

Biology

Administered May 2013

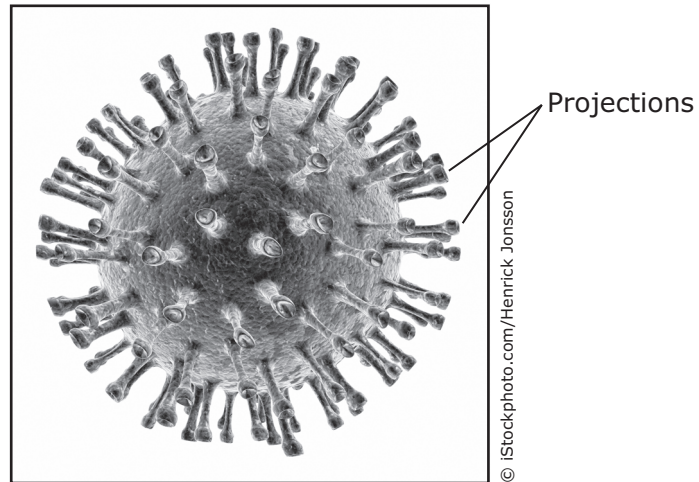
RELEASED

Biology

DIRECTIONS

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

- 1 A photograph of a virus is shown below.



The projections on the surface of this virus allow the virus to —

- A move inside a host cell
- B attach to a host cell
- C control a host cell's DNA
- D signal other viruses to infect a host cell

- 2 Surtsey is an island located south of Iceland. The island was formed by a volcanic eruption and first appeared in 1963. The table below contains descriptions of changes in the population and diversity of species on Surtsey.

	Description
I	Sea lyme grass, sea rockets, oyster plants, and other vascular plants appear.
II	The lava and sands have few nutrients and are barren.
III	Dwarf willow trees colonize the island.
IV	Mosses, lichens, and plants that are adapted to dispersal by the sea or the wind and that grow in sand appear.

Which of these lists the descriptions in the correct order of ecological succession on Surtsey?

- F** I, II, IV, III **H** IV, III, I, II
G III, I, II, IV **J** II, IV, I, III

-
- 3 Having a standard taxonomic system benefits the scientific community by allowing scientists from all over the world to do which of the following?

- A** Have a common system for the classification of locations containing fossils
B Use a similar system to classify the impact of removing species from ecosystems
C Have a common understanding in the classification of organisms
D Understand how other scientists classify predator–prey relationships

-
- 4 The technique known as chromosome painting is the result of scientific research. Scientists use chromosome painting to mark the locations of genes on human chromosomes with fluorescent tags. It is also possible to apply this technique to the chromosomes of many different species. Chromosome painting allows for which of the following?

- F** A comparison of the genomes of different species
G The sequencing of proteins from many species
H An increase in mutations in many species
J The extraction of amino acids from different species

- 5** Health-care workers are exposed to many different types of pathogenic and nonpathogenic microorganisms. Which body systems work together to protect the body from pathogens?
- A** Muscular and vascular
 - B** Digestive and excretory
 - C** Circulatory and immune
 - D** Endocrine and reproductive
-

- 6** Which of these statements best explains the process of energy conversion that takes place in the mitochondria?
- F** Energy is required for carbon dioxide molecules to form six-carbon sugar molecules.
 - G** Water molecules and radiant energy are necessary for anaerobic respiration to take place.
 - H** Oxygen molecules release energy in the form of heat during combustion reactions.
 - J** The energy in the bonds of glucose molecules is transferred to the phosphate bonds in ATP.
-

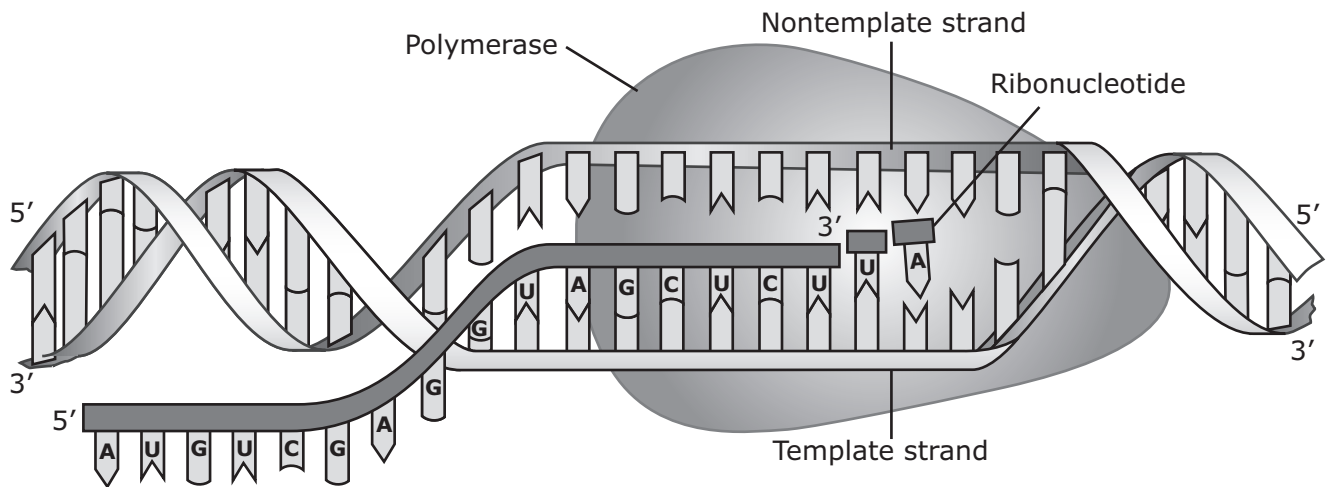
- 7** Leaves are part of a plant's shoot system. The xylem tissue in leaves transports —
- A** the bacteria needed for nitrogen fixation in root nodules
 - B** the wax required to coat the surface of actively growing tissue
 - C** the water and minerals that are absorbed by the roots
 - D** the oxygen that regulates the rate of carbohydrate production

- 8** Some organisms have genes that improve their ability to survive and reproduce. If the genes also help their offspring survive and reproduce, then which of the following will most likely increase?
- F** The frequency of the genes in one individual
 - G** The frequency of the genes in the population
 - H** The number of genes in one chromosome
 - J** The number of genes in the species
-

- 9** The overgrowth of algae poses a major problem for coral reefs. Intensive fishing is one factor that contributes to algae overgrowth because it does which of the following?
- A** Allows more sunlight to be available to algae
 - B** Inhibits the spread of pathogens in algae colonies
 - C** Reduces the number of organisms that feed on algae
 - D** Increases the competition between different algae species
-

- 10** Enzymes are proteins that help increase the rate of chemical reactions inside cells. These proteins are composed of many simpler molecules called amino acids. Which of the following suggests that the shape of an enzyme determines the enzyme's function?
- F** Enzymes are specific to a substrate.
 - G** Enzymes can operate in a wide range of conditions.
 - H** Enzymes are activated by neighboring molecules.
 - J** Enzymes can be found in all life-forms.

11 A section of a nucleic acid is shown below.



The process represented in the diagram produces a molecule that is complementary to the template strand of DNA. What type of molecule is produced?

- A** New DNA
- B** Polypeptide
- C** Messenger RNA
- D** Carbohydrate

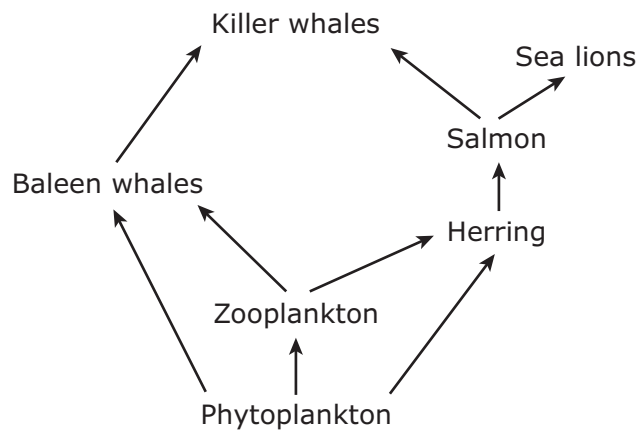
12 Which of the following correctly describes how a diagram of cellular respiration would differ from a diagram of photosynthesis?

- F** The cellular-respiration diagram would show electromagnetic waves as the final product.
- G** The cellular-respiration diagram would show glucose as the main source of energy.
- H** The cellular-respiration diagram would show energy stored in large protein molecules.
- J** The cellular-respiration diagram would show water as the main source of chemical energy.

13 If several pea plants with the genotype TTYy are crossed with pea plants with the genotype Ttyy, what percentage of the offspring will be expected to have the TTYy allele combination?

- A** 25%
- B** 40%
- C** 50%
- D** 75%

14



Which of the following are missing from the food web shown above?

- F** Producers
- G** Decomposers
- H** Omnivores
- J** Predators

- 15** The concept of gene flow is demonstrated when a cow is driven off from its herd, joins another herd, and reproduces. When the cow contributes to the gene pool of the new herd, which of these most likely increases?
- A** Natural selection
 - B** Genetic variation
 - C** Environmental fitness
 - D** Reproductive mutations

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- 16** A photomicrograph of onion root tip cells during mitosis is shown below.



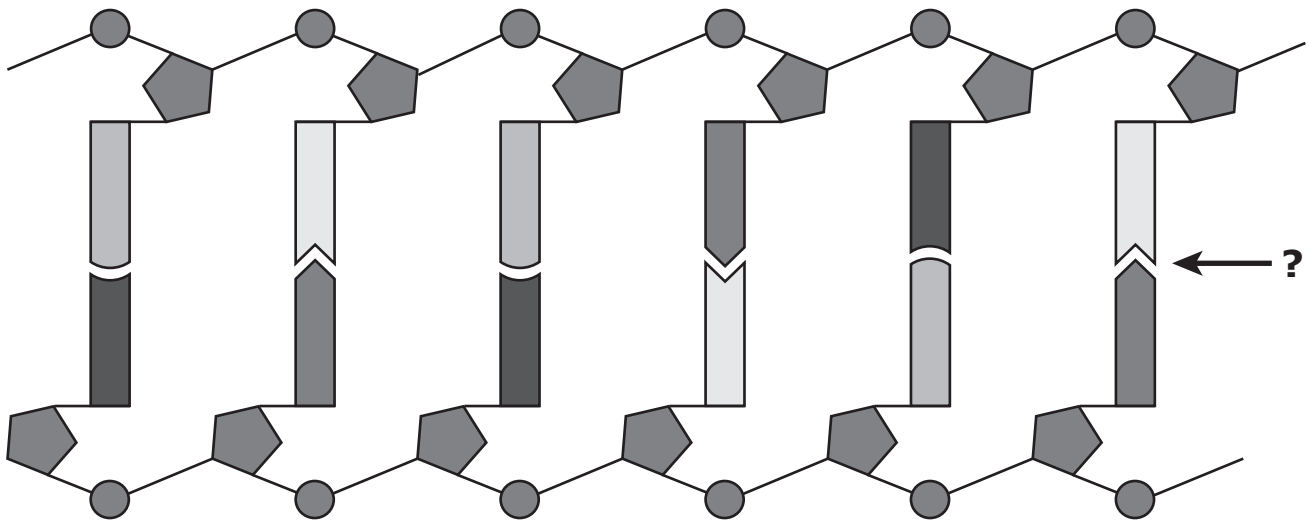
Which phase of mitosis is occurring in the cell indicated by the arrow?

- F** Prophase
- G** Metaphase
- H** Anaphase
- J** Telophase

17 A dog's pituitary gland produces the hormone ACTH, which stimulates the adrenal glands to secrete cortisol. Cortisol helps regulate body weight, mineral balance, the structure of connective tissue, the production of white blood cells, and skin health. When cortisol levels are low, the pituitary gland secretes ACTH. When cortisol levels are high, the pituitary gland stops secreting ACTH. Based on this information, which of the following would most likely be the cause of elevated levels of cortisol in a dog?

- A** Undersized adrenal glands
- B** An excess of ACTH
- C** An inactive pituitary gland
- D** An immune response to the excess level of cortisol

18 A model of a DNA molecule is shown below.



The arrow indicates —

- F** the bond between adjacent phosphate and deoxyribose molecules
- G** the junction of introns and exons in the sense strand of DNA
- H** the hydrogen bond between complementary nucleotides
- J** the junction of a codon and a DNA triplet

- 19 A student collected the animal shown below on a field trip. The student used a dichotomous key and a microscope to classify the animal.



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Dichotomous Key

Step	Characteristic	Identification
1a	Possesses segmentation	Go to 2
1b	Lacks segmentation	Go to 3
2a	Has an exoskeleton with jointed appendages	Phylum Arthropoda
2b	Has no exoskeleton, unjointed appendages (if any present), and a segmented worm-like body; is possibly in a tube (if in a tube, may have tentacles)	Phylum Annelida
3a	Possesses a foot, a radula, arms, and/or a shell	Phylum Mollusca
3b	Lacks all of the above and is dorsoventrally flattened	Phylum Platyhelminthes

How should this animal be classified?

- A Arthropoda
- B Annelida
- C Mollusca
- D Platyhelminthes

- 20 Proteins and polysaccharides are polymers. These polymers are formed by dehydration synthesis. Which statement correctly identifies a difference in the structure of proteins and polysaccharides?

- F Only polysaccharides are comprised of repeating units of cytosine, adenine, guanine, and thymine.
- G Only proteins are formed from amino acids joined by peptide bonds.
- H Only polysaccharides can be folded and twisted to very specific shapes.
- J Only proteins can be large molecules with thousands of subunits.

- 23** Both euglena and cyanobacteria are photosynthetic unicellular organisms found in pond water. The feature that distinguishes euglena from cyanobacteria is the —
- A** ability to maintain homeostasis
 - B** presence of ribosomes
 - C** ability to reproduce
 - D** presence of a nuclear membrane

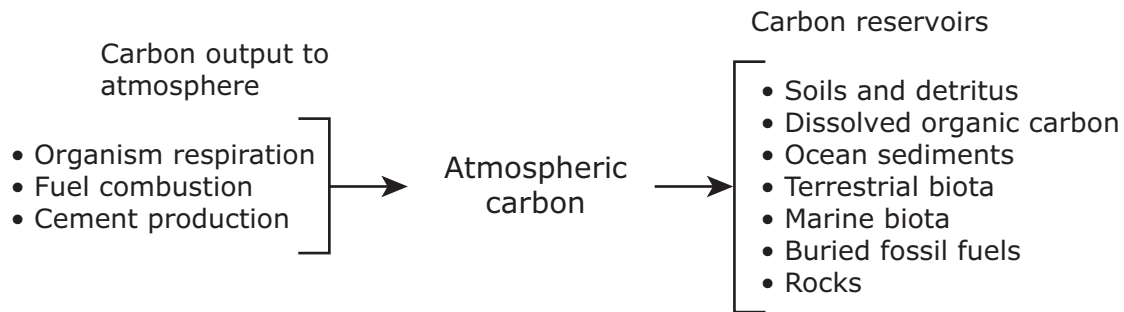
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- 24** The acacia ant (*Pseudomyrmex ferruginea*) lives in the bullshorn acacia plant, as shown below.



The acacia ant nests and feeds in the plant's hollow thorns. The ant helps protect the bullshorn acacia by attacking insects and grazing animals that come near the plant. The relationship between the acacia ant and the bullshorn acacia is an example of which of the following?

- F** Commensalism
- G** Mutualism
- H** Neutralism
- J** Parasitism

- 27** The carbon cycle includes processes that release carbon into the atmosphere and places that act as carbon reservoirs. The diagram below shows both major processes that release carbon and major carbon reservoirs.



Which of these disruptions would cause an excess output in the carbon cycle?

- A** The destruction of terrestrial biota
- B** Increases in marine biota
- C** A reduction in the use of fossil fuels
- D** A thickening of ocean sediments
-
- 28** Arthropods are joint-legged animals. Spiders, crabs, pill bugs, centipedes, and millipedes are examples of the many types of arthropods. Which of these arthropods are most closely related?
- F** Arthropods of the same family
- G** Arthropods of the same class
- H** Arthropods of the same genus
- J** Arthropods of the same species

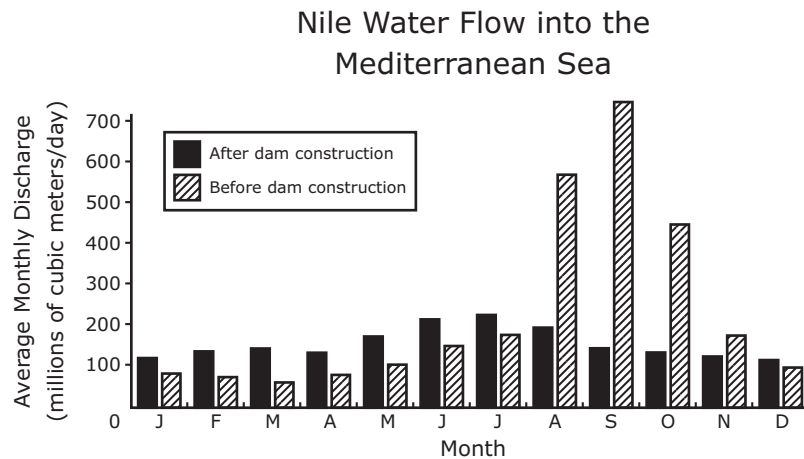
29 Which cellular process takes place in the ribosomes that are bound to the endoplasmic reticulum?

- A** The breakdown of waste material
- B** The conversion of radiant energy to glucose
- C** The synthesis of new proteins
- D** The replication of nucleic acids

30 Characteristics such as a widow's peak or attached earlobes are determined by the genetic code. Which components of DNA are referred to as the genetic code?

- F** Phosphate groups
- G** Nitrogenous bases
- H** Deoxyribose sugars
- J** Hydrogen bonds

- 31** The Nile River flows into the Mediterranean Sea. The Aswan High Dam contains the flow of water from the river and reduces the annual fall flooding. The floodwater is trapped behind the huge dam, allowing irrigation for agriculture. Sediments that would be washed away by the annual floods are also trapped behind the dam. The graph shows the water flow from the Nile that enters the Mediterranean Sea.



How has this dam most likely affected the Mediterranean Sea ecosystem?

- A** Reduced nutrients from the land support fewer producers in the sea.
- B** Water trapped behind the dam causes the marine ecosystem to move inland.
- C** The flooding in August through November causes marine life to be destroyed.
- D** The water temperature of the sea has increased.

-
- 32** Plant hormones serve as chemical messengers between cells and tissues. Auxin is a plant hormone that causes the cells on the shady side of a plant shoot to elongate. The response enabled by auxin is known as —

- F** geotropism
- G** transpiration
- H** phototropism
- J** photosynthesis

- 33** Which of these must occur during S phase of the cell cycle so that two daughter cells can be produced during M phase?
- A** The DNA must be replicated.
 - B** The chromosomes must be joined.
 - C** The cytoplasm must be separated.
 - D** The cell membrane must be expanded.

- 34** After examining the fossil record, scientists have determined that scorpions today are much smaller than their extinct ancestors. For example, *Jaekelopterus rhenaniae*, a giant scorpion species that lived 255 million to 460 million years ago, was 2.5 meters long. Which of the following conclusions is supported by this information?
- F** Scorpions living today have increased their numbers since they first appeared.
 - G** Scorpions in the fossil record are smaller than their descendants are.
 - H** Scorpions have changed as a result of natural selection.
 - J** Scorpions do not appear in their original state in the fossil record.

- 35** A student is studying the ecology of a playa lake, which forms after a rainfall in a dry lake bed. The table lists the organisms that the student observed.

Organisms Observed			
Day 1	Day 2	Day 3	Day 4
Fairy shrimp Clam shrimp Tadpole shrimp	Fairy shrimp Clam shrimp Tadpole shrimp Mayfly larvae	Fairy shrimp	None

Which level of biological organization has the student described in the table?

- A** Biosphere
- B** Organelle
- C** Ecosystem
- D** Community

- 38** In cocker spaniels the allele for a black coat color (B) is dominant over the allele for a brown coat color (b). If a brown cocker spaniel is crossed with a heterozygous black cocker spaniel, which of the following genotypic ratios can be expected?
- F** 0 BB: 2 Bb: 2 bb
 - G** 1 BB: 2 Bb: 1 bb
 - H** 2 BB: 0 Bb: 2 bb
 - J** 2 BB: 1 Bb: 0 bb

-
- 39** A harmless scarlet king snake and a venomous eastern coral snake have similar band patterns, as shown below. For the scarlet king snake, the adaptation of having a banding pattern like the eastern coral snake's is known as mimicry.



© Joe McDonald/CORBIS

Scarlet king snake



© iStockphoto.com/Mark Kostich

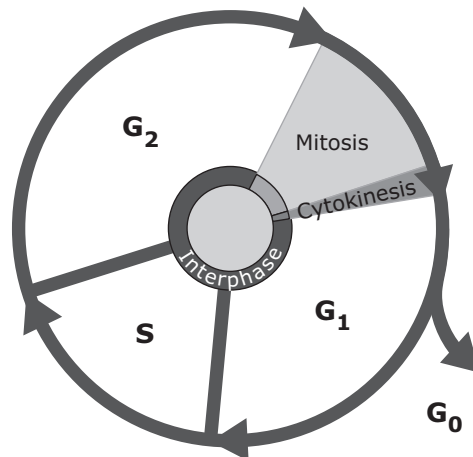
Eastern coral snake

The outcome of this adaptation in the scarlet king snake is to —

- A** make it easier for the scarlet king snake to attract prey
- B** make it easier for the scarlet king snake to interbreed with the other snake
- C** allow the scarlet king snake to blend in with its environment
- D** protect the scarlet king snake from predators

- 40** A student sets up a compost bin outdoors. Inside the bin microorganisms convert the student's vegetable and paper scraps into rich fertilizer. Which of the following best describes the role that these microorganisms play in natural habitats?
- F** The microorganisms help balance the numbers of producers and consumers.
 - G** The microorganisms help keep nutrients cycling through the ecosystem.
 - H** The microorganisms turn solar energy into sugars.
 - J** The microorganisms function as autotrophs.

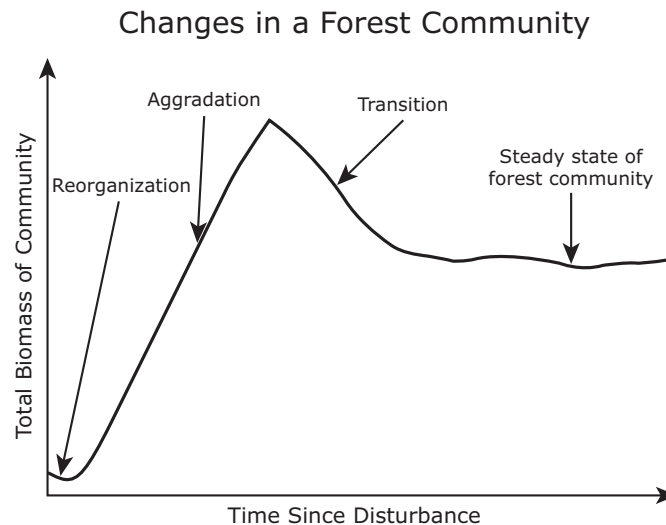
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- 41** The diagram below represents the cell cycle.



When cells leave the cell cycle, they exit during G_1 phase and then enter G_0 phase, a resting period. Most normal cells can leave G_0 phase and reenter the cell cycle at G_1 phase before entering S phase. Cancer cells are different because they cannot enter G_0 phase and are likely to do which of the following?

- A** Fail to complete S phase
- B** Mutate during G_1 phase
- C** Repeat the cell cycle continuously
- D** Die after completing mitosis

42 The graph shows the basic changes in a forest community after a disturbance occurred.



The information shown in the graph suggests that the changes in the forest community were caused by —

- | | |
|--|---------------------------------------|
| F tree-leaf replacement after a storm | H repeated habitat destruction |
| G succession after a fire | J decreased species diversity |

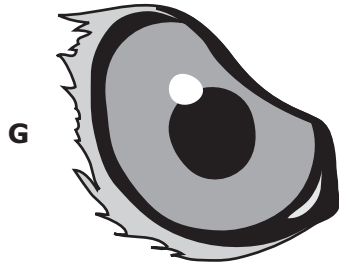
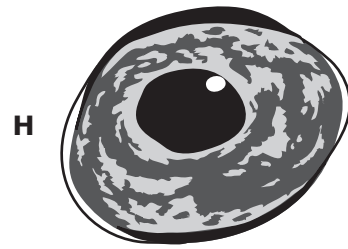
43 How does DNA in cells determine an organism's complex traits?

- A** DNA contains codes for proteins, which are necessary for the growth and functioning of an organism.
- B** DNA separates into long single strands that make up each part of an organism.
- C** DNA produces the energy an organism needs in order to grow.
- D** DNA folds into the nucleus of each of the cells of an organism.

- 44** Copper is a micronutrient that can be found in soil. Copper is important for reproductive growth in plants and plays an indirect role in chlorophyll production. Which statement correctly describes the interaction that occurs between the root and the shoot systems of plants to allow reproduction to occur?
- F** Copper is produced in the roots when copper-containing compounds are hydrolyzed.
 - G** Copper that is absorbed by the roots is transported to reproductive tissues by the shoot system.
 - H** The shoot system stores copper for later use by the roots and the reproductive structures.
 - J** The shoot system transports copper to the roots after it is taken in through stomata in the leaves.

-
- 45** Cold sores are caused by the herpes simplex virus type 1. A company that wants to develop antiviral drugs would ask a research immunologist to study —
- A** the mechanism used by the virus to infect cells
 - B** how closely related the virus is to cold viruses
 - C** the metabolism of the virus
 - D** meiosis in the virus

- 46** The iris controls the size and shape of the pupil. Which eye most likely belongs to an animal that is active most of the day on white desert sand?



-
- 47** Cell differentiation is critical during embryonic development. The process of cell differentiation results in the production of many types of cells, including germ, somatic, and stem cells. Cell differentiation is most directly regulated by —

- A** ATP
- B** DNA
- C** lipids
- D** sugars

-
- 48** The human digestive system is approximately 900 cm long. Food is moved through the digestive tract primarily by —

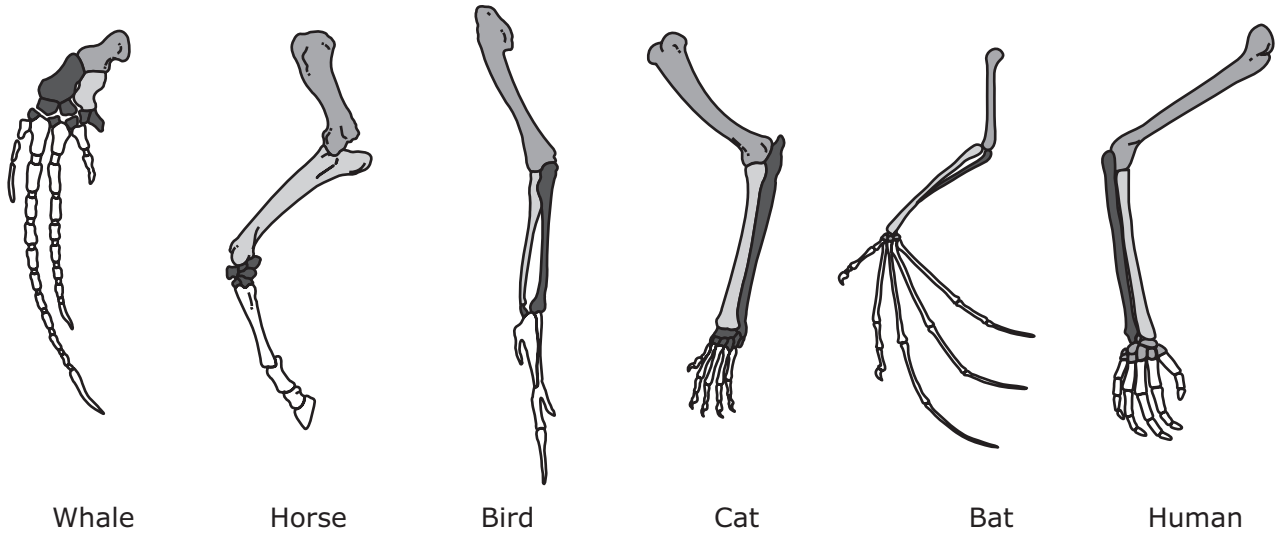
- F** bile produced by the pancreas
- G** the enzymes amylase and pepsin
- H** muscular contractions
- J** hydrochloric acid in the stomach

- 49** The fact that a strain of yeast with a certain defective gene can use the human version of the gene to repair itself is evidence that yeast and humans —
- A** depend on the same food supply
 - B** share a genetic code
 - C** both have eukaryotic cells
 - D** have identical genomes
-

- 50** A native species and a non-native species are competing for resources within the same ecosystem. The non-native species is more likely to survive than the native species in which of the following situations?
- F** Both the native species and the non-native species thrive on the same food source.
 - G** The native species is immune to certain pathogens in the ecosystem.
 - H** Predators prey on both native and non-native species.
 - J** The non-native species has no natural enemies in the ecosystem.
-

- 51** Changes in water pressure within guard cells cause the cells to open or close the stoma. This response helps the plant maintain homeostasis by —
- A** stabilizing the plant's temperature through the evaporation of water
 - B** regulating the amount of water the plant loses during transpiration
 - C** allowing oxygen needed for photosynthesis to enter the plant
 - D** enabling the plant to release more carbon dioxide at night for photosynthesis

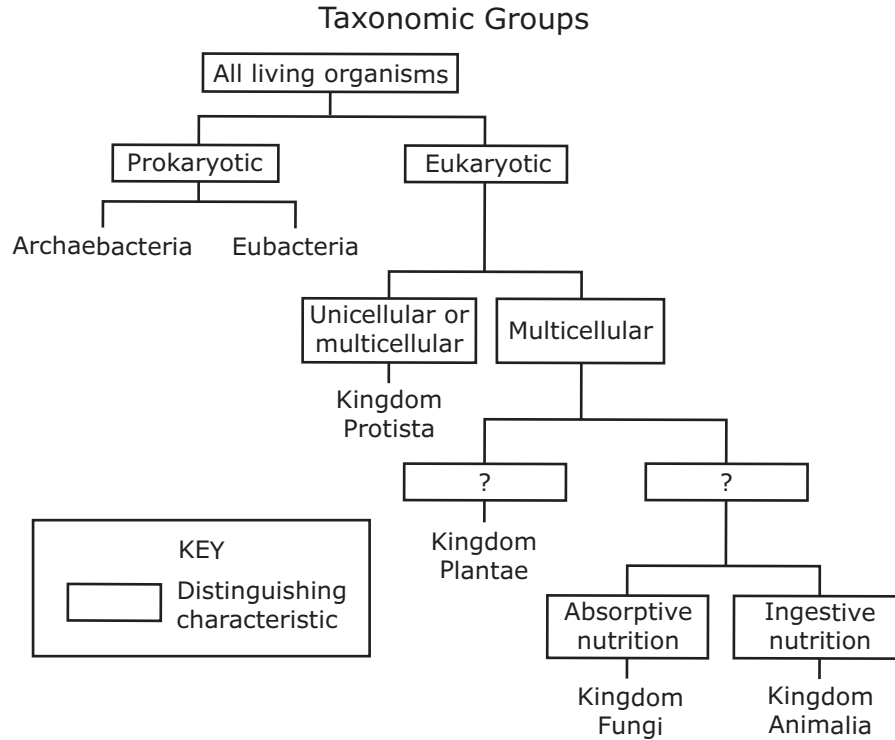
- 52** The limbs of several organisms are shown in the illustrations below. Scientists sometimes compare the limbs of these organisms to look for evidence of common ancestry.



These limbs provide evidence of common ancestry because they —

- F** have the same basic structure
 - G** perform the same function
 - H** are the same size
 - J** are parts of mammals
-
- 53** A mutation that occurs in the gametes of an organism will most likely be transferred to which of the following?
- A** The siblings of the organism
 - B** The offspring of the organism
 - C** The other organisms living nearby
 - D** The mating partner of the organism

- 54 The diagram shows taxonomic groups and a major distinguishing characteristic of all but two of them.



Which characteristics will be used to complete the chart?

- | | | | | | |
|--|-------------------|----------------|---|-------------|---------------|
| <p>F</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Motile</td> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Nonmotile</td> </tr> </table> | Motile | Nonmotile | <p>H</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Autotrophic</td> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Heterotrophic</td> </tr> </table> | Autotrophic | Heterotrophic |
| Motile | Nonmotile | | | | |
| Autotrophic | Heterotrophic | | | | |
| <p>G</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Nonphotosynthetic</td> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Photosynthetic</td> </tr> </table> | Nonphotosynthetic | Photosynthetic | <p>J</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">No nucleus</td> <td style="border: 1px solid black; width: 50%; text-align: center; padding: 5px;">Nucleus</td> </tr> </table> | No nucleus | Nucleus |
| Nonphotosynthetic | Photosynthetic | | | | |
| No nucleus | Nucleus | | | | |



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