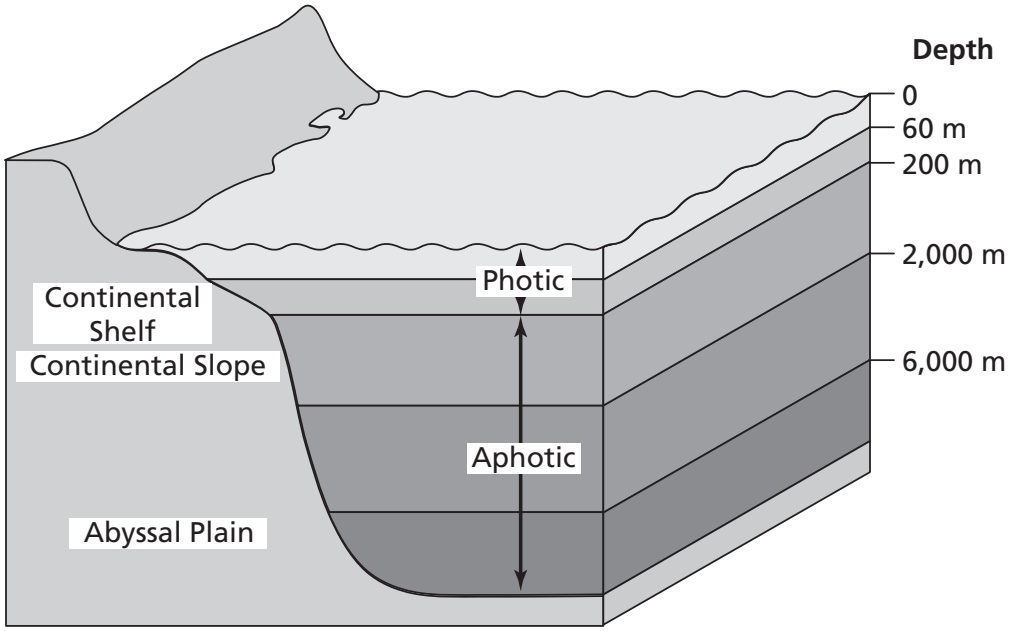
B providing an electrical potential

C decreasing activation energy

D serving as an active transport medium

Read the passage and answer questions 99 and 100.

The marine ecosystem is the largest aquatic system on Earth. Scientists have divided the ocean into layers called zones. The two major zones of the ocean are the photic and aphotic zones. These zones extend from the surface to the depths where light no longer penetrates. These two zones are further divided into layers based on availability of food, currents, and water temperature. Organisms have adapted to the conditions in these different layers.



Currents affect the productivity of the oceans by bringing up valuable nutrients from the ocean floor. These nutrients are used by phytoplankton. Dissolved oxygen is carried back to deep areas of the ocean when colder water sinks. This movement of nutrients and dissolved oxygen allows marine life to exist at all depths.

Item Information

Item Code:	TEB120405	Passage Title:	
Standard Code:	3210.5.2	Passage Code:	
Standard Text:	Recognize the relationship between form and function in living things.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	B	DOK Level:	3-4

Photosynthetic organisms have many adaptive mechanisms that cause them to remain near the surface, such as buoyancy bubbles, droplets of oil, and increased surface area. Which statement explains the function of these mechanisms?

A They stabilize pressure as the organisms move vertically through the different zones.

B They help to keep the organisms in the layer with the greatest amount of light.

C They are beneficial in camouflaging the phytoplankton from consumers.

D They help absorb more wavelengths of light to maximize photosynthesis.

Item Information

Item Code:	TEB120407	Passage Title:	
Standard Code:	3210.Inq.7	Passage Code:	
Standard Text:	Compare conclusions that offer different, but acceptable explanations for the same set of experimental data.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	3-4

The water pressure at 6000 m is more than 5850 pounds per square inch. Some researchers concluded that there was less biodiversity at this depth than at 50 m due to this extreme pressure. Other researchers concluded that the lesser biodiversity at 6000 m was due to a lack of food. Which statement explains why each group's conclusion is acceptable?

A Both light and pressure are dependent upon the movement of ocean currents.

B Both research groups followed the scientific method in their investigations.

C Both light and pressure affect what organisms will be found at different depths.

D Both research groups compared the pressure and available light at different depths.

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Tennessee Comprehensive Assessment Program TCAP
TNReady—Biology
Item Release
Spring 2018

Tennessee Comprehensive Assessment Program

TCAP

TNReady—Chemistry Item Release

TN Department of Education

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Table of Contents

Metadata Interpretation Guide – Chemistry

Item Information

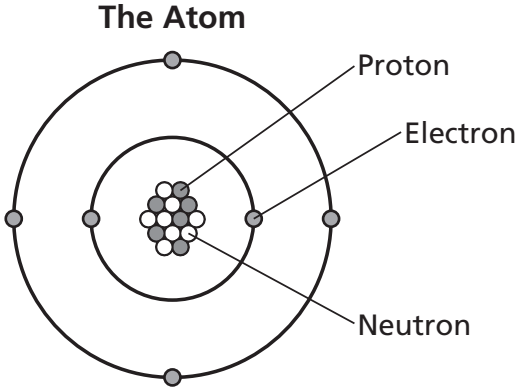
Item Code:	TNS10220	Passage Title:	
Standard Code:	0307.1.1	Passage Code:	
Standard Text:	Identify specific parts of a plant and describe their function.		
Reporting Category:	Cells, Flow of Matter & Energy, Heredity		
Correct Answer:	B	DOK Level:	2

Item Code: Unique letter/number code used to identify the item.	**Passage Title:** (if listed): Title of the passage(s) associated with this item.
Standard Code: Primary educational standard assessed.	**Passage Code:** (if listed): Unique letter/number code used to identify the passage(s) that go with this item.
Standard Text: Text of the educational standard assessed.	
Reporting Category: Text of the Reporting Category the standard assesses.	
Correct Answer: Correct answer. This may be blank for constructed response items where students write or type their responses.	**DOK Level** (if listed): Depth of Knowledge (cognitive complexity) is measured on a four-point scale. 1= Recall; 2= Skill/Concepts; 3= Strategic Thinking; 3-4 = Strategic/Extended Thinking

Item Information

Item Code:	TEC120185	Passage Title:	
Standard Code:	3221.1.1	Passage Code:	
Standard Text:	Compare and contrast the major models of the atom (i.e., Bohr, and the quantum mechanical model).		
Reporting Category:	Atomic Structure		
Correct Answer:	B	DOK Level:	2

The diagram is a simplified representation of an atom.



What is the atomic number of the atom given in the diagram at the neutral state?

A 4

B 6

C 12

D 14

Item Information

Item Code:	TEC120005	Passage Title:	
Standard Code:	3221.1.1	Passage Code:	
Standard Text:	Compare and contrast the major models of the atom (i.e., Bohr, and the quantum mechanical model).		
Reporting Category:	Atomic Structure		
Correct Answer:	B	DOK Level:	1

Which statement best describes the Bohr model of the atom?

A Electrons can move freely between intermediate energy levels.

B Electrons move around the nucleus in circular orbits.

C Electrons emit and absorb energy at continuous wavelengths.

D Electrons are accommodated in lower energy levels.

Item Information

Item Code:	TEC120577	Passage Title:	
Standard Code:	3221.1.2	Passage Code:	
Standard Text:	Interpret the periodic table to describe an element's atomic makeup.		
Reporting Category:	Atomic Structure		
Correct Answer:	B	DOK Level:	2

Which characteristic is part of the description for a chlorine atom?

A valence orbital of 4*p*

B three occupied energy levels

C highly reactive metallic substance

D solid at room temperature

Item Information

Item Code:	TEC120297	Passage Title:	
Standard Code:	3221.1.2	Passage Code:	
Standard Text:	Interpret the periodic table to describe an element's atomic makeup.		
Reporting Category:	Atomic Structure		
Correct Answer:	B	DOK Level:	2

What is the difference in valence electrons between a neutral atom of chlorine and a chloride ion?

A A neutral atom of chlorine has 7 valence electrons, and a chloride ion has 1 valence electron.

B A neutral atom of chlorine has 7 valence electrons, and a chloride ion has 8 valence electrons.

C A neutral atom of chlorine has 8 valence electrons, and a chloride ion has 7 valence electrons.

D A neutral atom of chlorine has 17 valence electrons, and a chloride ion has 18 valence electrons.

Item Information

Item Code:	TEC110280	Passage Title:	
Standard Code:	3221.1.3	Passage Code:	
Standard Text:	Describe the trends found in the periodic table with respect to atomic size, ionization energy, or electronegativity.		
Reporting Category:	Atomic Structure		
Correct Answer:	D	DOK Level:	2

Which of these elements has the strongest attraction for electrons during chemical bonding?

A oxygen

B nitrogen

C neon

D fluorine

Item Information

Item Code:	TEC110314	Passage Title:	
Standard Code:	3221.1.3	Passage Code:	
Standard Text:	Describe the trends found in the periodic table with respect to atomic size, ionization energy, or electronegativity.		
Reporting Category:	Atomic Structure		
Correct Answer:	D	DOK Level:	1

Which pair of arrows correctly represents how the electronegativity of elements changes from lowest to highest on the periodic table of the elements?

A

C

B

D

Item Information

Item Code:	TEC110038	Passage Title:	
Standard Code:	3221.1.3	Passage Code:	
Standard Text:	Describe the trends found in the periodic table with respect to atomic size, ionization energy, or electronegativity.		
Reporting Category:	Atomic Structure		
Correct Answer:	D	DOK Level:	2

When moving from left to right across a period on the periodic table, which trends are generally found?

A Atomic size and ionization energy both decrease.

B Atomic size increases and ionization energy decreases.

C Atomic size and electronegativity both decrease.

D Atomic size decreases and ionization energy increases.

Item Information

Item Code:	TEC110219	Passage Title:	
Standard Code:	3221.1.4	Passage Code:	
Standard Text:	Determine the Lewis electron-dot structure or number of valence electrons for an atom of any main-group element from its atomic number or position in the periodic table.		
Reporting Category:	Atomic Structure		
Correct Answer:	C	DOK Level:	2

How many valence electrons are in a neutral atom of nitrogen?

A 2

B 3

C 5

D 7

Item Information

Item Code:	TEC120102	Passage Title:	
Standard Code:	3221.1.4	Passage Code:	
Standard Text:	Determine the Lewis electron-dot structure or number of valence electrons for an atom of any main-group element from its atomic number or position in the periodic table.		
Reporting Category:	Atomic Structure		
Correct Answer:	C	DOK Level:	2

The diagram represents the Lewis electron-dot structure of an element at ground state.

Which group of elements in the periodic table does this Lewis electron-dot structure represent?

A Group 2

B Group 4

C Group 14

D Group 16

Item Information

Item Code:	TEC110040	Passage Title:	
Standard Code:	3221.1.4	Passage Code:	
Standard Text:	Determine the Lewis electron-dot structure or number of valence electrons for an atom of any main-group element from its atomic number or position in the periodic table.		
Reporting Category:	Atomic Structure		
Correct Answer:	B	DOK Level:	1

What is the correct number of valence electrons for a neutral atom of tellurium with the atomic number 52?

A 5

B 6

C 7

D 8

Item Information

Item Code:	TEC120191	Passage Title:	
Standard Code:	3221.1.5	Passage Code:	
Standard Text:	Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d and f orbitals.		
Reporting Category:	Atomic Structure		
Correct Answer:	A	DOK Level:	2

An atom of which element has its highest-energy electrons located in a sphere-shaped orbital while at ground state?

A helium (He)

B chlorine (Cl)

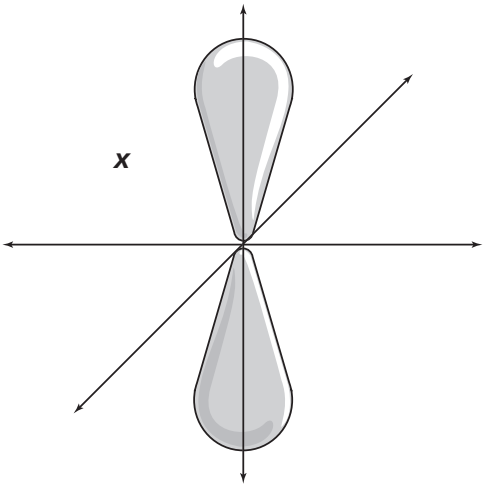
C oxygen (O)

D phosphorus (P)

Item Information

Item Code:	TEC120045	Passage Title:	
Standard Code:	3221.1.5	Passage Code:	
Standard Text:	Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d and f orbitals.		
Reporting Category:	Atomic Structure		
Correct Answer:	D	DOK Level:	2

A representation of a 2*p* orbital is shown in the diagram.



Which statement best describes the electrons in the 2*p* orbital?

A Each electron assumes a dumbbell shape when it occupies a 2*p* orbital.

B Each electron spends its time in only one of the two lobes of the 2*p* orbital.

C The movement of a 2*p* electron is restricted to within the walls of the orbital.

D The 2*p* electron is likely to be found within a region represented by the orbital.

Item Information

Item Code:	TEC110036	Passage Title:	
Standard Code:	3221.1.5	Passage Code:	
Standard Text:	Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d and f orbitals.		
Reporting Category:	Atomic Structure		
Correct Answer:	A	DOK Level:	2

Which electron configuration correctly represents the ground state of bromine?

A $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^5$

B $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4d^{10}\ 4p^5$

C $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^9\ 4p^6$

D $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4d^9\ 4p^6$

Item Information

Item Code:	TEC110252	Passage Title:	
Standard Code:	3221.1.5	Passage Code:	
Standard Text:	Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d and f orbitals.		
Reporting Category:	Atomic Structure		
Correct Answer:	C	DOK Level:	1

How many electrons can fill a *d* subshell?

A 2

B 6

C 10

D 14

Item Information

Item Code:	TEC120074	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	2

The equation represents the reaction to produce sodium hydrogen carbonate $(NaHCO_3)$.

$$Na_2CO_3(s) + CO_2(g) + H_2O(l) \rightarrow 2NaHCO_3(s)$$

Sodium hydrogen carbonate is classified as a

A compound.

B homogeneous mixture.

C heterogeneous mixture.

D solution.

Item Information

Item Code:	TEC120091	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	D	DOK Level:	1

Water can be separated into hydrogen and oxygen gas using electrolytic decomposition. Based on this information, water can be classified as a

A gaseous mixture.

B binary solution.

C suspension.

D compound.

Item Information

Item Code:	TEC120270	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	D	DOK Level:	2

A 250-gram sample contains particles with a specific number of protons. Which statement distinguishes the given substance both qualitatively and quantitatively?

A The sample is a heterogeneous mixture.

B The sample is one homogeneous compound.

C The sample is a pure homogeneous solid-solid solution.

D The sample is composed of one element.

Item Information

Item Code:	TEC120420	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	1

Which substance best represents a mixture?

A iron

B brass

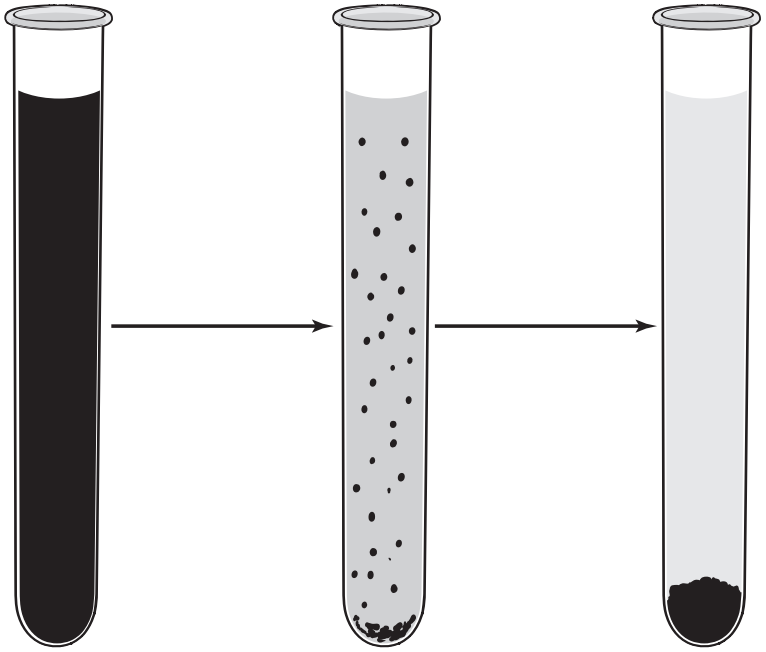
C salt

D carbon-14

Item Information

Item Code:	TEC120628	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	D	DOK Level:	1

The diagram shows a sample of matter as it changes over time.



Which statement describes this sample?

A It is a colloid.

B It is an element.

C It is a compound.

D It is a suspension.

Item Information

Item Code:	TEC120314	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

Which substance exists in the simplest form of matter?

A sodium chloride (NaCl)

B ethanol (C_2H_5OH)

C magnesium (Mg)

D hydrochloric acid (HCl)

Item Information

Item Code:	TEC110325	Passage Title:	
Standard Code:	3221.2.2	Passage Code:	
Standard Text:	Identify properties of a solution: solute and solvent in a solid, liquid or gaseous solution: procedure to make or determine the concentration of a solution in units of ppm, ppb, molarity, percent composition, factors that affect the rate of solution.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

How many liters of water must evaporate from 0.5 M salt solution to yield 1 mole of sodium chloride, NaCl(s)?

A 0.5 L

B 1.0 L

C 2.0 L

D 29 L

Item Information

Item Code:	TEC120188	Passage Title:	
Standard Code:	3221.2.2	Passage Code:	
Standard Text:	Identify properties of a solution: solute and solvent in a solid, liquid or gaseous solution: procedure to make or determine the concentration of a solution in units of ppm, ppb, molarity, percent composition, factors that affect the rate of solution.		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

What is the molarity of a solution prepared by dissolving 20.0 g of NaOH in enough water to make 0.50 L of solution?

A 0.25 M

B 1.0 M

C 10 M

D 40 M

Item Information

Item Code:	TEC120039	Passage Title:	
Standard Code:	3221.2.2	Passage Code:	
Standard Text:	Identify properties of a solution: solute and solvent in a solid, liquid or gaseous solution: procedure to make or determine the concentration of a solution in units of ppm, ppb, molarity, percent composition, factors that affect the rate of solution.		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	2

What will happen to the vapor pressure of a liquid when the temperature of the liquid increases?

A The vapor pressure will increase.

B The vapor pressure will decrease.

C The vapor pressure will not be affected by the temperature.

D The vapor pressure and boiling point will be changed to 1 atm.

Item Information

Item Code:	TEC120279	Passage Title:	
Standard Code:	3221.2.4	Passage Code:	
Standard Text:	Identify properties of matter (e.g., physical: density, boiling point, melting point, or chemical: ability to rust or tarnish, be sour) or changes in matter (e.g., physical: phase change, shape, color, or chemical: formation of a gas or precipitate).		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	2

Which of these indicates a chemical change has occurred?

A a pungent-smelling gas being released from a rotting egg

B the volume of a gas changing from 5 L to 10 L after a decrease in pressure

C adding solute to a solution to change the density of the solution

D adding solute to a solution to saturate the solution

Item Information

Item Code:	TEC120712	Passage Title:	
Standard Code:	3221.2.4	Passage Code:	
Standard Text:	Identify properties of matter (e.g., physical: density, boiling point, melting point, or chemical: ability to rust or tarnish, be sour) or changes in matter (e.g., physical: phase change, shape, color, or chemical: formation of a gas or precipitate).		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

The table shows accepted densities of four metals.

Densities of Four Metals

Metal	Density (g/cm^3)
Gold	19.32
Lead	11.34
Silver	10.49
Tungsten	19.25

A student receives a sample of one of the metals in the table. The sample has a volume of 0.407 cubic centimeter and a mass of 4.27 grams. Which metal did the student most likely receive?

A Gold

B Lead

C Silver

D Tungsten

Item Information

Item Code:	TEC120194	Passage Title:	
Standard Code:	3221.2.4	Passage Code:	
Standard Text:	Identify properties of matter (e.g., physical: density, boiling point, melting point, or chemical: ability to rust or tarnish, be sour) or changes in matter (e.g., physical: phase change, shape, color, or chemical: formation of a gas or precipitate).		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	2

Which of these is an example of a physical change?

A dissolving sugar in water

B cooking an egg in water

C fermenting a sugar solution

D burning wood into charcoal

Item Information

Item Code:	TEC120717	Passage Title:	
Standard Code:	3221.2.4	Passage Code:	
Standard Text:	Identify properties of matter (e.g., physical: density, boiling point, melting point, or chemical: ability to rust or tarnish, be sour) or changes in matter (e.g., physical: phase change, shape, color, or chemical: formation of a gas or precipitate).		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	1

A student pours vegetable oil, water, and honey into a graduated cylinder. The substances separate into layers. The layers form due to differences in which physical property?

A density

B solubility

C viscosity

D flammability

Item Information

Item Code:	TEC110411	Passage Title:	
Standard Code:	3221.2.5	Passage Code:	
Standard Text:	Compare and contrast heat and temperature changes (endothermic /exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	2

Which of these phase changes requires energy?

A boiling water on a stove

B making dry ice from carbon dioxide gas

C freezing water into ice

D condensing water vapor to rain

Item Information

Item Code:	TEC120541	Passage Title:	
Standard Code:	3221.2.5	Passage Code:	
Standard Text:	Compare and contrast heat and temperature changes (endothermic /exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

A scientist measures the temperature in a calorimeter before and after a chemical reaction. She notes the change in energy ($\triangle H$) as -60 kilojoules. Which conclusion should the scientist make based on the $\triangle H$?

A The reaction is endothermic because the heat is released.

B The reaction is exothermic because the heat is released.

C The reaction is exothermic because the heat is absorbed.

D The reaction is endothermic because the heat is absorbed.

Item Information

Item Code:	TEC120109	Passage Title:	
Standard Code:	3221.2.5	Passage Code:	
Standard Text:	Compare and contrast heat and temperature changes (endothermic /exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	2

Which of these is an endothermic process?

A melting of ice

B burning of gasoline

C mixing of water and acid

D condensation of a vapor

Item Information

Item Code:	TEC110303	Passage Title:	
Standard Code:	3221.2.5	Passage Code:	
Standard Text:	Compare and contrast heat and temperature changes (endothermic /exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

In the given chemical equation, hydrogen peroxide decomposes exothermically into water and oxygen.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

Why is the reaction considered an exothermic chemical reaction?

A The reaction absorbs heat from the surroundings.

B The reaction releases heat into the surroundings.

C Activation energy is added to the reaction.

D Activation energy is removed from the reaction.

Item Information

Item Code:	TEC110473	Passage Title:	
Standard Code:	3221.2.6	Passage Code:	
Standard Text:	Investigate similarities and differences among solids, liquids and gases in terms of energy and particle spacing.		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

Which statement describes a difference among molecules in the different phases of matter?

A Gas molecules possess a lesser degree of movement than molecules in liquid and solid.

B Gas molecules possess a greater kinetic energy than molecules in liquid and solid.

C Liquid molecules possess a greater degree of movement than molecules in gas and solid.

D Liquid molecules possess a greater kinetic energy than molecules in gas and solid.

Item Information

Item Code:	TEC120137	Passage Title:	
Standard Code:	3221.2.6	Passage Code:	
Standard Text:	Investigate similarities and differences among solids, liquids and gases in terms of energy and particle spacing.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

The density of solid lead (Pb) at room temperature is 11.35 g/cm^3, while the density of liquid lead at its melting point of 327°C is 10.68 g/cm^3. Why is the density of the liquid lead slightly lower?

A The liquid lead atoms have slightly less kinetic energy than the solid lead atoms.

B The liquid lead atoms have a slightly larger atomic radius than the solid lead atoms.

C The liquid lead atoms are less closely arranged in a given amount of space than the solid lead atoms.

D The liquid lead atoms are less likely to move in a given amount of space than the solid lead atoms.

Item Information

Item Code:	TEC120426	Passage Title:	
Standard Code:	3221.2.6	Passage Code:	
Standard Text:	Investigate similarities and differences among solids, liquids and gases in terms of energy and particle spacing.		
Reporting Category:	Matter and Energy		
Correct Answer:	A	DOK Level:	1

Which substance contains the particles with the <u>greatest</u> kinetic energy?

A oxygen (O_2) gas

B liquid water (H_2O)

C sodium chloride (NaCl) crystals

D aqueous sodium hydroxide (NaOH)

Item Information

Item Code:	TEC110333	Passage Title:	
Standard Code:	3221.2.6	Passage Code:	
Standard Text:	Investigate similarities and differences among solids, liquids and gases in terms of energy and particle spacing.		
Reporting Category:	Matter and Energy		
Correct Answer:	D	DOK Level:	2

Which property do particles in the solid and liquid phase have in common compared to particles in the gas phase?

A They are less densely spaced as compared to particles in the gas phase.

B They are easily compressible as compared to particles in the gas phase.

C They have higher kinetic energy as compared to particles in the gas phase.

D They are spaced closely to one another as compared to particles in the gas phase.

Item Information

Item Code:	TEC120733	Passage Title:	
Standard Code:	3221.2.7	Passage Code:	
Standard Text:	Predict how changes in volume, temperature, and pressure affect the behavior of a gas.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

What is the temperature of 2.60 mol of a gas at a pressure of 102.63 atm and a volume of 341 mL?

A 0.00950 K

B 116 K

C 164 K

D 1110 K

Item Information

Item Code:	TEC120740	Passage Title:	
Standard Code:	3221.2.7	Passage Code:	
Standard Text:	Predict how changes in volume, temperature, and pressure affect the behavior of a gas.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

What is the final volume of 5.31 L of an ideal gas when heated from 200 K to 300 K at constant pressure?

A 0.1 L

B 4 L

C 8 L

D 1000 L

Item Information

Item Code:	TEC120736	Passage Title:	
Standard Code:	3221.2.7	Passage Code:	
Standard Text:	Predict how changes in volume, temperature, and pressure affect the behavior of a gas.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

What will be the new pressure of a gas at 36.0 atm and 108°C if the temperature of the gas is increased to 441°C?

A 0.0504 atm

B 19.2 atm

C 67.5 atm

D 13,700 atm

Item Information

Item Code:	TEC110518	Passage Title:	
Standard Code:	3221.2.7	Passage Code:	
Standard Text:	Predict how changes in volume, temperature, and pressure affect the behavior of a gas.		
Reporting Category:	Matter and Energy		
Correct Answer:	D	DOK Level:	2

A gas is in a container with a pressure of 1.00 atm. The volume of the gas in the container changes and fills 20.0 liters at a pressure of 5.00 atm. What was the initial volume of the gas?

A 5.00 liters

B 20.0 liters

C 22.4 liters

D 100.0 liters

Item Information

Item Code:	TEC120295	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	2

Which compound has the incorrect IUPAC name?

A $SnCl_2$, tin chloride

B SF_6, sulfur hexafluoride

C $Fe_2(SO_4)_3$, iron(III) sulfate

D Au_2O_3, gold(III) oxide

Item Information

Item Code:	TEC120429	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	3-4

What is the approximate percent composition by mass of carbon (C) in ascorbic acid ($C_6H_8O_6$)?

A 7%

B 12%

C 41%

D 69%

Item Information

Item Code:	TEC120361	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	1

Which of these is the IUPAC name for PCl_5?

A monophosphorus tetrachloride

B phosphorus(V) chloride

C phosphorus hypochlorite

D phosphorus pentachloride

Item Information

Item Code:	TEC110067	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

Given the compound $C_{12}H_{22}O_{11}$, determine the molar mass.

A 15 g/mol

B 45 g/mol

C 275 g/mol

D 342 g/mol

Item Information

Item Code:	TEC120544	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	3-4

An analysis shows a solid substance is composed of 20 g of Ca and 80 g of Br. What is the empirical formula of this compound?

A $CaBr$

B $CaBr_2$

C $CaBr_4$

D Ca_2Br

Item Information

Item Code:	TEC120171	Passage Title:	
Standard Code:	3221.3.2	Passage Code:	
Standard Text:	Determine the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

Which equation represents a single replacement reaction?

A $AgNO_3 + BaCl_2 \rightarrow AgCl + Ba(NO_3)_2$

B $C_8H_{18} + O_2 \rightarrow CO_2 + H_2O$

C $K + MgBr_2 \rightarrow KBr + Mg$

D $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$

Item Information

Item Code:	TEC120010	Passage Title:	
Standard Code:	3221.3.2	Passage Code:	
Standard Text:	Determine the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

Which of these describes a combustion reaction?

A when two or more substances combine to form one substance

B when one compound breaks down into two or more substances

C when two compounds interchange elements to form two new compounds

D when a compound quickly combines with oxygen to release energy

Item Information

Item Code:	TEC120142	Passage Title:	
Standard Code:	3221.3.2	Passage Code:	
Standard Text:	Determine the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

Which reactants will combine to produce zinc sulfide (ZnS) in a double replacement reaction?

A $Zn(s)$ and $SO_4(s)$

B $Zn(s)$ and $H_2S(aq)$

C $ZnSO_4(s)$ and $Na(s)$

D $Zn(NO_3)_2(aq)$ and $Na_2S(aq)$

Item Information

Item Code:	TEC120546	Passage Title:	
Standard Code:	3221.3.2	Passage Code:	
Standard Text:	Determine the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	2

Carbonic acid (H_2CO_3) forms carbon dioxide (CO_2) and water (H_2O) during a decomposition reaction. Which of these represents the reactant side of the chemical reaction?

A H_2CO_3

B $H_2O + CO_2$

C $CO_2 + H_2CO_3$

D $H_2O + CO_2 + H_2CO_3$

Item Information

Item Code:	TEC120201	Passage Title:	
Standard Code:	3221.3.2	Passage Code:	
Standard Text:	Determine the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

Which of these is a characteristic of a composition reaction?

A The reactants are two metals.

B The reactants form a single product.

C The reactants produce two or more products.

D The reactants separate into individual atoms.

Item Information

Item Code:	TEC120084	Passage Title:	
Standard Code:	3221.3.3	Passage Code:	
Standard Text:	Predict the products of a chemical reaction (e.g., composition and decomposition of binary compounds).		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

A partial chemical equation is shown.

$$\mathbf{Cu + F_2 \rightarrow \_\_}$$

Copper (Cu) has two oxidation states, +1 and +2. Which of these are possible products of the chemical reaction?

A CuF and Cu_2F

B Cu_2F and CuF_2

C Cu_2F_2 and CuF_2

D CuF and CuF_2

Item Information

Item Code:	TEC120096	Passage Title:	
Standard Code:	3221.3.3	Passage Code:	
Standard Text:	Predict the products of a chemical reaction (e.g., composition and decomposition of binary compounds).		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	2

The partial chemical equation represents the reaction between aluminum (Al) and iodine (I_2) in the presence of water.

$$Al + I_2 \rightarrow \_\_$$

What is the expected product of the reaction?

A AlI_3

B Al_3I

C Al_3I_3

D AlI

Item Information

Item Code:	TEC110211	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

What is the value of the coefficient for oxygen when the equation is balanced?

$$\_\_\_C_2H_4 + \_\_\_O_2 \rightarrow \_\_\_CO_2 + \_\_\_H_2O$$

A 2

B 3

C 4

D 6

Item Information

Item Code:	TEC120643	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

An unbalanced chemical equation is shown.

$$\_\_CaO + \_\_H_3PO_4 \rightarrow \_\_Ca_3(PO_4)_2 + \_\_H_2O$$

What is the molar ratio of H_3PO_4 to H_2O when the equation is balanced?

A 3 : 1

B 1 : 2

C 2 : 3

D 3 : 2

Item Information

Item Code:	TEC120282	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

The chemical equation represents the reaction between aluminum bromide $(AlBr_3)$ and potassium sulfate (K_2SO_4).

$$\_\_\_AlBr_3 + \_\_\_K_2SO_4 \rightarrow \_\_\_KBr + \_\_\_Al_2(SO_4)_3$$

What is the molar ratio for aluminum bromide and potassium sulfate once the equation is balanced?

A 2 : 1

B 3 : 2

C 2 : 3

D 1 : 3

Item Information

Item Code:	TEC120594	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

Based on the amount of reactants shown in the chemical equation, how many moles of NO will be produced?

$$4NH_3 + 5O_2 \rightarrow \_\_NO + 6H_2O$$

A 3

B 4

C 5

D 6

Item Information

Item Code:	TEC110308	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

The unbalanced chemical equation represents a chemical reaction.

$$\mathbf{CuO + Al \rightarrow Cu + Al_2O_3}$$

When balancing the equation, what are the lowest correct coefficients?

A 2, 3, 2, 1

B 2, 3, 2, 3

C 3, 2, 3, 1

D 1, 3, 3, 2

Item Information

Item Code:	TEC110307	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

The chemical reaction represents photosynthesis.

$$\_\_\_CO_2 + \_\_\_H_2O + \text{energy} \rightarrow \_\_\_C_6H_{12}O_6 + \_\_\_O_2$$

Which set of coefficients correctly balances the chemical equation given?

A 3, 6, 1, 4

B 9, 4, 2, 3

C 6, 6, 1, 6

D 1, 2, 1, 3

Item Information

Item Code:	TEC110137	Passage Title:	
Standard Code:	3221.3.5	Passage Code:	
Standard Text:	Convert among the following quantities of a substance: mass, number of moles, number of particles, molar volume at STP.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

As part of a chemistry lab experiment, a student prepares a solution using 1.75 moles of sodium chloride (NaCl). How many grams of NaCl are needed for the experiment?

A 1.75 g

B 33.4 g

C 58.4 g

D 102 g

Item Information

Item Code:	TEC120207	Passage Title:	
Standard Code:	3221.3.5	Passage Code:	
Standard Text:	Convert among the following quantities of a substance: mass, number of moles, number of particles, molar volume at STP.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

What is the approximate mass of 1.50 moles of magnesium nitride (Mg_3N_2)?

A 57.1 grams

B 101 grams

C 129 grams

D 151 grams

Item Information

Item Code:	TEC120400	Passage Title:	
Standard Code:	3221.3.6	Passage Code:	
Standard Text:	Identify and solve stoichiometry problems which interconvert volume of gases at STP, moles, and mass.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	3-4

What is the mass of 44.8 L of argon (Ar) gas at STP?

A 0.05 g

B 19.9 g

C 25.1 g

D 79.9 g

Item Information

Item Code:	TEC120662	Passage Title:	
Standard Code:	3221.3.6	Passage Code:	
Standard Text:	Identify and solve stoichiometry problems which interconvert volume of gases at STP, moles, and mass.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

The chemical equation shows the reaction between calcium oxide (CaO) and carbon (C).

$$\mathbf{CaO + 3C \rightarrow CaC_2 + CO}$$

How many grams of calcium carbide (CaC_2) will be produced when 36.0 grams of CaO react with excess C?

A 31.5 grams

B 33.4 grams

C 41.2 grams

D 101 grams

Item Information

Item Code:	TEC120664	Passage Title:	
Standard Code:	3221.3.6	Passage Code:	
Standard Text:	Identify and solve stoichiometry problems which interconvert volume of gases at STP, moles, and mass.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	3-4

The chemical equation represents the reaction between acetylene (C_2H_2) and oxygen gas (O_2).

$$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$$

How many grams of carbon dioxide (CO_2) will the reaction produce from 3.50 grams of oxygen in excess acetylene?

A 3.85 grams

B 6.02 grams

C 7.70 grams

D 12.0 grams

Item Information

Item Code:	TEC120238	Passage Title:	
Standard Code:	3221.3.7	Passage Code:	
Standard Text:	Classify substances as acids or bases based on their formulas and how they react with litmus and phenolphthalein.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

The table shows four solutions and the observed reactions to acid-base indicators.

Solution	Reaction with Litmus	Reaction with Phenolphthalein
1	Red litmus stays red	No observed reaction
2	Blue litmus turns red	Turns pink to colorless
3	Red litmus turns blue	Turns colorless to pink
4	Blue litmus stays blue	Turns colorless to pink

Which solution is <u>most</u> likely acidic based on the observations recorded in the table?

A Solution 1

B Solution 2

C Solution 3

D Solution 4

Item Information

Item Code:	TEC110071	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	1

What is the balanced nuclear equation for the alpha decay of radium-226 into radon?

A $^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Rn} + {}^{4}_{2}\mathrm{He}$

B $^{226}_{88}\mathrm{Ra} \rightarrow {}^{222}_{86}\mathrm{Rn} + 2\left({}^{2}_{1}\mathrm{He}\right)$

C $^{226}_{88}\mathrm{Ra} \rightarrow {}^{226}_{86}\mathrm{Rn} + {}^{0}_{-2}\mathrm{e}$

D $^{226}_{88}\mathrm{Ra} \rightarrow {}^{226}_{86}\mathrm{Rn} + 2\left({}^{0}_{-1}\mathrm{e}\right)$

Item Information

Item Code:	TEC120603	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

The equation represents the decay of Th-231.

$$^{231}\text{Th} \rightarrow {}^{231}\text{Pa} + \_\_\_$$

Which of these completes the equation shown?

A gamma ray

B beta particle

C alpha particle

D proton particle

Item Information

Item Code:	TEC120668	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	3-4

The half-life for beryllium-11 is 13.81 seconds. How much time passes before an initial amount of 9.0 grams of beryllium-11 decays to 0.28 gram?

A 0.43 second

B 14 seconds

C 69 seconds

D 450 seconds

Item Information

Item Code:	TEC110247	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

The nuclear reaction represents the alpha decay of the americium-241 isotope.

$$^{241}_{95}\mathrm{Am} \rightarrow {}^{4}_{2}\mathrm{He} + ?$$

Which product results from the decay of americium-241?

A $^{244}_{97}\mathrm{Bk}$

B $^{237}_{93}\mathrm{Np}$

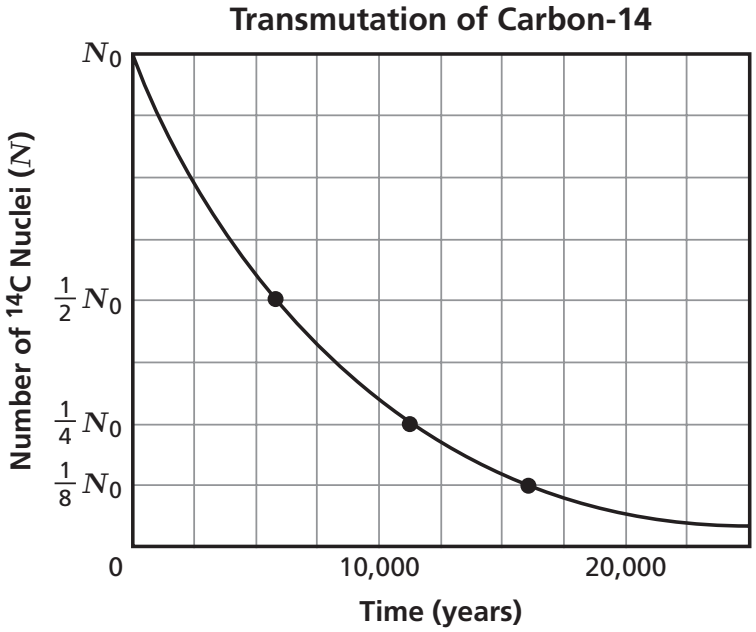
C $^{237}_{93}\mathrm{Bk}$

D $^{237}_{95}\mathrm{Np}$

Item Information

Item Code:	TEC120178	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

The graph represents the transmutation of carbon-14.



Which property of carbon-14 does the graph illustrate?

A the unpredictable decay rate of a radioactive isotope

B the predictable decay rate of a radioactive isotope

C the random rate of loss of mass in a radioactive isotope

D the uniform rate of energy absorption of a radioactive isotope

Item Information

Item Code:	TEC120602	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	3-4

The half-life of iodine-131 is about 8 days. What is the approximate percent of a sample of iodine-131 that remains after 24 days?

A 3%

B 12%

C 28%

D 50%

Item Information

Item Code:	TEC120017	Passage Title:	
Standard Code:	3221.Inq.2	Passage Code:	
Standard Text:	Analyze the components of a properly designed scientific investigation.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

A student sets up a scientific investigation to determine which type of fatty acid yields the most soapsuds when used in soap. The student takes 1 mL samples from four different soaps containing different fatty acids and places each sample into a separate bottle containing 20 mL of water. Then the student shakes each bottle to dissolve the soap samples. The results of the investigation are given in the table.

Suds Produced from Different Fatty Acids

Sample	Volume of Suds (mL)
Sample 1	5
Sample 2	3
Sample 3	4
Sample 4	2

What could the student have done to obtain a reliable experimental outcome?

A use Sample 1 for all the investigations because it produces the most suds

B use experimental controls to identify false results

C use 2 mL of the soap samples in 10 mL of water and shake vigorously

D use another solvent and repeat the same investigation

Item Information

Item Code:	TEC120517	Passage Title:	
Standard Code:	3221.Inq.3	Passage Code:	
Standard Text:	Determine appropriate tools to gather precise and accurate data.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	2

Students observed the reaction represented by the chemical equation shown.

$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$$

The amount of sodium bicarbonate ($NaHCO_3$) reacted determines the amount of carbon dioxide (CO_2) released. Which of these can the students use to make the <u>most</u> precise and accurate measurement of the amount of $NaHCO_3$ used?

A a pH sensor probe with a resolution of 0.005 pH unit

B a 500 mL beaker, a graduated cylinder, and a rubber balloon

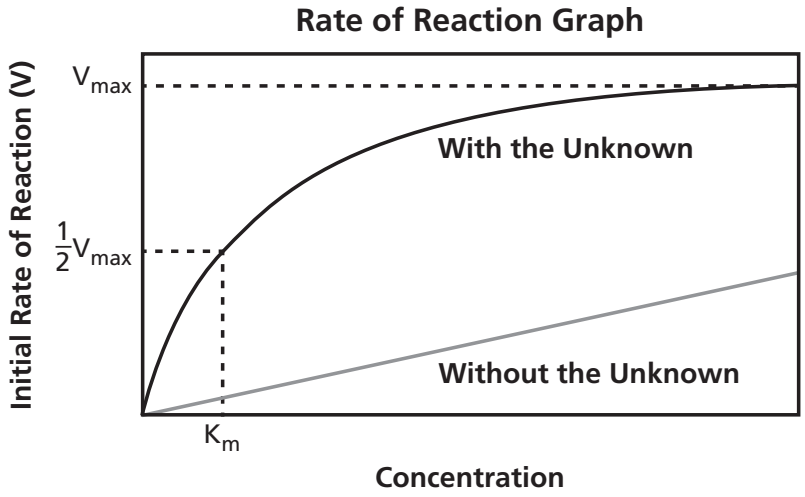
C a digital thermometer that gives results in whole and 0.5 degrees Celsius

D a metric balance that measures in units that are precise to 0.001 g

Item Information

Item Code:	TEC120373	Passage Title:	
Standard Code:	3221.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	3-4

The graph shows reaction rate curves.



A student concludes that the unknown chemical acts as a catalyst. Which evidence from the graph supports the student's conclusion?

A The amount of product increased when the chemical was added.

B The chemical remained unchanged at the end of the reaction.

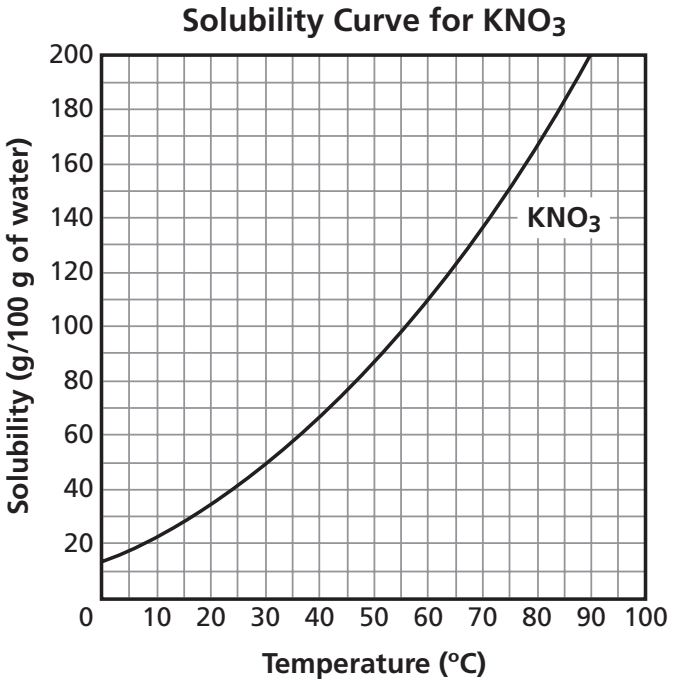
C The rate of reaction increased when the chemical was added.

D The chemical caused a reduction in the rate of reaction.

Item Information

Item Code:	TEC120519	Passage Title:	
Standard Code:	3221.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	3-4

The solubility curve of potassium nitrate (KNO_3) is shown.



Which statement provides the best conclusion based on the graph?

A Solubility increases as the temperature increases.

B Solubility decreases as the temperature increases.

C Solubility decreases as the surface area increases.

D Solubility increases as the stirring decreases.

Item Information

Item Code:	TEC110451	Passage Title:	
Standard Code:	3221.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	2

The table shows data collected for the temperature and volume of a gas during an investigation.

	Initial Volume at 400 Kelvin	Final Volume at 600 Kelvin
Sample 1	3 L	4.5 L
Sample 2	6 L	9 L
Sample 3	5 L	7.5 L

Based on the table, which statement is a defensible conclusion?

A The volume of the gas increases as the temperature increases.

B The volume and temperature of the gas remain constant at all times.

C The temperature of the gas increases as the volume decreases.

D The temperature of the gas decreases as the volume increases.

Item Information

Item Code:	TEC120610	Passage Title:	
Standard Code:	3221.Inq.6	Passage Code:	
Standard Text:	Determine why a conclusion is free of bias.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	3-4

Researchers are considering performing clinical trials on 8250 participants to determine the effectiveness of a medication to lower cholesterol. Which method will most likely ensure that the conclusion is free of bias?

A prescribing a specific diet for participants in addition to the medication

B choosing random participants from all geographical areas

C informing technicians of the expected results prior to the laboratory analysis

D accepting participants with normal cholesterol levels

Item Information

Item Code:	TEC120036	Passage Title:	
Standard Code:	3221.Inq.6	Passage Code:	
Standard Text:	Determine why a conclusion is free of bias.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	3-4

A scientist is testing a chemical for treatment of a disease. The chart shows two possible designs for the test.

Design 1	Patients who report the most severe symptoms are placed in the experimental group, and others are placed in a control group.
Design 2	Patients are placed in the experimental group and control group, and neither the patients nor the scientist know which treatment is being administered to which group.

Which experimental design would allow for the scientist to reach a conclusion without bias?

A Design 1, because the effect of the chemical would be most evident when given to those with severe symptoms

B Design 1, because the chemical would be more effective at treating patients who report they are very sick

C Design 2, because the chemical would be more effective if the patients know they are taking it

D Design 2, because neither the patient nor the scientist would know if the chemical has been administered

Item Information

Item Code:	TEC120262	Passage Title:	
Standard Code:	3221.TE.1	Passage Code:	
Standard Text:	Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	2

Which tool best serves the intended purpose?

A measure 50.2 mL of a liquid using a flask

B measure the volume of 20 L of a gas using a balance

C measure the density of an irregular object using a metric ruler

D measure the boiling point of a liquid using a thermometer

Item Information

Item Code:	TEC120530	Passage Title:	
Standard Code:	3221.TE.2	Passage Code:	
Standard Text:	Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	2

A pharmaceutical company has designed a chemical formula to synthesize a revolutionary sanitizer. The company claims that the new sanitizer reduces hospital-acquired infections better than existing methods. Which step should be taken next to prove the claim?

A researching the current methods used by hospital staff

B changing the chemical formula as suggested by health inspectors

C testing the sanitizer by setting up a control center and a testing center

D making large batches of the sanitizer and providing it for general hospital use

Item Information

Item Code:	TEC120246	Passage Title:	
Standard Code:	3221.TE.3	Passage Code:	
Standard Text:	Evaluate the overall benefit to cost ratio of a new technology.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

In many countries, nuclear fission is an established method of energy production used to meet energy needs. Which statement describes nuclear fission as a beneficial energy source?

A Disposal of radioactive waste products requires containment safeguards.

B Nuclear fission has little effect on global warming.

C Possible nuclear radiation leaks can lead to harmful effects on civilians.

D High amounts of heat are released into the environment.

Item Information

Item Code:	TEC120264	Passage Title:	
Standard Code:	3221.TE.3	Passage Code:	
Standard Text:	Evaluate the overall benefit to cost ratio of a new technology.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	2

Compressed natural gas (CNG) is preferred as a fuel over liquefied petroleum gas (LPG). Which of these is likely the greatest benefit of using CNG instead of LPG?

A The production cost of CNG fuel is higher compared to LPG fuel.

B Combustion of LPG creates 5% to 10% more greenhouse gases than CNG.

C The energy yield from LPG is higher than the energy yield from CNG.

D CNG emits 20% to 45% less smog-forming pollutants than LPG.

Item Information

Item Code:	TEC120127	Passage Title:	
Standard Code:	3221.TE.4	Passage Code:	
Standard Text:	Use design principles to determine if a new technology will improve the quality of life for an intended audience.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	3-4

Lithium batteries in gasoline-electric hybrid cars can reduce air pollution and fuel consumption. However, engineers have found that lithium is gradually deposited in the current collector of the hybrid car, reducing battery efficiency. What effect will this have on hybrid technology if the battery design remains unchanged?

A The number of miles per gallon of gasoline for hybrid cars will increase as the batteries operate over time.

B The cost of replacing the batteries in hybrid cars will encourage the continued use of gasoline-only cars.

C The amount of pollution given off by hybrid cars will not change over time.

D The cost of driving the hybrid cars will decrease to the point where gasoline-only cars are eliminated.

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Tennessee Comprehensive Assessment Program TCAP
TNReady—Chemistry
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Spring 2018

Tennessee Comprehensive Assessment Program

TCAP

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TN Department of Education

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Item Information

Item Code:	TNS10220	Passage Title:	
Standard Code:	0307.1.1	Passage Code:	
Standard Text:	Identify specific parts of a plant and describe their function.		
Reporting Category:	Cells, Flow of Matter & Energy, Heredity		
Correct Answer:	B	DOK Level:	2

Item Code: Unique letter/number code used to identify the item.	**Passage Title:** (if listed): Title of the passage(s) associated with this item.
Standard Code: Primary educational standard assessed.	**Passage Code:** (if listed): Unique letter/number code used to identify the passage(s) that go with this item.
Standard Text: Text of the educational standard assessed.	
Reporting Category: Text of the Reporting Category the standard assesses.	
Correct Answer: Correct answer. This may be blank for constructed response items where students write or type their responses.	**DOK Level** (if listed): Depth of Knowledge (cognitive complexity) is measured on a four-point scale. 1= Recall; 2= Skill/Concepts; 3= Strategic Thinking; 3-4 = Strategic/Extended Thinking

Item Information

Item Code:	GS040040	Passage Title:	
Standard Code:	3210.1.1	Passage Code:	
Standard Text:	Identify the cellular organelles associated with major cell processes.		
Reporting Category:	Cells		
Correct Answer:	B	DOK Level:	1

Which correctly matches the cell process to the organelle in which it occurs?

A protein synthesis – lysosome

B respiration – mitochondrion

C photosynthesis – ribosome

D DNA replication – chloroplast

Item Information

Item Code:	GS050272	Passage Title:	
Standard Code:	3210.1.1	Passage Code:	
Standard Text:	Identify the cellular organelles associated with major cell processes.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	1

Most of the aerobic respiration of a cell takes place in which structure?

A chloroplast

B lysosome

C vacuole

D mitochondrion

Item Information

Item Code:	GS040042	Passage Title:	
Standard Code:	3210.1.2	Passage Code:	
Standard Text:	Distinguish between prokaryotic and eukaryotic cells.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	1

***Staphylococcus* cells are classified as prokaryotes because they**

A lack a cell membrane

B move using flagella

C move using cilia

D lack a nucleus

Item Information

Item Code:	GS040043	Passage Title:	
Standard Code:	3210.1.2	Passage Code:	
Standard Text:	Distinguish between prokaryotic and eukaryotic cells.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

A chart listing the characteristics of five cells is shown below.

Cell Characteristics

Cell	Nucleus	Cell Wall	Cell Membrane	Membrane Bound Organelles
1	No	Yes	Yes	No
2	Yes	Yes	Yes	Yes
3	Yes	No	Yes	Yes
4	Yes	Yes	Yes	Yes
5	No	Yes	Yes	No

Based on the chart, which cells would be classified as prokaryotic?

A 1 and 3

B 2 and 4

C 1 and 5

D 3 and 5

Item Information

Item Code:	TEB110080	Passage Title:	
Standard Code:	3210.1.2	Passage Code:	
Standard Text:	Distinguish between prokaryotic and eukaryotic cells.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

Which statement best supports the idea that eukaryotic cells evolved after prokaryotic cells?

A Eukaryotic cells are much smaller in size than prokaryotic cells.

B Eukaryotic cells are more common in the environment than prokaryotic cells.

C Eukaryotic cells are more complex than prokaryotic cells.

D Eukaryotic cells require less energy than prokaryotic cells.

Read the passage and answer questions XX and XX.

The hemlock woolly adelgid, *Adelges tsugae*, is a destructive aphid-like insect native to Asia. In North America this pest threatens the health of the eastern hemlock and Carolina hemlock trees. The adelgid was first reported near Richmond, VA, in 1951 and has since spread through the eastern states. The adelgid completes two life cycles within one year. As the adelgid matures, it produces a covering of white wool-like wax filaments. These filaments provide protection from predators and prevent the adelgid from drying out.

Feeding on stored starches that are crucial for the trees' growth, the adelgid can damage a hemlock enough that it can die within 4 years. Chemical control can help reduce the damage but is limited to individual tree treatments. The best control option is biological because there are natural predators that feed on the adelgid. Several beetle predators have been imported from China and Japan and are slowly becoming established in the infested areas.

Item Information

Item Code:	TEB120114	Passage Title:	
Standard Code:	3210.1.3	Passage Code:	
Standard Text:	Distinguish among proteins, carbohydrates, lipids, and nucleic acids.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	1

The white wool-like filamentous substance that the adelgid produces for protection is <u>most</u> likely made up of

A lipids.

B proteins.

C nucleic acids.

D carbohydrates.

Item Information

Item Code:	TEB120116	Passage Title:	
Standard Code:	3210.2.4	Passage Code:	
Standard Text:	Predict how various types of human activities affect the environment.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	3-4

Which is a negative ecological effect of introducing nonnative predators to help eradicate the hemlock woolly adelgid?

A The predators could begin to feed on the hemlock trees.

B The predators could disappear once they have depleted the adelgid population.

C The predators could mutate into an organism that no longer preys on the adelgid.

D The predators could attack other insect species that are beneficial to the ecosystem.

Item Information

Item Code:	GS001022	Passage Title:	
Standard Code:	3210.1.4	Passage Code:	
Standard Text:	Identify positive tests for carbohydrates, lipids, and proteins.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

Rick is using iodine to test a food sample for the presence of starch.

What color will the sample turn if starch is present?

A orange or red

B yellow or green

C dark blue or black

D light red or pink

Item Information

Item Code:	GS000092	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	B	DOK Level:	1

Cells regulate chemical reactions in order to produce things they need to grow and survive. What type of molecule is <u>most</u> responsible for regulating chemical reactions inside cells?

A lipids

B enzymes

C vitamins

D carbohydrates

Item Information

Item Code:	GS040353	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

Which best describes how the enzyme carbonic anhydrase helps to form carbonic acid from carbon dioxide and water?

A The enzyme binds the substrates together so they can react.

B The enzyme breaks apart so that the substrates are more likely to react.

C The enzyme strengthens the chemical bonds in both the water and the carbon dioxide.

D The enzyme increases the energy needed for the substrates to react.

Item Information

Item Code:	TEB110046	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

Which statement best explains the importance of enzymes lowering the activation energy necessary for reactions to take place?

A Reactions that require less energy to begin are able to occur more quickly.

B Reactions requiring less energy are able to produce less product.

C Reactions are able to proceed slowly to maintain the metabolism of the cells.

D Reactions produce heat, causing the chemical bonds to become strong.

Item Information

Item Code:	TEB120091	Passage Title:	
Standard Code:	3210.1.5	Passage Code:	
Standard Text:	Identify how enzymes control chemical reactions in the body.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	2

In the human mouth, saliva contains several enzymes used in digestion, one of which is amylase. When a person chews on a saltine cracker for a short while, a sweet taste is detected. What reaction is taking place in response to the enzyme amylase?

A Amylase is specifically binding with salt to create glucose.

B Amylase is producing the starch necessary to produce glucose.

C Amylase is increasing the activation energy needed to produce glucose.

D Amylase is catalyzing the digestion of the saltine cracker to produce glucose.

Item Information

Item Code:	TEB120319	Passage Title:	
Standard Code:	3210.1.6	Passage Code:	
Standard Text:	Determine the relationship between cell growth and cell reproduction.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

The data table below lists the increase in surface area and volume that occurs as a cell grows.

Cell Growth

Surface Area (m^2)	1	4	9	16	25
Volume (m^3)	1	8	27	64	125
Surface Area: Volume Ratio	1:1	1:2	1:3	1:4	1:5

Based on the data, which of these <u>best</u> describes why cells divide when they reach a certain size?

A The surface area-to-volume ratio of a cell remains constant during growth.

B The surface area of a cell increases more than its volume during growth.

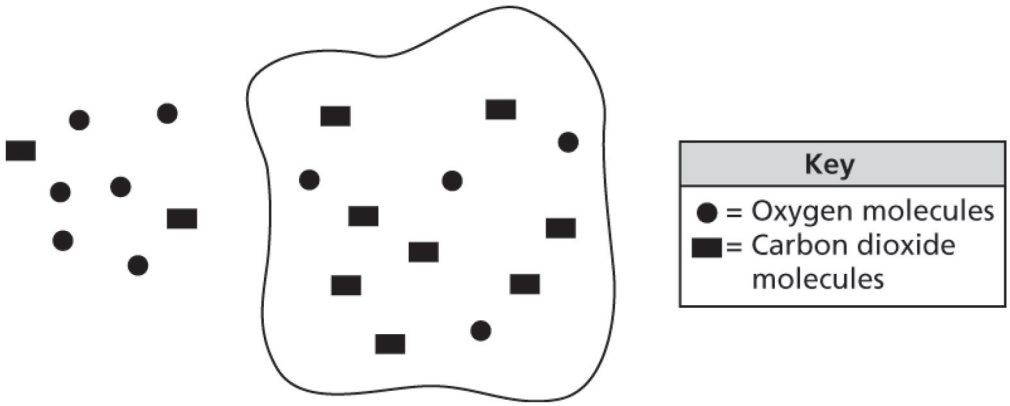
C The volume of a cell increases more than its surface area during growth.

D The volume of a cell increases as the surface area decreases during growth.

Item Information

Item Code:	GS040055	Passage Title:	
Standard Code:	3210.1.7	Passage Code:	
Standard Text:	Predict the movement of water and other molecules across selectively permeable membranes.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

A diagram of a cell is shown below. The cell membrane is permeable to both the oxygen and carbon dioxide molecules.



Initially, the oxygen and carbon dioxide molecules will <u>most</u> likely move in which direction?

A Oxygen will enter the cell, and carbon dioxide will exit the cell.

B Oxygen will exit the cell, and carbon dioxide will enter the cell.

C Both oxygen and carbon dioxide will enter the cell.

D Both oxygen and carbon dioxide will exit the cell.

Item Information

Item Code:	TEB120248	Passage Title:	
Standard Code:	3210.1.7	Passage Code:	
Standard Text:	Predict the movement of water and other molecules across selectively permeable membranes.		
Reporting Category:	Cells		
Correct Answer:	A	DOK Level:	2

An animal cell is placed in an isotonic solution. Which best explains why there is no net movement of water across the cell membrane?

A Water flows across the membrane at the same rate in both directions.

B Water flows into the cell at a faster rate, causing the cell to swell.

C Water flows out of the cell at a faster rate, causing the cell to shrink.

D Water flows across the membrane at a slower rate in one direction.

Item Information

Item Code:	GS040156	Passage Title:	
Standard Code:	3210.1.8	Passage Code:	
Standard Text:	Compare and contrast active and passive transport.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	1

Some protein channels in a cell membrane can use energy to change their shape to allow certain molecules to pass through the membrane. This is an example of

A facilitated transport.

B diffusion.

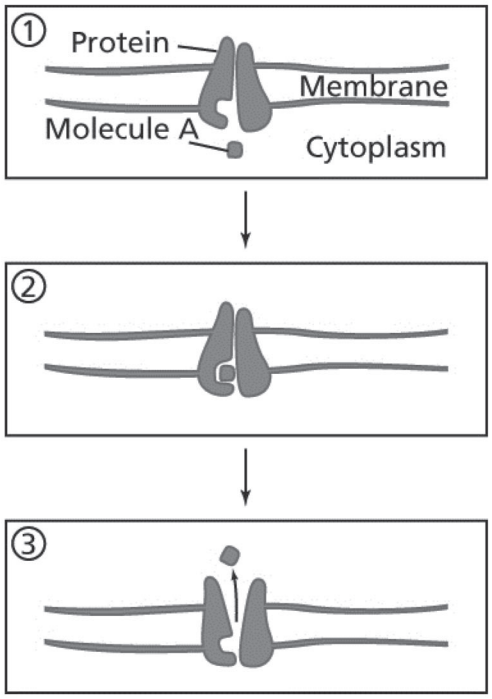
C exocytosis.

D active transport.

Item Information

Item Code:	GS010257	Passage Title:	
Standard Code:	3210.1.8	Passage Code:	
Standard Text:	Compare and contrast active and passive transport.		
Reporting Category:	Cells		
Correct Answer:	D	DOK Level:	2

The diagram below shows a cellular process that requires energy.



What process allowed molecule A to leave the cell?

A osmosis

B diffusion

C passive transport

D active transport

Item Information

Item Code:	TEB110347	Passage Title:	
Standard Code:	3210.1.8	Passage Code:	
Standard Text:	Compare and contrast active and passive transport.		
Reporting Category:	Cells		
Correct Answer:	C	DOK Level:	2

Cells are able to pump ions across their membranes in opposition to a concentration gradient due to

A the destruction of electrons within the cell.

B a drop in temperature outside the cell.

C an expenditure of energy by the cell.

D a vacuole formation within the cell.

Item Information

Item Code:	TEB120144	Passage Title:	
Standard Code:	3210.1.8	Passage Code:	
Standard Text:	Compare and contrast active and passive transport.		
Reporting Category:	Cells		
Correct Answer:	B	DOK Level:	2

The energy necessary to move sodium ions across a cell membrane comes from

A the movement of H_2O.

B the use of ATP.

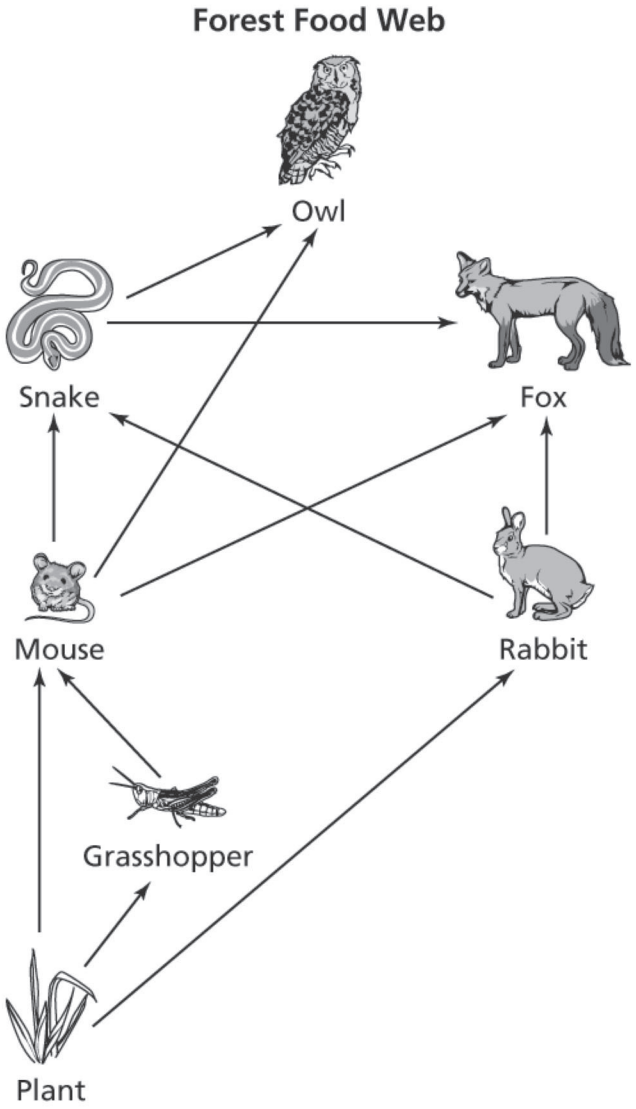
C the manufacturing of RNA.

D the replication of DNA.

Item Information

Item Code:	GS040059	Passage Title:	
Standard Code:	3210.2.1	Passage Code:	
Standard Text:	Predict how population changes of organisms at different trophic levels affect an ecosystem.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

A food web of a forest ecosystem is shown in the diagram below.



Which will <u>most</u> likely happen if the number of snakes in the ecosystem decreases?

A increase in owl population

B increase in rabbit population

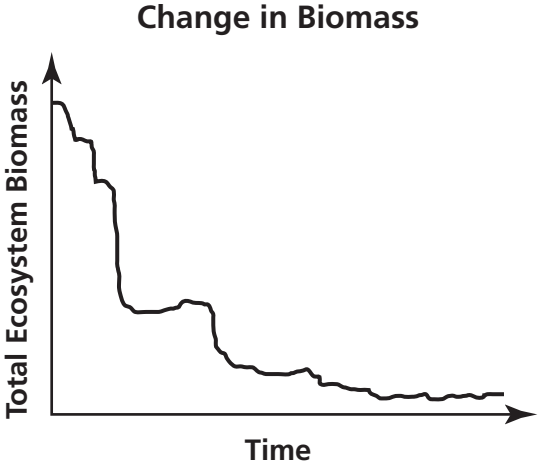
C decrease in mouse population

D decrease in grasshopper population

Item Information

Item Code:	TEB120173	Passage Title:	
Standard Code:	3210.2.1	Passage Code:	
Standard Text:	Predict how population changes of organisms at different trophic levels affect an ecosystem.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	2

The graph below shows the change in the total ecosystem biomass over time.



This overall system change was <u>most</u> likely caused by a rapid decline in the populations at which trophic level?

A decomposer

B primary consumer

C tertiary consumer

D producer

Item Information

Item Code:	GS040170	Passage Title:	
Standard Code:	3210.2.2	Passage Code:	
Standard Text:	Interpret the relationship between environmental factors and fluctuations in population size.		
Reporting Category:	Interdependence		
Correct Answer:	C	DOK Level:	2

Methyl mercury is a toxic chemical that is formed when mercury is combined with water. Methyl mercury accumulates in the tissues of organisms, and the concentration increases at each trophic level. Which population of organisms would be <u>most</u> harmed by an increase in mercury content?

A lake-bottom plants

B photosynthetic microorganisms

C carnivorous fish

D herbivorous crustaceans

Item Information

Item Code:	TEB110216	Passage Title:	
Standard Code:	3210.2.2	Passage Code:	
Standard Text:	Interpret the relationship between environmental factors and fluctuations in population size.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	2

Ecologists have found that dense populations of organisms have lower birth rates, higher death rates, and slower growth rates than less dense populations. Which best explains these findings?

A interactions between predator and prey

B natural environmental disturbances

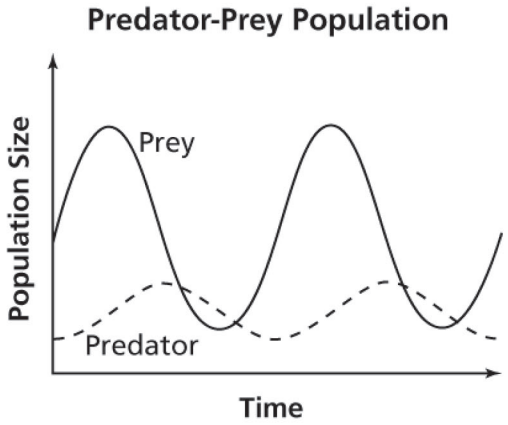
C unusual weather changes

D stressors from competition for resources

Item Information

Item Code:	GS040006	Passage Title:	
Standard Code:	3210.2.3	Passage Code:	
Standard Text:	Determine how the carrying capacity of an ecosystem is affected by interactions among organisms.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

The graph below represents the fluctuations for a predator and prey population based on the carrying capacity of that particular ecosystem.



Based on the data in the graph, which statement is a valid conclusion?

A The increase in prey population is a result of an increased predator population.

B The increase in predator population is a result of an increased prey population.

C The predator and prey populations increase and decrease at the exact same time.

D The predator and prey populations have no effect on each other's population size.

Item Information

Item Code:	GS040162	Passage Title:	
Standard Code:	3210.2.3	Passage Code:	
Standard Text:	Determine how the carrying capacity of an ecosystem is affected by interactions among organisms.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	2

How would the carrying capacity of an ecosystem be affected if there were a decrease in the number of decomposers?

A It would increase as a result of more available space.

B It would increase due to less competition occurring among organisms.

C It would remain the same regardless of the decomposer population.

D It would decrease due to a low amount of available nutrients for plants.

Item Information

Item Code:	TEB110209	Passage Title:	
Standard Code:	3210.2.5	Passage Code:	
Standard Text:	Make inferences about how a specific environmental change can affect the amount of biodiversity.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	3-4

Plants and animals require particular physical habitats and often have species-specific ranges of temperature and moisture levels in which they can survive and reproduce. This combination of requirements often limits where they exist geographically. Because species interact and rely upon other species in many different ways, which is a likely effect of a warming climate on the interaction of species in an ecosystem?

A The organisms in the ecosystem will become extinct immediately because they cannot adapt.

B The majority of flowering plants will remain dormant until favorable conditions return to their ecosystem.

C The plants will find other means of transporting their seeds to more favorable habitats.

D The life cycle of many insects will be disrupted, and they may not be available to pollinate the plants.

Item Information

Item Code:	GS040103	Passage Title:	
Standard Code:	3210.2.6	Passage Code:	
Standard Text:	Predict how a specific environmental change may lead to the extinction of a particular species.		
Reporting Category:	Interdependence		
Correct Answer:	D	DOK Level:	2

Five hundred acres of timber need to be harvested from a 1000-acre wildlife area. One option is to remove a 500-acre plot, while another option is to remove five 100-acre sections. Why would the first option be more damaging to the ecosystem?

A Displaced species would be able to move to nearby undisturbed sections.

B Replanting efforts would be less disruptive to remaining preserve areas.

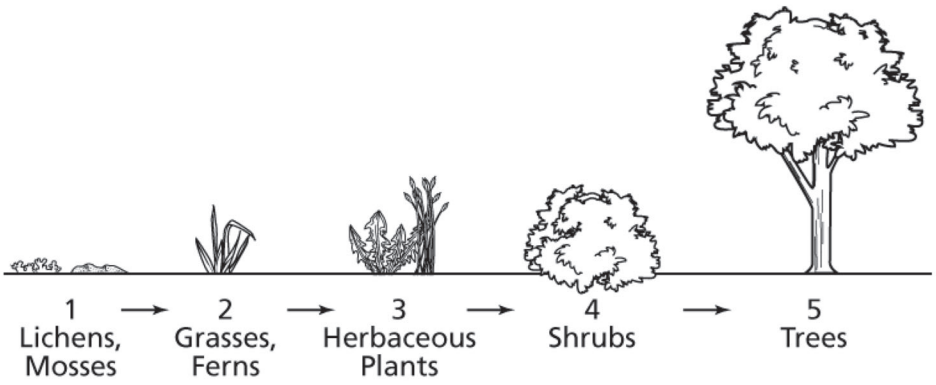
C Fewer roads would have to be made to accommodate forestry.

D A species may become extinct due to elimination of its habitat.

Item Information

Item Code:	GS040072	Passage Title:	
Standard Code:	3210.2.7	Passage Code:	
Standard Text:	Analyze factors responsible for the changes associated with biological succession.		
Reporting Category:	Interdependence		
Correct Answer:	A	DOK Level:	2

A diagram representing succession is shown below.



Herbaceous plants become less numerous in the final stages of succession. Which of these factors <u>most</u> likely limits their ability to survive?

A too little sunlight

B too much water

C too many soil minerals

D too few grazing herbivores

Item Information

Item Code:	TEB120324	Passage Title:	
Standard Code:	3210.2.7	Passage Code:	
Standard Text:	Analyze factors responsible for the changes associated with biological succession.		
Reporting Category:	Interdependence		
Correct Answer:	B	DOK Level:	2

Which statement best explains why grasses and shrubs give way to larger and more complex plant species such as hardwood and softwood trees over time due to ecological succession?

A Tree seedlings require fewer nutrients than grass seedlings do in order to mature.

B An increasing amount of soil allows for the establishment of more extensive root systems.

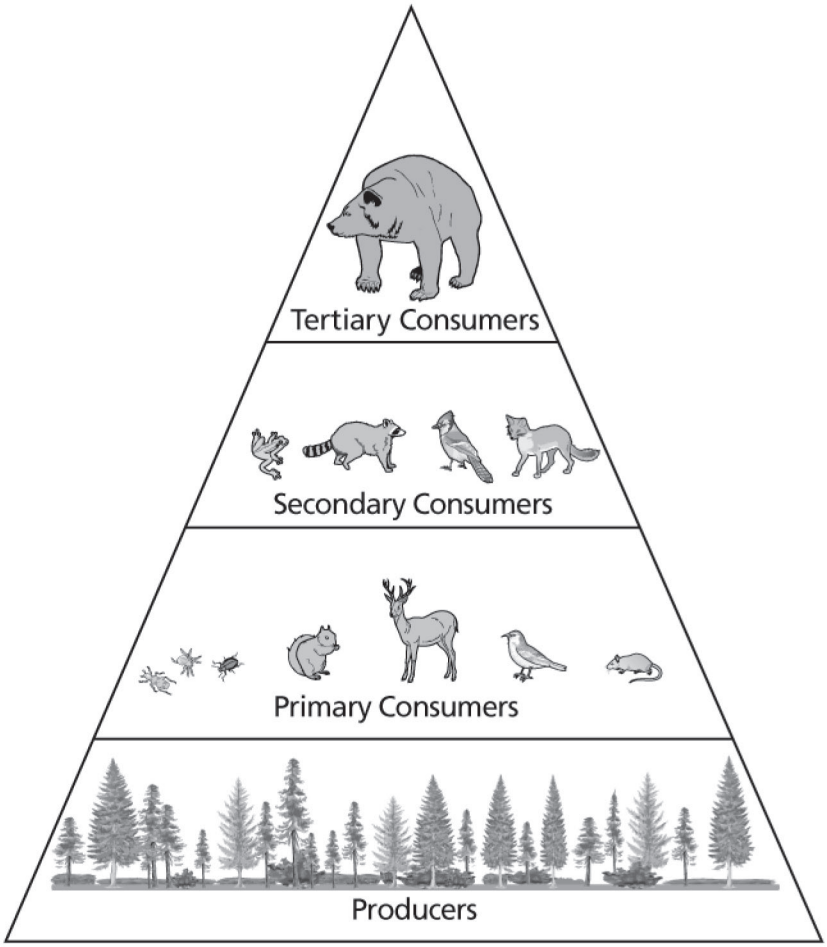
C Tree seeds require a higher soil temperature than grass seeds do in order to germinate.

D An increasing amount of sunlight reaching the forest floor facilitates the germination of tree seeds.

Item Information

Item Code:	GS040105	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	2

An energy pyramid representing a woodland ecosystem is shown below.



Which <u>best</u> explains how energy is transferred within the energy pyramid?

A All available energy is transferred to the highest trophic level.

B All available energy remains in the lowest trophic level.

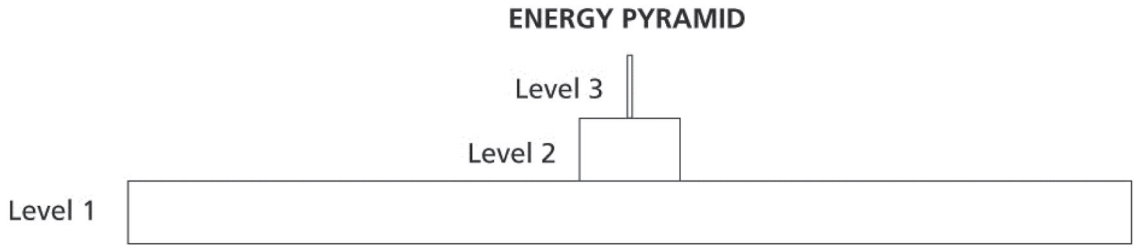
C Each trophic level receives all the energy from the previous level.

D Each trophic level receives a small percentage of energy from the previous level.

Item Information

Item Code:	GS000705	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	1

Study the energy pyramid shown below.



Approximately what percent of the energy in Level 1 will be transferred to Level 2?

A 10 percent

B 25 percent

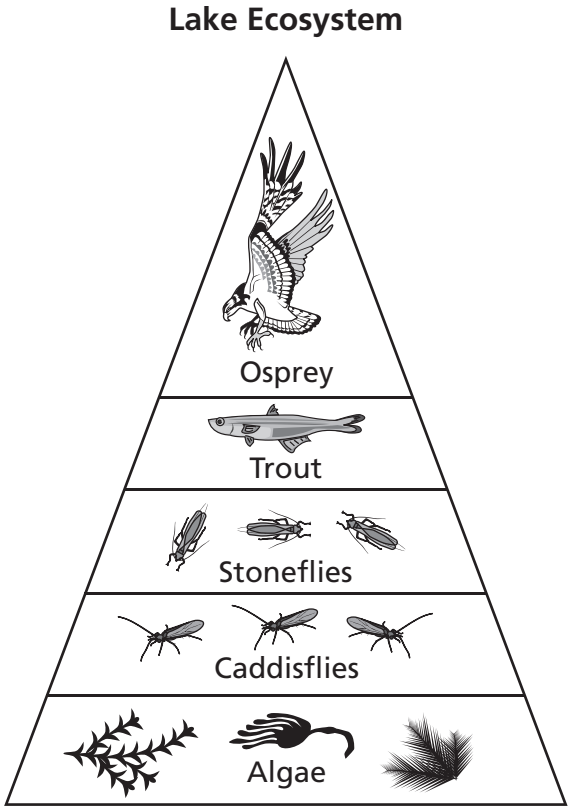
C 50 percent

D 90 percent

Item Information

Item Code:	GS040239	Passage Title:	
Standard Code:	3210.3.1	Passage Code:	
Standard Text:	Interpret a diagram that illustrates energy flow in an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	2

An energy pyramid of a lake ecosystem is shown below.



Stoneflies directly obtain energy from which trophic level?

A Algae

B Caddisflies

C Trout

D Osprey

Item Information

Item Code:	GS040363	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	A	DOK Level:	2

Which description best represents the biological process that produces the greatest number of ATP molecules?

A the use of oxygen to perform aerobic respiration

B the movement of nutrient molecules through diffusion

C the absorption of carbon dioxide to perform photosynthesis

D the division of cells through asexual reproduction

Item Information

Item Code:	GS010376	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	1

What is one way anaerobic respiration differs from aerobic respiration?

A It produces sugars from sunlight.

B It produces fewer molecules of ATP.

C It only occurs when oxygen is present.

D It only occurs in the presence of a catalyst.

Item Information

Item Code:	GS040361	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	1

The process of fermentation takes place

A when oxygen is present

B when no oxygen is available

C when water is present

D when no water is available

Item Information

Item Code:	TEB120111	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	2

A sports physiologist was monitoring athletes to determine at which point their muscles began to work under anaerobic conditions. The best way to test for this would be to check for a buildup of

A ADP.

B ATP.

C lactic acid.

D carbon dioxide.

Item Information

Item Code:	TEB120320	Passage Title:	
Standard Code:	3210.3.2	Passage Code:	
Standard Text:	Distinguish between aerobic and anaerobic respiration.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	3-4

Which statement best explains what occurs in skeletal muscle cells during vigorous exercise?

A They produce more than 36 molecules of ATP per molecule of glucose.

B They switch from breaking down glucose to synthesizing glucose.

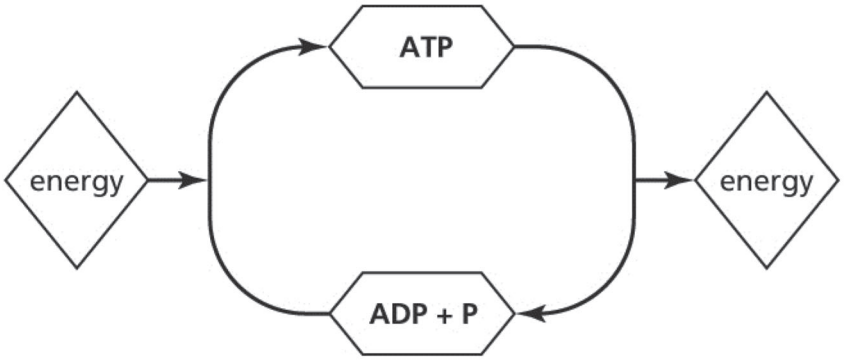
C They switch from anaerobic respiration to aerobic respiration.

D They produce lactic acid instead of carbon dioxide.

Item Information

Item Code:	GS001024	Passage Title:	
Standard Code:	3210.3.3	Passage Code:	
Standard Text:	Compare and contrast photosynthesis and cellular respiration in terms of energy transformation.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	2

Study the diagram below.



Which of these processes provides energy that is used most directly to make ATP?

A the storage of sugars

B the transport of sugars

C the synthesis of sugars

D the breakdown of sugars

Item Information

Item Code:	GS040154	Passage Title:	
Standard Code:	3210.3.3	Passage Code:	
Standard Text:	Compare and contrast photosynthesis and cellular respiration in terms of energy transformation.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	2

The solar energy necessary for photosynthesis is converted to chemical energy and released for the cell's use by which process?

A radiation

B distillation

C respiration

D transpiration

Item Information

Item Code:	TEB120019	Passage Title:	
Standard Code:	3210.3.3	Passage Code:	
Standard Text:	Compare and contrast photosynthesis and cellular respiration in terms of energy transformation.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	3-4

Heterotrophs depend on autotrophs for chemical energy in a food chain. Which statement describes how autotrophs depend on heterotrophs for survival?

A supply oxygen for aerobic respiration

B provide sunlight for photosynthesis

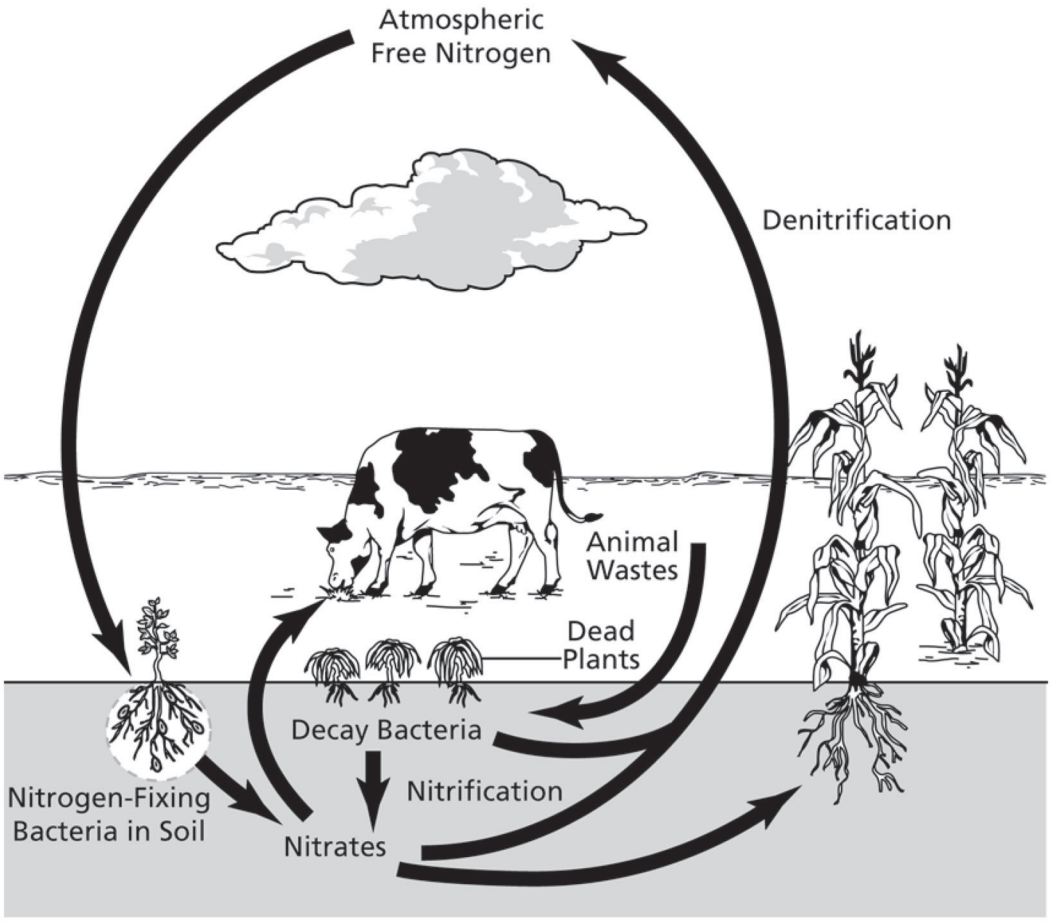
C produce carbon dioxide gas for photosynthesis

D make lactic acid during anaerobic respiration

Item Information

Item Code:	GS040253	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	B	DOK Level:	2

The diagram below represents the nitrogen cycle.



Which statement <u>best</u> explains what would most likely occur first if the amount of organic matter in an area suddenly decreased?

A The number of decomposers would increase.

B The amount of available nitrogen in the soil would decrease.

C The number of nitrogen-fixing bacteria would increase.

D The amount of atmospheric nitrogen would decrease.

Item Information

Item Code:	GS010190	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	D	DOK Level:	2

A city of one million people produces approximately 864,000 kilograms of air pollutants a day, including large amounts of sulfur oxides. What is the <u>most</u> likely effect of this pollution on the environment?

A increase of the ozone in the stratosphere

B larger number of plant life in the city

C reduction of the greenhouse effect

D an increase in acid rain

Item Information

Item Code:	GS010433	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	2

The burning of fossil fuels has increased carbon dioxide emissions dramatically since the 1950s. If the amount of carbon dioxide in the atmosphere continues to rise, it appears to cause a warming trend and affect ecosystems throughout the world by

A increasing the amount of acid rain.
B increasing the amount of ultraviolet radiation.
C changing climates and melting the polar ice caps.
D contaminating water sources with toxic chemicals.

Item Information

Item Code:	TEB110078	Passage Title:	
Standard Code:	3210.3.4	Passage Code:	
Standard Text:	Predict how changes in a biogeochemical cycle can affect an ecosystem.		
Reporting Category:	Flow of Matter & Energy		
Correct Answer:	C	DOK Level:	1

Decomposers play an important role in the nitrogen cycle to help maintain the health of an ecosystem. Which would most likely occur if there was a decrease in the number of decomposers?

A Waste products would be converted to carbohydrates.

B Energy needed for producers to make food would increase.

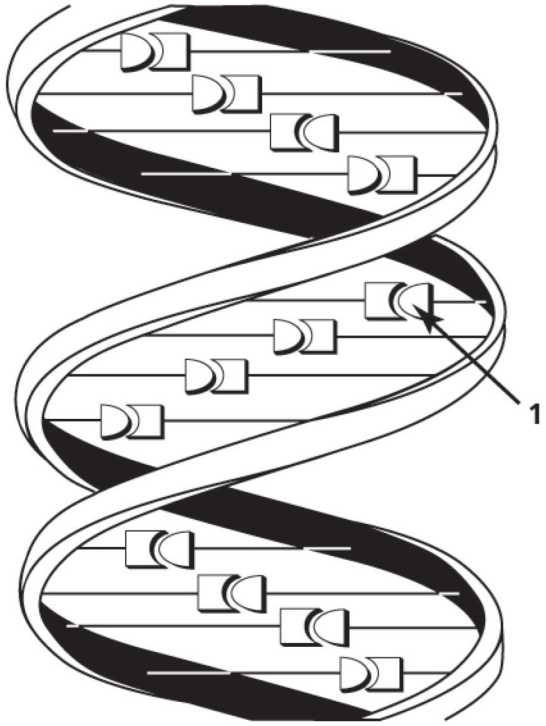
C Necessary nutrients would not be recycled in the environment.

D The amount of carbon dioxide in the atmosphere would decrease.

Item Information

Item Code:	GS040171	Passage Title:	
Standard Code:	3210.4.1	Passage Code:	
Standard Text:	Identify the structure and function of DNA.		
Reporting Category:	Heredity		
Correct Answer:	C	DOK Level:	1

A DNA molecule is shown in the diagram below.



What part of the DNA molecule is represented by the structure labeled 1?

A a nucleotide

B an amino acid

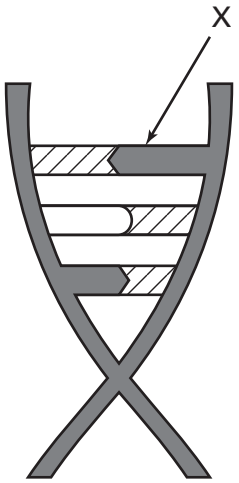
C a nitrogen base

D a phosphate

Item Information

Item Code:	TEB120184	Passage Title:	
Standard Code:	3210.4.1	Passage Code:	
Standard Text:	Identify the structure and function of DNA.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	1

The diagram shown represents part of a DNA molecule.



If X represents adenine, what molecule is its complementary base?

A cytosine

B thymine

C guanine

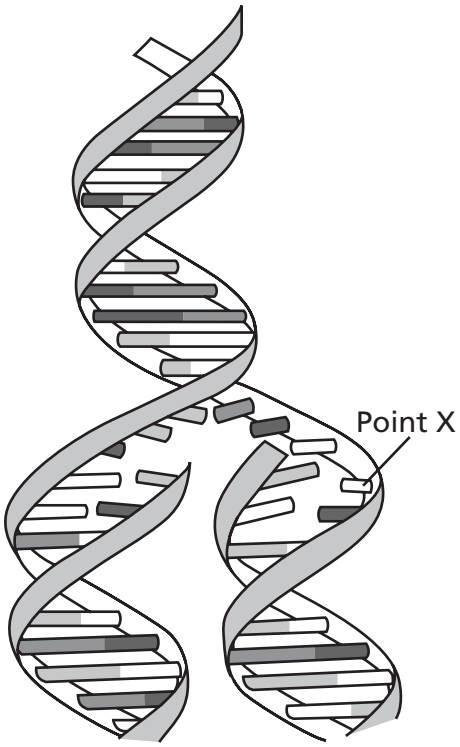
D uracil

Item Information

Item Code:	TEB110060	Passage Title:	
Standard Code:	3210.4.2	Passage Code:	
Standard Text:	Associate the process of DNA replication with its biological significance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

The diagram below represents DNA replication in which a mutation has occurred at Point X.

DNA Replication



During the cell cycle, this mutation at Point X can result in the production of a mutated protein in which cell?

A the parent cell only

B one resulting cell only

C one resulting cell and the parent cell

D both resulting cells and the parent cell

Item Information

Item Code:	TEB110222	Passage Title:	
Standard Code:	3210.4.2	Passage Code:	
Standard Text:	Associate the process of DNA replication with its biological significance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

In order to ensure an exact copy of DNA is passed on, replication must occur before

A electron transfer.

B mitosis.

C protein synthesis.

D glycolysis.

Item Information

Item Code:	GS040012	Passage Title:	
Standard Code:	3210.4.3	Passage Code:	
Standard Text:	Recognize the interactions between DNA and RNA during protein synthesis.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

Which best describes the process that occurs when nuclear DNA codes for a protein in the cytoplasm?

A One strand of the DNA temporarily leaves the nucleus to be translated by a ribosome in the cytoplasm.

B mRNA is transcribed from DNA and leaves the nucleus to be translated by tRNA in the cytoplasm.

C A ribosome makes an RNA copy of DNA in the nucleus, then returns to the cytoplasm for protein synthesis.

D The tRNA copies the DNA in the nucleus, then transports the information to the ribosomes in the cytoplasm for protein synthesis.

Item Information

Item Code:	TEB120022	Passage Title:	
Standard Code:	3210.4.3	Passage Code:	
Standard Text:	Recognize the interactions between DNA and RNA during protein synthesis.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

During protein synthesis, an RNA strand is transcribed from one strand of DNA.

GCG TTA CCT

What is the complementary RNA strand to the DNA strand shown?

A CGC UUT CCT

B CGC AAU GGA

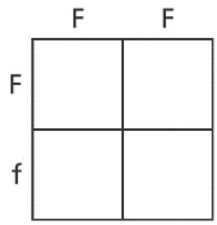
C GCG UUA CCU

D CGC AAT GGA

Item Information

Item Code:	GS000865	Passage Title:	
Standard Code:	3210.4.4	Passage Code:	
Standard Text:	Determine the probability of a particular trait in an offspring based on the genotype of the parents and the particular mode of inheritance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

In humans, the allele for having freckles (F) is dominant to the allele for not having freckles (f).



What is the probability that a child from this cross will be heterozygous for freckles?

A 25%

B 50%

C 75%

D 100%

Item Information

Item Code:	GS001087	Passage Title:	
Standard Code:	3210.4.4	Passage Code:	
Standard Text:	Determine the probability of a particular trait in an offspring based on the genotype of the parents and the particular mode of inheritance.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	2

A cross between a white horse and a brown horse produces offspring that are golden in color. The possible results of a cross between two golden-colored horses are shown below.

RESULTS OF A CROSS BETWEEN TWO GOLDEN HORSES

Chance	Coat Color
25%	White
50%	Golden
25%	Brown

Based on these results, what is the most likely mode of inheritance for coat color in these horses?

A polygenic

B sex-linked

C complete dominance

D incomplete dominance

Item Information

Item Code:	TEB120125	Passage Title:	
Standard Code:	3210.4.4	Passage Code:	
Standard Text:	Determine the probability of a particular trait in an offspring based on the genotype of the parents and the particular mode of inheritance.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	1

A seed company was experimenting with different types of plant stems. Some of the plants they were working with had weak stems and a low survival rate. They crossed plants with weak stems with plants that had strong stems and produced offspring that all had strong stems. Based on these results, the allele for having strong stems is

A dominant.

B recessive.

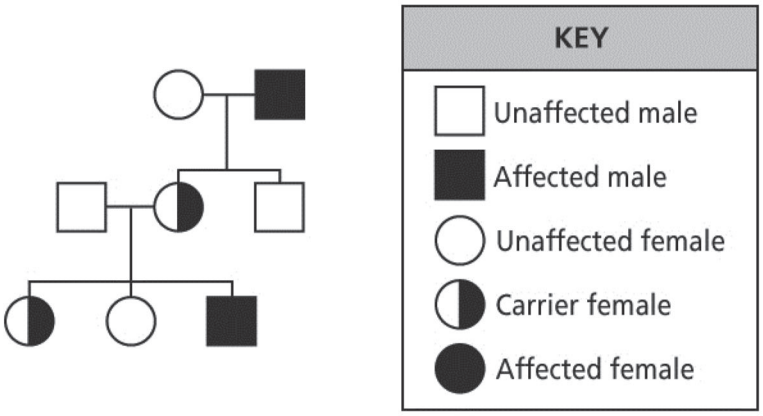
C sex-linked.

D codominant.

Item Information

Item Code:	GS001046	Passage Title:	
Standard Code:	3210.4.5	Passage Code:	
Standard Text:	Apply pedigree data to interpret various modes of genetic inheritance.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	2

The inheritance pattern of a particular condition is shown below.



This inheritance pattern shows that the condition is

A autosomal dominant

B autosomal recessive

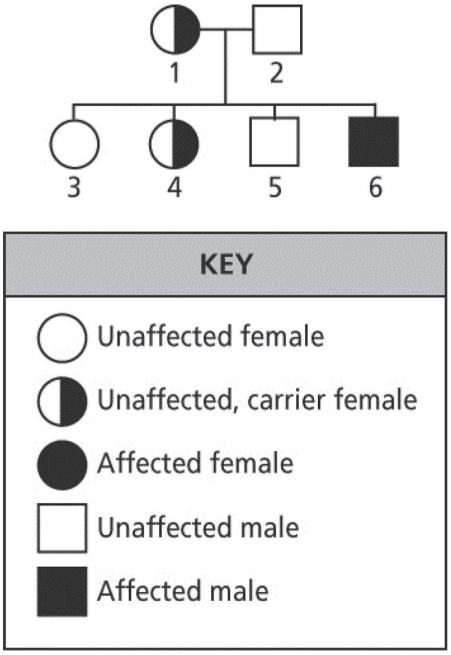
C sex-linked dominant

D sex-linked recessive

Item Information

Item Code:	GS001068	Passage Title:	
Standard Code:	3210.4.5	Passage Code:	
Standard Text:	Apply pedigree data to interpret various modes of genetic inheritance.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	2

The pedigree below shows the occurrence of a condition in two generations of a human family.



Which of these terms describes the inheritance pattern shown in the pedigree?

A autosomal dominant

B autosomal recessive

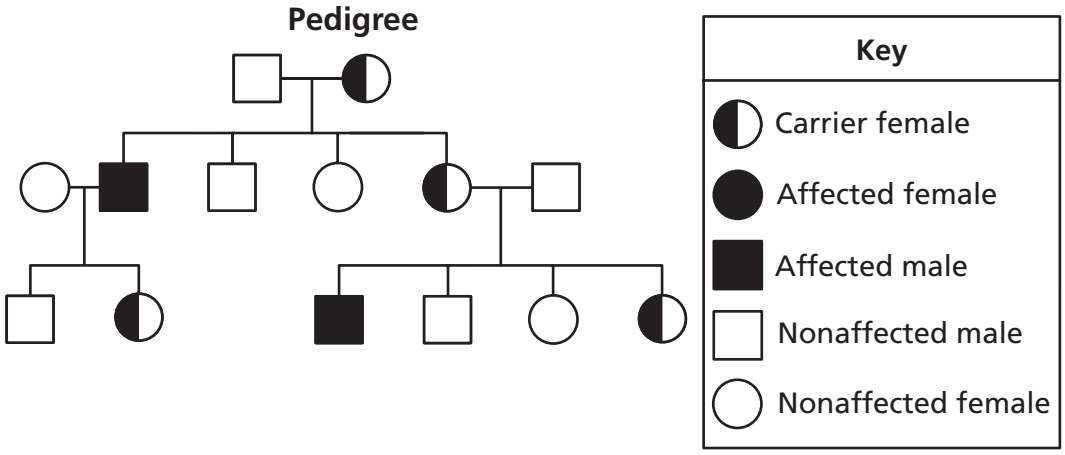
C sex-linked dominant

D sex-linked recessive

Item Information

Item Code:	TEB110064	Passage Title:	
Standard Code:	3210.4.5	Passage Code:	
Standard Text:	Apply pedigree data to interpret various modes of genetic inheritance.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

The pedigree below represents an inherited disorder.



What mode of inheritance is shown?

A autosomal dominant

B X-linked recessive

C autosomal recessive

D X-linked dominant

Item Information

Item Code:	GS000749	Passage Title:	
Standard Code:	3210.4.6	Passage Code:	
Standard Text:	Describe how meiosis is involved in the production of egg and sperm cells.		
Reporting Category:	Heredity		
Correct Answer:	C	DOK Level:	1

The body cells of an adult chimpanzee contain 48 chromosomes.

How many chromosomes does a chimpanzee's fertilized egg have?

A 12

B 24

C 48

D 96

Item Information

Item Code:	GS040207	Passage Title:	
Standard Code:	3210.4.7	Passage Code:	
Standard Text:	Describe how meiosis and sexual reproduction contribute to genetic variation in a population.		
Reporting Category:	Heredity		
Correct Answer:	D	DOK Level:	1

Which event in meiosis increases genetic variation within a population?

A Chromosomes form pairs.

B DNA condenses to form chromosomes.

C Chromosomes duplicate themselves.

D Segments of chromosomes cross over.

Item Information

Item Code:	GS040016	Passage Title:	
Standard Code:	3210.4.7	Passage Code:	
Standard Text:	Describe how meiosis and sexual reproduction contribute to genetic variation in a population.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	1

Which best explains how the process of meiosis contributes to genetic variation?

A by producing diploid cells that contain an exact copy of one diploid cell's DNA

B by producing haploid cells with a random combination of alleles from one diploid cell

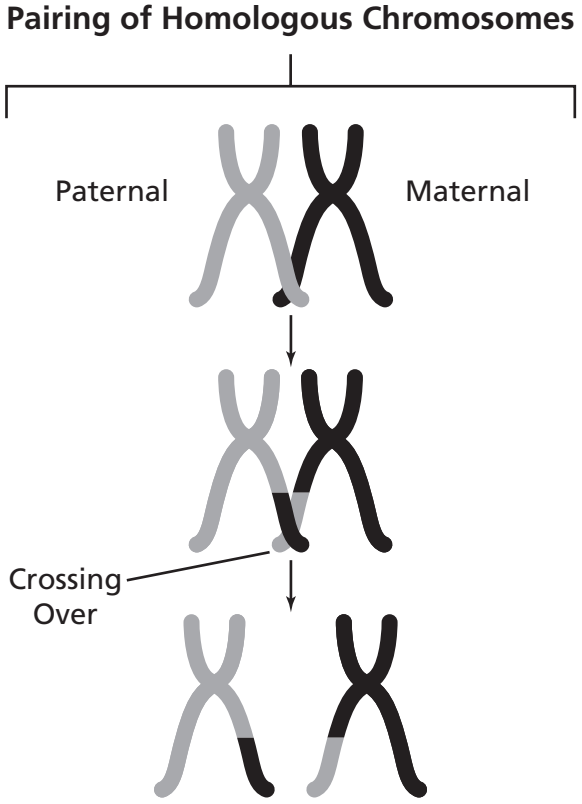
C by producing diploid cells that contain the alleles from only two diploid cells

D by producing haploid cells that contain DNA from two diploid cells

Item Information

Item Code:	TEB120292	Passage Title:	
Standard Code:	3210.4.7	Passage Code:	
Standard Text:	Describe how meiosis and sexual reproduction contribute to genetic variation in a population.		
Reporting Category:	Heredity		
Correct Answer:	B	DOK Level:	2

The diagram shown illustrates a process that occurs during meiosis.



This process results in

A the division of the cell.

B an increase in genetic variation.

C the reduction in the number of alleles.

D an increase in the number of chromosomes.

Item Information

Item Code:	GS000529	Passage Title:	
Standard Code:	3210.4.8	Passage Code:	
Standard Text:	Determine the relationship between mutations and human genetic disorders.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	2

Cystic fibrosis is a hereditary disease that affects the respiratory and digestive systems. Cystic fibrosis occurs when two recessive alleles of a gene (*cc*) are present. A person with one allele for cystic fibrosis is called a carrier (*Cc*) of the disease.

If both parents are carriers, what percentage of their children are expected to have cystic fibrosis?

A 25%

B 50%

C 75%

D 100%

Item Information

Item Code:	GS050086	Passage Title:	
Standard Code:	3210.4.9	Passage Code:	
Standard Text:	Evaluate the scientific and ethical issues associated with gene technologies: genetic engineering, cloning, transgenic organism production, stem cell research, and DNA fingerprinting.		
Reporting Category:	Heredity		
Correct Answer:	A	DOK Level:	2

Which statement best explains a primary argument against developing transgenic organisms, whose genomes carry genes from another species?

A Transgenic organisms may cause unknown consequences in an ecosystem.

B Transgenic organisms may increase food production in many crops.

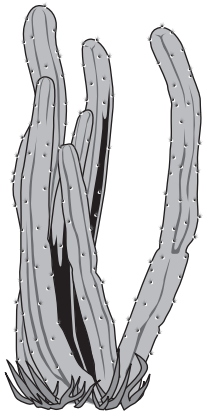
C Transgenic organisms may eliminate harmful diseases in a population.

D Transgenic organisms may prevent harmful mutations in humans.

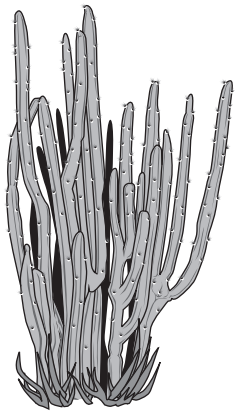
Item Information

Item Code:	TEB110022	Passage Title:	
Standard Code:	3210.5.1	Passage Code:	
Standard Text:	Compare and contrast the structural, functional, and behavioral adaptations of animals or plants found in different environments.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	2

A cactus found in the deserts of North and South America is similar in structure to a plant species found in Africa.



Cacti
(North and South America)



***Euphorbia* sp.**
(Africa)

Which statement <u>best</u> explains how these plants express a similar structure?

A Artificial selection for similar traits occurred.

B Both plant species are pollinated by the same insects.

C Seeds were dispersed from birds across both continents.

D Both plant species are exposed to the same environmental pressures.

Item Information

Item Code:	GS000425	Passage Title:	
Standard Code:	3210.5.2	Passage Code:	
Standard Text:	Recognize the relationship between form and function in living things.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	B	DOK Level:	2

Scientists think that the Hawaiian honeycreepers shown below are closely related. The scientists think the ancestor of the honeycreepers is a finch that migrated to Hawaii.

Which of these <u>most likely</u> led to the different sizes and shapes of the honeycreeper beaks?

A the presence of predators

B the presence of a variety of food types

C the ability of individual birds to change their beak shape

D the desire of individual birds to avoid competition for food

Item Information

Item Code:	GS040284	Passage Title:	
Standard Code:	3210.5.2	Passage Code:	
Standard Text:	Recognize the relationship between form and function in living things.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	2

Which <u>best</u> explains why muscle cells have more mitochondria than skin cells?

A Muscle cells divide more often than skin cells.

B Muscle cells make more protein than skin cells.

C Muscle cells require more energy than skin cells.

D Muscle cells break down more waste than skin cells.

Item Information

Item Code:	TEB110355	Passage Title:	
Standard Code:	3210.5.2	Passage Code:	
Standard Text:	Recognize the relationship between form and function in living things.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	2

Human bones have both strength and a limited amount of flexibility. Their strength helps bones to perform which function?

A circulate oxygen

B absorb calcium

C produce blood cells

D provide support

Item Information

Item Code:	TEB120046	Passage Title:	
Standard Code:	3210.5.2	Passage Code:	
Standard Text:	Recognize the relationship between form and function in living things.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	C	DOK Level:	2

Hawks found in the United States are divided into three groups: short-winged hawks, broad-winged hawks, and harrier hawks.

Scientists have determined that these birds came from a common ancestor. Which best explains why they have developed different physical and behavioral characteristics?

A They chose beneficial mutations to ensure their survival.

B They bred with other species of birds.

C They filled different niches in the environment.

D They imitated other bird species in their habitats.

Item Information

Item Code:	GS040022	Passage Title:	
Standard Code:	3210.5.3	Passage Code:	
Standard Text:	Recognize the relationships among environmental change, genetic variation, natural selection, and the emergence of a new species.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	B	DOK Level:	2

Over a period of time, the average annual temperature of a particular region significantly decreases, resulting in longer winters with increased snowfall. As a result, the majority coat color of a rabbit population has changed from brown to white. Which best explains this change in coat color among the rabbit population?

A White coat color provides more warmth than brown coat color.

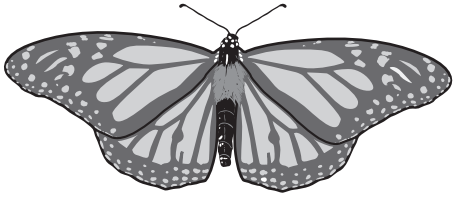
B Rabbits with white coat color are less visible to predators.

C Geographic isolation separated the two populations and resulted in a species with different coat colors.

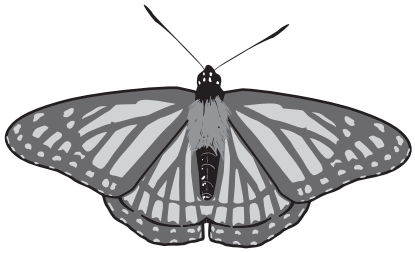
D Genetic mutation caused a change in the dominant allele, resulting in white as the dominant coat color.

Read the passage and answer questions XX and XX.

The illustrations shown are of the monarch butterfly, *Danaus plexippus*, and the viceroy butterfly, *Basilarchia archippus*. The viceroy butterfly appears very similar to the monarch butterfly; however, the viceroy has a curved black line on both of its hind wings, and the monarch does not.



Monarch
(*Danaus plexippus*)



Viceroy
(*Basilarchia archippus*)

In the natural world, bright orange coloring is often a warning to predators that the creature displaying the color is toxic. Monarch caterpillars eat milkweed plants that contain a class of chemicals called cardenolides which are nontoxic to insects but toxic to vertebrates. The milkweed eaten at the caterpillar stage causes the adult butterfly to taste bitter. The monarch butterfly's bright coloring and unpleasant taste is an effective defense against most butterfly predators.

The viceroy caterpillars eat cottonwood leaves which are nontoxic to vertebrates. However, the viceroy butterfly so closely resembles the monarch that most butterfly predators mistake it for the toxic monarch and leave it alone.

Item Information

Item Code:	TEB120224	Passage Title:	
Standard Code:	3210.5.3	Passage Code:	
Standard Text:	Recognize the relationships among environmental change, genetic variation, natural selection, and the emergence of a new species.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	2

Which process is <u>most</u> likely responsible for the appearance of the viceroy butterfly?

A divergent evolution

B genetic drift

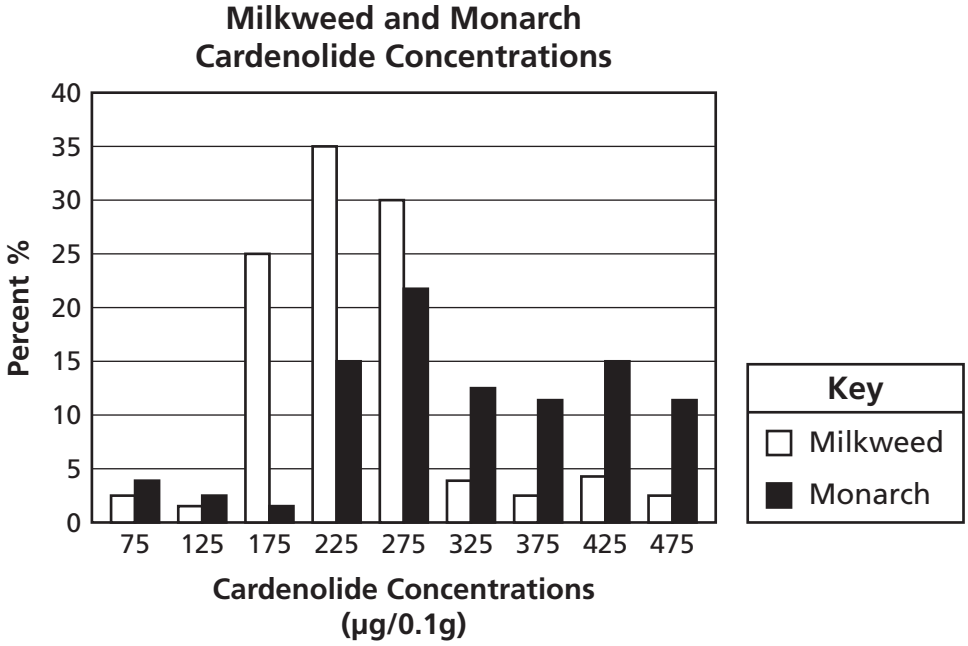
C environmental change

D natural selection

Item Information

Item Code:	TEB120225	Passage Title:	
Standard Code:	3210.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	3-4

The graph shown represents data collected that compare the various concentrations of cardenolides found in different milkweed plants and the concentrations found in adult monarchs that fed on milkweed as caterpillars.



Scientists concluded that cardenolide concentrations are maintained throughout the life stages of the monarch butterfly. Based on the graph, which statement best defends the scientists' conclusion?

A The cardenolide concentration in the milkweed decreased as the caterpillars consumed the milkweed.

B The cardenolide concentration decreased in the monarchs when they became adults.

C The cardenolide concentration in the adult monarchs is dependent on the concentration found in the milkweed.

D The cardenolide concentration remained in the adult monarchs regardless of the concentration in the milkweed.

Item Information

Item Code:	GS040023	Passage Title:	
Standard Code:	3210.5.4	Passage Code:	
Standard Text:	Describe the relationship between the amount of biodiversity and the ability of a population to adapt to a changing environment.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	A	DOK Level:	2

Which population would be <u>best</u> suited for adapting to an environment that undergoes a sudden change in climate?

A a population with many phenotypes

B a population with a higher number of males than females

C a population with individuals that all express dominant traits

D a population with a high rate of emigration

Item Information

Item Code:	GS040183	Passage Title:	
Standard Code:	3210.5.4	Passage Code:	
Standard Text:	Describe the relationship between the amount of biodiversity and the ability of a population to adapt to a changing environment.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	A	DOK Level:	2

Geneticists have discovered that cheetahs share approximately 99% of the same genes, resulting in an extremely low genetic diversity in the cheetah populations of the world. Which is the <u>most</u> likely result of this lack of genetic diversity?

A reduced ability to adapt to a changing environment

B lengthened reproductive cycles

C decreased rates of allele mutations

D increased rate of expression of dominant traits

Item Information

Item Code:	TEB120327	Passage Title:	
Standard Code:	3210.5.4	Passage Code:	
Standard Text:	Describe the relationship between the amount of biodiversity and the ability of a population to adapt to a changing environment.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	A	DOK Level:	3-4

The number of migratory birds along the main migration corridors has been declining in recent years. Vulnerable to environmental changes, migratory birds, such as the Canada Warbler, are dependent on stopover sites to rest and refuel as they make their long journey from northern Canada to South America. The cause of the overall decline in migratory birds is complex and specific to certain species. However, it is a reflection of a larger environmental problem

A tied to the loss of habitats the birds need for resources.

B related to an increase in the number of bird predators.

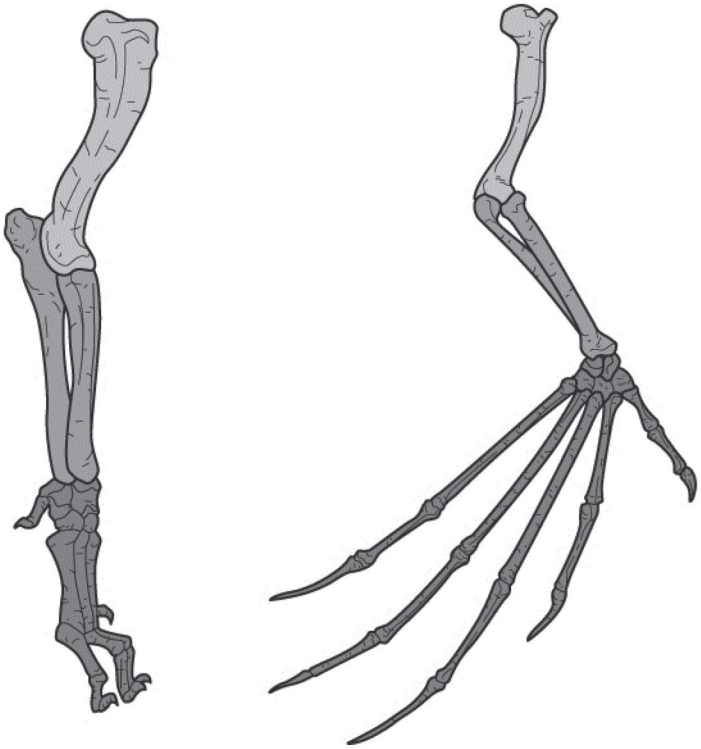
C tied to competition among nonmigratory bird species.

D related to an increase in the number of bird watchers.

Item Information

Item Code:	GS010174	Passage Title:	
Standard Code:	3210.5.5	Passage Code:	
Standard Text:	Apply evidence from the fossil record, comparative anatomy, amino acid sequences, and DNA structure that support modern classification systems.		
Reporting Category:	Biodiversity & Change		
Correct Answer:	D	DOK Level:	2

The diagram below shows the bone structure of two animals.



What do these two animals <u>most</u> likely have in common?

A They shared the same habitat.

B Their limbs served the same function.

C They are of the same species.

D They share a common ancestor.

Item Information

Item Code:	TEB120065	Passage Title:	
Standard Code:	3210.Inq.1	Passage Code:	
Standard Text:	Select a description or scenario that reevaluates and/or extends a scientific finding.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	3-4

In 1796, Edward Jenner investigated the relationship between cowpox and smallpox. People who became ill with cowpox, a nonfatal disease, did not catch smallpox, a deadly disease. Jenner injected a patient with the cowpox virus and several months later injected the same patient with smallpox virus. The patient did not contract smallpox. Jenner's research influenced the development of

A painkillers.

B anesthetics.

C vaccines.

D antibiotics.

Item Information

Item Code:	GS040295	Passage Title:	
Standard Code:	3210.Inq.2	Passage Code:	
Standard Text:	Analyze the components of a properly designed scientific investigation.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	2

A student is designing an investigation to compare the effectiveness of organic fertilizers to chemical fertilizers. Which best represents the correct process the student should follow to prepare for this investigation?

A hypothesize, research, collect data from experiment, conduct experiment, and discuss conclusions and applications

B hypothesize, collect data from experiment, discuss conclusions and applications, and research

C research, hypothesize, conduct experiment, collect data from experiment, and discuss conclusions and applications

D research, discuss conclusions and applications, conduct experiment, hypothesize, and collect data from experiment

Item Information

Item Code:	GS040071	Passage Title:	
Standard Code:	3210.Inq.3	Passage Code:	
Standard Text:	Determine appropriate tools to gather precise and accurate data.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	1

A researcher wants to observe the process of cell division in bacteria. Which tool would be <u>most</u> appropriate for the researcher to use for gathering accurate data?

A hand lens

B digital camera

C video microscope

D graphing calculator

Item Information

Item Code:	GS040386	Passage Title:	
Standard Code:	3210.Inq.4	Passage Code:	
Standard Text:	Evaluate the accuracy and precision of data.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

The table shows the results of students measuring the length of an acorn. The acorn is exactly 2.00 centimeters long.

Trial	Student Measurements in Centimeters			
	1	2	3	4
1	2.15	2.01	2.025	2.00
2	2.16	1.95	2.00	2.45
3	2.30	2.00	1.875	2.20
4	2.21	2.00	2.10	2.10
5	2.00	1.95	2.10	2.20

Which student made the <u>most</u> accurate and precise measurements of the acorn?

A Student 1

B Student 2

C Student 3

D Student 4

Item Information

Item Code:	GS040115	Passage Title:	
Standard Code:	3210.Inq.4	Passage Code:	
Standard Text:	Evaluate the accuracy and precision of data.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	2

Students in a science class measured the length of three different leaves and recorded the data in the table below.

Leaf Measurement Results

Leaf Number	Actual Length	Student 1	Student 2	Student 3	Student 4
1	10.5 cm	10 cm	11 cm	10.4 cm	15 cm
2	4.2 cm	4 cm	6 cm	4.2 cm	42 cm
3	2.3 cm	2 cm	4 cm	2.5 cm	5 cm

Which student recorded the length of the leaves <u>most</u> accurately?

A 1

B 2

C 3

D 4

Item Information

Item Code:	GS040116	Passage Title:	
Standard Code:	3210.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	2

A laboratory exercise simulating the activities of the cell membrane is conducted using dialysis tubing filled with a sucrose solution. The initial mass of each bag is measured and recorded. Each bag is placed in a beaker containing distilled water. After 24 hours each bag is massed and recorded again. The results are shown below.

Cell Membrane Activity

Contents in Dialysis Tubing Bag	Initial Mass	Final Mass	Percent Change in Mass
Distilled Water	25.1 g	26.3 g	4.78%
2% Sucrose	25.9 g	28.4 g	9.65%
6% Sucrose	26.3 g	30.1 g	14.45%
10% Sucrose	30.7 g	37.6 g	22.48%

Students conclude that water molecules, not sucrose molecules, moved into and out of the bag. Which statement best defends the conclusion?

A The distilled water in the beakers had the least change in mass.

B The change in mass indicates the movement of sucrose molecules.

C Only distilled water can cross a semipermeable membrane.

D Molecules only move when the sucrose concentration is above 5.00%.

Item Information

Item Code:	GS050213	Passage Title:	
Standard Code:	3210.Inq.5	Passage Code:	
Standard Text:	Defend a conclusion based on scientific evidence.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

A biology class investigated the rate of photosynthesis of aquatic plants at varying distances from a light source in their classroom aquarium. The class concluded that the rate of photosynthesis increases when the plants are closer to the light source. Which statement best supports the students' classroom conclusion when applied in a pond ecosystem?

A Most aquatic plants found in a pond have small leaves.

B Most aquatic plants in a pond are found in shallow waters.

C Most aquatic plants found in a pond belong to the same species.

D Most aquatic plants in a pond are found in areas of moving water.

Item Information

Item Code:	GS050310	Passage Title:	
Standard Code:	3210.Inq.6	Passage Code:	
Standard Text:	Determine why a conclusion is free of bias.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	D	DOK Level:	2

A research company evaluated a two-year study on the use of asthma inhalers conducted by Agency X. Agency X had concluded that the data they collected were valid and the inhalers were effective in the treatment of certain asthmatic conditions.

The research company followed the same procedure set up by Agency X. They used a double blind study with the same number of different patients, for the same time period. The research company determined that the conclusion of Agency X is valid and that the inhalers are effective. To ensure their results are free of bias, Agency X

A performed a two-year study.

B researched a previously published paper.

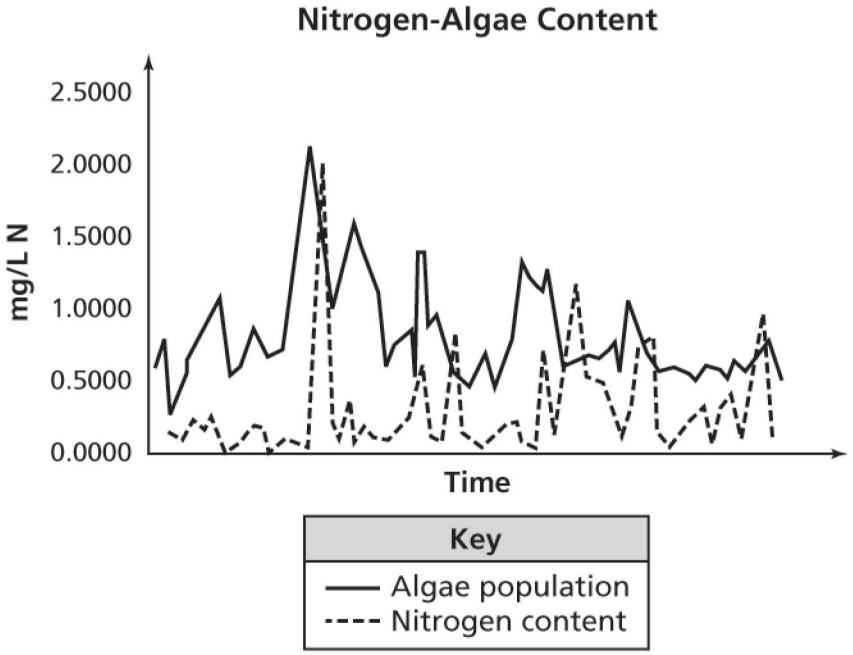
C had the research company use the same patients.

D sent the results to an independent research company.

Item Information

Item Code:	GS040160	Passage Title:	
Standard Code:	3210.Math.1	Passage Code:	
Standard Text:	Interpret a graph that depicts a biological phenomenon.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	3-4

A graph comparing the nitrogen content to the algae population size is shown below.



The shape of the lines on the graph indicates that nitrogen

A is a toxin to algae.

B is used by algae as a nutrient.

C supports the growth of algae competitors.

D prevents overgrowth of algae.

Item Information

Item Code:	GS050143	Passage Title:	
Standard Code:	3210.TE.1	Passage Code:	
Standard Text:	Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	2

A biology class is investigating whether the amount of dissolved oxygen in an aquarium changes when water temperature changes. They set up two aquariums, one as a control and the second as the variable. They will record the dissolved oxygen content over a 3-month period using an oxygen monitor. What other tool is necessary to conduct this investigation?

A pH meter

B microscope

C thermometer

D graduated cylinder

Item Information

Item Code:	GS040119	Passage Title:	
Standard Code:	3210.TE.3	Passage Code:	
Standard Text:	Evaluate the overall benefit to cost ratio of a new technology.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	2

A chart comparing three types of light bulbs is shown below.

Light Bulb Type	Features	Per Unit Cost
Incandescent Light Bulbs	Life span is 1,500 hours Uses 3,600 KWh of electricity for 60,000 hours	$0.67 per bulb
Compact Fluorescent Light Bulbs (CFL)	Life span is 10,000 hours Uses 840 KWh of electricity for 60,000 hours	$3.00 per bulb
Light-Emitting Diode Light Bulbs (LED)	Life span is 60,000 hours Uses 360 KWh of electricity for 60,000 hours	$54.95 per bulb

A school district concerned with reducing CO_2 emissions is evaluating which type of light bulb would be the most efficient. Which statement explains why the compact fluorescent light bulb (CFL) is the best choice?

A The CFL light bulb lasts longer than the incandescent light bulb.

B The CFL light bulb is cheaper than the light-emitting diode light bulb (LED).

C The CFL light bulb provides the longest life span for the least cost.

D The CFL light bulb uses more electricity per hour than the light-emitting diode light bulb (LED).

Item Information

Item Code:	TEB120363	Passage Title:	
Standard Code:	3210.TE.3	Passage Code:	
Standard Text:	Evaluate the overall benefit to cost ratio of a new technology.		
Reporting Category:	Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	C	DOK Level:	3-4

A company has produced an absorbent polymer that helps remove oil from contaminated ecosystems. However, this polymer is expensive to produce in mass quantities. Which statement best explains how this technology is beneficial, even though it is expensive to produce?

A It reduces the likelihood of oil spills.

B It ensures the survival of endangered species.

C It helps the environment return to a healthy state.

D It produces clean drinking water for human consumption.

Tennessee Comprehensive Assessment Program TCAP TNReady—Biology Item Release Spring 2017

Tennessee Comprehensive Assessment Program

TCAP

TNReady—Chemistry Item Release

TN Department of Education

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Metadata Interpretation Guide – Science

Item Information

Item Code:	TNS10220	Passage Title:	
Standard Code:	0307.1.1	Passage Code:	
Standard Text:	Identify specific parts of a plant and describe their function.		
Reporting Category:	Cells, Flow of Matter & Energy, Heredity		
Correct Answer:	B	DOK Level:	2

Item Code: Unique letter/number code used to identify the item.	**Passage Title:** (if listed): Title of the passage(s) associated with this item.
Standard Code: Primary educational standard assessed.	**Passage Code:** (if listed): Unique letter/number code used to identify the passage(s) that go with this item.
Standard Text: Text of the educational standard assessed.	
Reporting Category: Text of the Reporting Category the standard assesses.	
Correct Answer: Correct answer. This may be blank for constructed response items where students write or type their responses.	**DOK Level** (if listed): Depth of Knowledge (cognitive complexity) is measured on a four-point scale. 1= Recall; 2= Skill/Concepts; 3= Strategic Thinking; 3-4 = Strategic/Extended Thinking

Item Information

Item Code:	TEC110154	Passage Title:	
Standard Code:	3221.1.2	Passage Code:	
Standard Text:	Interpret the periodic table to describe an element's atomic makeup.		
Reporting Category:	Atomic Structure		
Correct Answer:	C	DOK Level:	1

Carbon (C) exists in many isotopic forms. In each isotope, which subatomic particles differ in number?

A electrons

B orbitals

C neutrons

D protons

Item Information

Item Code:	TEC110134	Passage Title:	
Standard Code:	3221.1.2	Passage Code:	
Standard Text:	Interpret the periodic table to describe an element's atomic makeup.		
Reporting Category:	Atomic Structure		
Correct Answer:	A	DOK Level:	2

Based on their placement in the periodic table, which set of elements is among the <u>most</u> reactive?

A lithium and fluorine

B carbon and aluminum

C argon and neon

D gold and platinum

Item Information

Item Code:	TEC110165	Passage Title:	
Standard Code:	3221.1.5	Passage Code:	
Standard Text:	Represent an electron's location in the quantum mechanical model of an atom in terms of the shape of electron clouds (s and p orbitals in particular), relative energies of orbitals, and the number of electrons possible in the s, p, d and f orbitals.		
Reporting Category:	Atomic Structure		
Correct Answer:	B	DOK Level:	2

Which element contains its highest energy electrons in a *d* orbital while in a ground state?

A Rn

B Hg

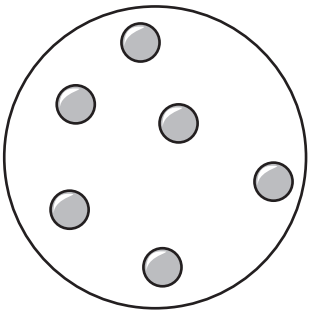
C Fr

D He

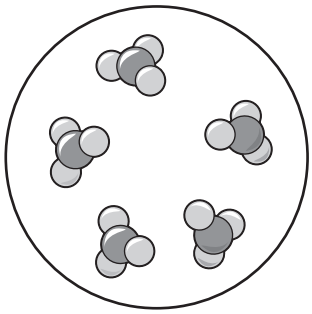
Item Information

Item Code:	TEC120046	Passage Title:	
Standard Code:	3221.2.1	Passage Code:	
Standard Text:	Distinguish among elements, compounds, and mixtures.		
Reporting Category:	Matter and Energy		
Correct Answer:	D	DOK Level:	2

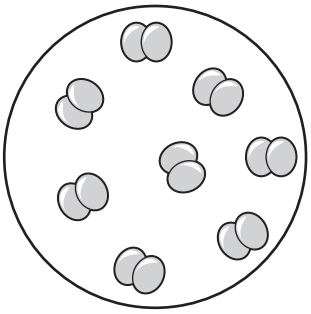
Which of these represents a mixture?



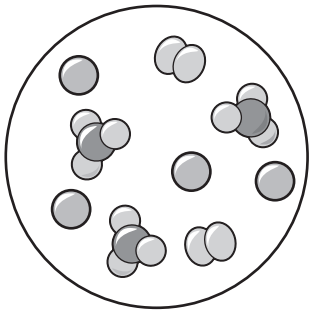
A



C



B



D

Item Information

Item Code:	TEC110436	Passage Title:	
Standard Code:	3221.2.2	Passage Code:	
Standard Text:	Identify properties of a solution: solute and solvent in a solid, liquid or gaseous solution: procedure to make or determine the concentration of a solution in units of ppm, ppb, molarity, percent composition, factors that affect the rate of solution.		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

What is the molarity of a solution when 80.0 g of sodium chloride (NaCl) are dissolved in 500.0 mL of water?

A 1.37 M

B 1.45 M

C 2.74 M

D 6.25 M

Item Information

Item Code:	TEC110167	Passage Title:	
Standard Code:	3221.2.3	Passage Code:	
Standard Text:	Classify a solution as saturated, unsaturated, or supersaturated based on its composition and temperature and a solubility graph.		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

A student is preparing solutions for a laboratory experiment by dissolving solid solutes in liquid solvents. Which action will increase the rate of solubility?

A lowering the temperature of the solvent

B stirring the solute in the solution

C increasing the pressure on the solution

D increasing the particle size of the solute

Item Information

Item Code:	TEC110079	Passage Title:	
Standard Code:	3221.2.4	Passage Code:	
Standard Text:	Identify properties of matter (e.g., physical: density, boiling point, melting point, or chemical: ability to rust or tarnish, be sour) or changes in matter (e.g., physical: phase change, shape, color, or chemical: formation of a gas or precipitate).		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

Which example best represents a chemical change?

A ice cubes melting at a warm temperature

B milk spoiling when left out of the refrigerator

C water evaporating from a rooftop

D firewood being chopped for a fire

Item Information

Item Code:	TEC110439	Passage Title:	
Standard Code:	3221.2.5	Passage Code:	
Standard Text:	Compare and contrast heat and temperature changes (endothermic /exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes		
Reporting Category:	Matter and Energy		
Correct Answer:	C	DOK Level:	2

The heat of fusion of water is 80 calories/gram. How much energy is required to change 50 grams of ice into liquid water?

A 60 cal

B 200 cal

C 4000 cal

D 5000 cal

Item Information

Item Code:	TEC110437	Passage Title:	
Standard Code:	3221.2.5	Passage Code:	
Standard Text:	Compare and contrast heat and temperature changes (endothermic /exothermic) in chemical (e.g., combustion) or physical (e.g., phase transformations) processes		
Reporting Category:	Matter and Energy		
Correct Answer:	B	DOK Level:	2

The total energy required to melt 30.0 grams of a solid is 741 joules. What is the latent heat of fusion for this substance?

A 12.4 J/g

B 24.7 J/g

C 126 J/g

D 741 J/g

Item Information

Item Code:	TEC110268	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	3-4

What is the percent composition of carbon in the glucose molecule ($C_6H_{12}O_6$) if the molar mass is 180 g/mol?

A 6.7%

B 40.%

C 53%

D 90.%

Item Information

Item Code:	TEC110207	Passage Title:	
Standard Code:	3221.3.1	Passage Code:	
Standard Text:	Analyze ionic and covalent compounds in terms of their formation (electron transfer vs. sharing), names, chemical formulas (e.g., molecular:H2O, CO2, NH3: empirical: NaCl, CaBr2, Al(NO3)3), percent composition, and molar masses.		
Reporting Category:	Interactions of Matter		
Correct Answer:	B	DOK Level:	2

What is the chemical formula for nickel(II) sulfide?

A Ni_2S_3

B NiS

C $NiSO_4$

D $Ni_2(SO_4)_3$

Item Information

Item Code:	TEC120095	Passage Title:	
Standard Code:	3221.3.2	Passage Code:	
Standard Text:	Determine the reactants, products, and types of different chemical reactions: composition, decomposition, double replacement, single replacement, combustion.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

The chemical equation shows the reaction between hydrogen fluoride (HF) and sodium hydroxide (NaOH).

$$\mathbf{HF + NaOH \rightarrow H_2O + NaF}$$

Which type of chemical reaction does this equation represent?

A decomposition

B composition

C double replacement

D single replacement

Item Information

Item Code:	TEC120056	Passage Title:	
Standard Code:	3221.3.4	Passage Code:	
Standard Text:	Balance a chemical equation to determine molar ratios.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	2

The unbalanced chemical equation represents the breaking down of aluminum oxide (Al_2O_3).

$$\_\_\_Al_2O_3 \rightarrow \_\_\_Al + \_\_\_O_2$$

What is the molar ratio of aluminum oxide to oxygen (O_2) when the equation is balanced using the lowest possible number?

A 2 : 3

B 4 : 3

C 2 : 4

D 5 : 3

Item Information

Item Code:	TEC120175	Passage Title:	
Standard Code:	3221.3.5	Passage Code:	
Standard Text:	Convert among the following quantities of a substance: mass, number of moles, number of particles, molar volume at STP.		
Reporting Category:	Interactions of Matter		
Correct Answer:	C	DOK Level:	2

What is the approximate volume of 280 g of chlorine gas (Cl_2) at STP?

A 7.9 L

B 22 L

C 88 L

D 180 L

Item Information

Item Code:	TEC120556	Passage Title:	
Standard Code:	3221.3.7	Passage Code:	
Standard Text:	Classify substances as acids or bases based on their formulas and how they react with litmus and phenolphthalein.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	2

The table shows the reaction of four solutions with litmus paper.

Litmus Paper Reactions with Four Solutions

Solution	Litmus Paper
1	Blue litmus paper stays blue
2	Blue litmus paper turns red
3	Red litmus paper turns blue
4	Red litmus paper stays red

Which set of identifications most likely identifies KCl and KOH correctly based on information from the data table?

A 4 as KCl and 3 as KOH

B 1 as KCl and 2 as KOH

C 3 as KCl and 4 as KOH

D 3 as KCl and 2 as KOH

Item Information

Item Code:	TEC110185	Passage Title:	
Standard Code:	3221.3.7	Passage Code:	
Standard Text:	Classify substances as acids or bases based on their formulas and how they react with litmus and phenolphthalein.		
Reporting Category:	Interactions of Matter		
Correct Answer:	D	DOK Level:	2

A student performs an acid-base titration experiment to determine the amount of ascorbic acid in different brands of juice. Which solution should the student use as the base solution in this acid-base titration experiment?

A HCl

B $CaCl_2$

C LiBr

D NaOH

Item Information

Item Code:	TEC120253	Passage Title:	
Standard Code:	3221.3.8	Passage Code:	
Standard Text:	Describe radioactivity through a balanced nuclear equation and through an analysis of the half-life concept.		
Reporting Category:	Interactions of Matter		
Correct Answer:	A	DOK Level:	2

The half-life of the radioisotope potassium-42 is 12.36 hours. How much of a 450 g sample of potassium-42 will be left after 72 hours?

A 7.9 g

B 28 g

C 56 g

D 75 g

Item Information

Item Code:	TEC120026	Passage Title:	
Standard Code:	3221.Inq.2	Passage Code:	
Standard Text:	Analyze the components of a properly designed scientific investigation.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	B	DOK Level:	2

As part of an investigation, students were asked to prepare a sodium chloride solution of a certain molarity. The students were given a choice of procedures. Which procedure will result in 750 mL of 1.5 M NaOH solution?

A dissolving 40 g of NaOH in 1 L of water

B dissolving 45 g of NaOH in enough water to make up to 750 mL of solution

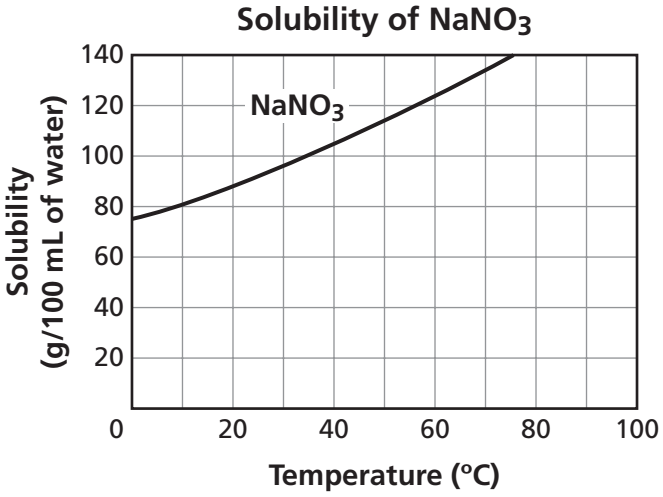
C dissolving 1.13 g of NaOH in 0.750 L of water

D dissolving 1.13 g of NaOH in enough water to make up to 750 mL of solution

Item Information

Item Code:	TEC120385	Passage Title:	
Standard Code:	3221.Inq.7	Passage Code:	
Standard Text:	Compare conclusions that offer different but acceptable explanations for the same set of experimental data.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	2

The graph shows the solubility for sodium nitrate ($NaNO_3$).



A student observed that 85 grams of $NaNO_3$ completely dissolved in 100 milliliters of water at 20°C. The student concluded the solution contained enough solvent molecules to make all the solute dissociate. Which statement is an alternate explanation for the student's observation?

A At 20°C the solvent had enough kinetic energy to dissociate the solute completely.

B Stirring the solution provided energy for the $NaNO_3$ to react with the water.

C At 20°C the kinetic energy of the water molecules caused the $NaNO_3$ to decompose.

D Water is the only solvent that can dissolve $NaNO_3$ at this temperature.

Item Information

Item Code:	TEC120125	Passage Title:	
Standard Code:	3221.TE.2	Passage Code:	
Standard Text:	Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.		
Reporting Category:	Embedded Inquiry, Technology & Engineering, Mathematics		
Correct Answer:	A	DOK Level:	3-4

An engineer designing a small rocket researched the characteristics of five different potential rocket fuels. Which additional step in the engineering protocol must be carried out to successfully design a fuel-efficient rocket engine?

A measure the efficiency and effectiveness of the fuels in extreme temperatures

B produce a rocket engine that is able to use the most expensive fuel

C fabricate a tank that will hold the least expensive fuel regardless of efficiency

D determine which type of fuel is most popular with the people involved in flying the rockets

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