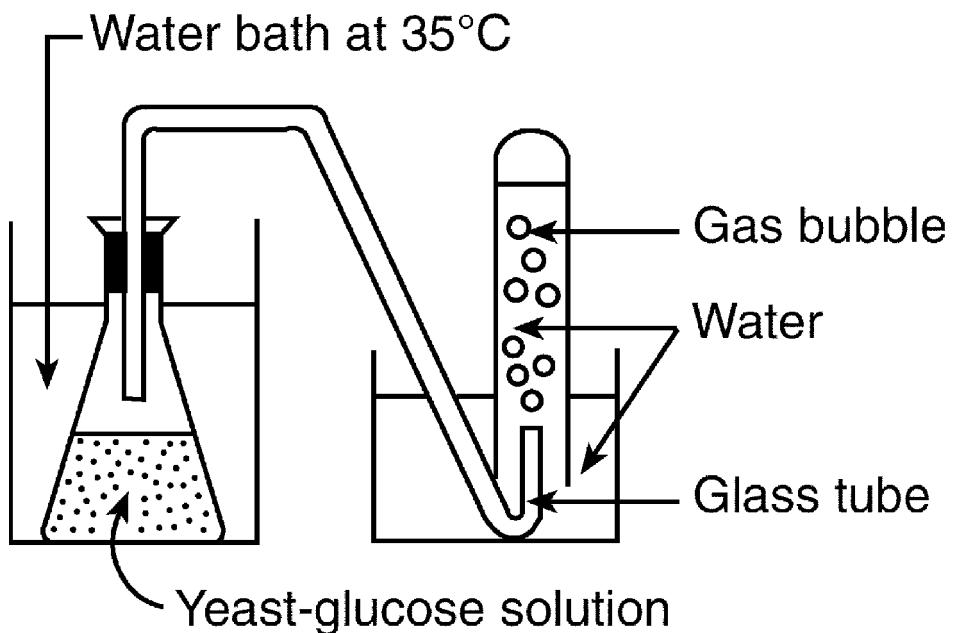


LIVING ENVIRONMENT REGENTS REVIEW QUESTIONS

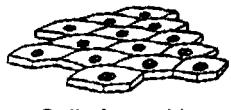
By Topic

January 2005 through August 2007



A Beach Channel High School Study Guide
By Gregory Arnold, A.P. Science

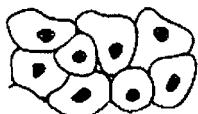
1. Some human body cells are shown in the diagrams below.



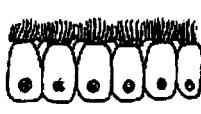
Cells from skin



Blood cells



Cells from lining of bladder



Cells from lining of trachea

These groups of cells represent different

- (1) tissues in which similar cells function together
- (2) organs that help to carry out a specific life activity
- (3) systems that are responsible for a specific life activity
- (4) organelles that carry out different functions

2. When organisms break the bonds of organic compounds, the organisms can

- (1) use the smaller molecules to plug the gaps in the cell membrane to slow diffusion
- (2) use the energy obtained to digest molecules produced by respiration that uses oxygen
- (3) obtain energy or reassemble the resulting materials to form different compounds
- (4) excrete smaller amounts of solid waste materials during vigorous exercise

3. The energy demands of a cell or an organism are met as a result of interactions between several life functions.

- Identify two life functions involved in meeting the energy demands of a cell or an organism. [2]

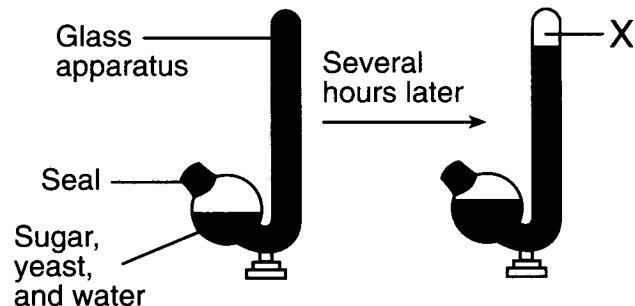
_____ and _____

- Explain how these two life functions interact to make energy available. [2]

4. Which group contains only molecules that are each assembled from smaller organic compounds?

- (1) proteins, water, DNA, fats
- (2) proteins, starch, carbon dioxide, water
- (3) proteins, DNA, fats, starch
- (4) proteins, carbon dioxide, DNA, starch

5. An investigation was carried out and the results are shown below. Substance X resulted from a metabolic process that produces ATP in yeast (a single-celled fungus).



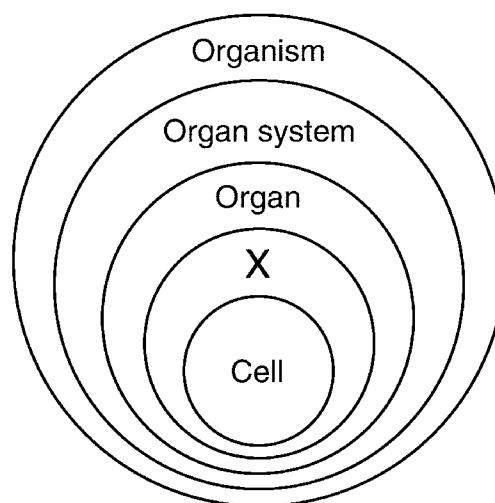
Which statement best describes substance X?

- (1) It is oxygen released by protein synthesis.
- (2) It is glucose that was produced in photosynthesis.
- (3) It is starch that was produced during digestion.
- (4) It is carbon dioxide released by respiration.

6. Which sequence illustrates the increasing complexity of levels of organization in multicellular organisms?

- (1) organelle → cell → tissue → organ → organ system → organism
- (2) cell → organelle → tissue → organ → organ system → organism
- (3) organelle → tissue → cell → organ → organ system → organism
- (4) cell → organism → organ system → organ → tissue → organelle

7. The diagram below represents levels of organization in living things. Which term would best represent X?



- (1) human
- (2) tissue
- (3) stomach
- (4) organelle

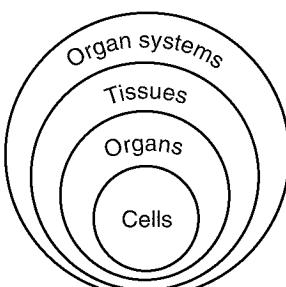
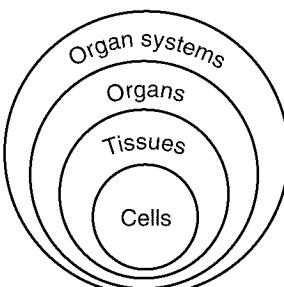
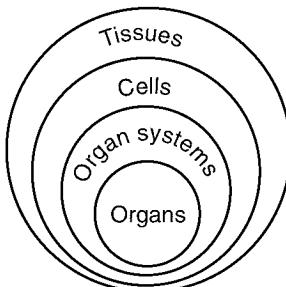
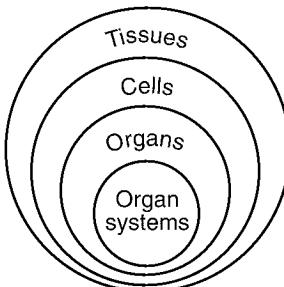
8. The levels of organization for structure and function in the human body from least complex to most complex are

- (1) systems → organs → tissues → cells
- (2) cells → organs → tissues → systems
- (3) tissues → systems → cells → organs
- (4) cells → tissues → organs → systems

9. Which sequence represents the correct order of organization in complex organisms?

- (1) tissues → organs → systems → cells
- (2) organs → tissues → systems → cells
- (3) systems → organs → cells → tissues
- (4) cells → tissues → organs → systems

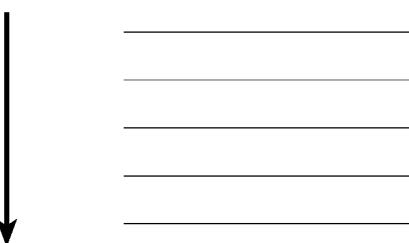
10. Which diagram best represents the levels of organization in the human body?



11. Write the structures listed below in order from least complex to most complex. [1]

- organ
- cell
- organism
- organelle
- tissue

Least complex:



Most complex:

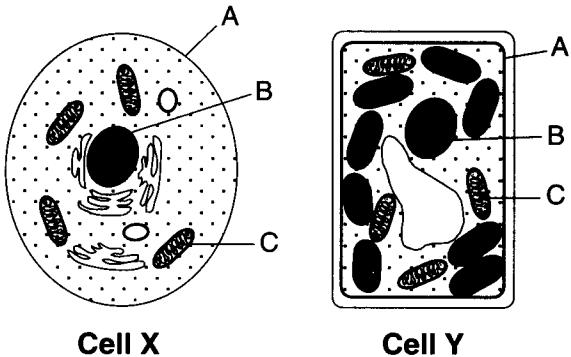
12. Most of the starch stored in the cells of a potato is composed of molecules that originally entered these cells as

- (1) enzymes
- (2) simple sugars
- (3) amino acids
- (4) minerals

1. Plants in areas with short growing seasons often have more chloroplasts in their cells than plants in areas with longer growing seasons. Compared to plants in areas with longer growing seasons, plants in areas with shorter growing seasons most likely

- (1) make and store food more quickly
- (2) have a higher rate of protein metabolism
- (3) grow taller
- (4) have a different method of respiration

Base your answers to questions 2 through 4 on the diagrams below of two cells, X and Y, and on your knowledge of biology.



2. Select one lettered organelle and write the letter of that organelle in the space below. Identify the organelle you selected. [1]

3. State one function of the organelle that you identified in question 43. [1]

4. Identify one process that is carried out in cell Y that is not carried out in cell X. [1]

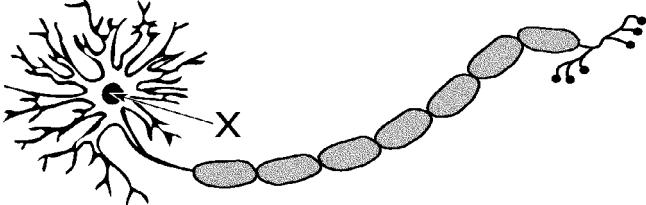
5. The largest amount of DNA in a plant cell is contained in

- (1) a nucleus
- (2) a chromosome
- (3) a protein molecule
- (4) an enzyme molecule

6. Which organelle is correctly paired with its specific function?

- (1) cell membrane—storage of hereditary information
- (2) chloroplast—transport of materials
- (3) ribosome—synthesis of proteins
- (4) vacuole—production of ATP

Base your answer to question 7 on the diagram below of a cell associated with coordination and on your knowledge of biology.



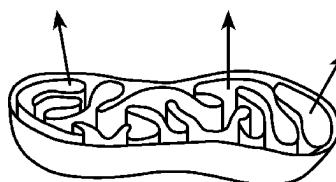
7. Structure X would be involved in the

- (1) storage of digestive enzymes
- (2) absorption of energy from the Sun
- (3) development of pathogens
- (4) synthesis of proteins

8. Organelles carry out specific processes involving chemical reactions. In the chart below, identify two organelles and, for each, identify a process involving chemical reactions that occurs there. Describe one specific way each process identified is important to the functioning of the organism. [4]

Organelle	Process Involving Chemical Reactions that Occur in the Organelle	How the Process is Important to the Functioning of the Organism
(1) _____	_____	_____
(2) _____	_____	_____

9. The diagram below represents a cell organelle involved in the transfer of energy from organic compounds.



The arrows in the diagram could represent the release of

- (1) ATP from a chloroplast carrying out photosynthesis
- (2) oxygen from a mitochondrion carrying out photosynthesis
- (3) glucose from a chloroplast carrying out respiration
- (4) carbon dioxide from a mitochondrion carrying out respiration

10. Homeostasis in unicellular organisms depends on the proper functioning of

- (1) organelles
- (2) insulin
- (3) guard cells
- (4) antibodies

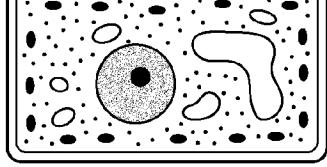
11. Describe how two of the cell structures listed below interact to help maintain a balanced internal environment in a cell.

- mitochondrion
- ribosome
- cell membrane
- nucleus
- vacuole

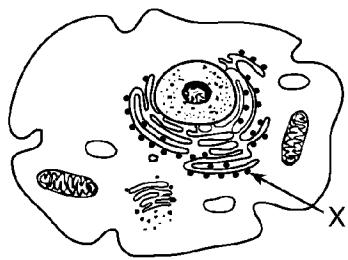
In your answer be sure to:

- select two of these structures, write their names, and state one function of each [2]
 - describe how each structure you selected contributes to the functioning of the other [2]
-
-
-
-
-
-

Base your answers to questions 12 through 14 on the diagrams below and on your knowledge of biology. The diagrams represent two different cells and some of their parts. The diagrams are not drawn to scale.



Cell A



Cell B

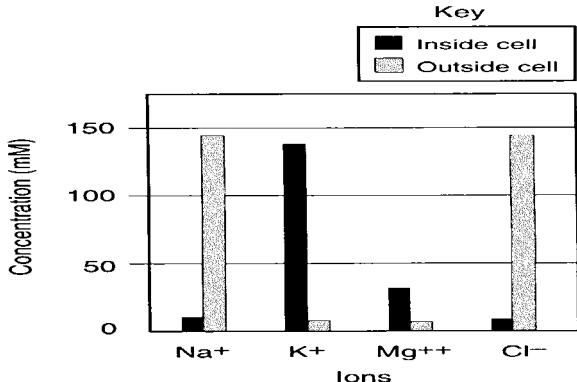
12. Identify an organelle in cell A that is the site of autotrophic nutrition. [1]

13. Identify the organelle labeled X in cell B. [1]

14. Which statement best describes these cells?

- (1) Cell B lacks vacuoles while cell A has them.
- (2) DNA would not be found in either cell A or cell B.
- (3) Both cell A and cell B use energy released from ATP.
- (4) Both cell A and cell B produce antibiotics.

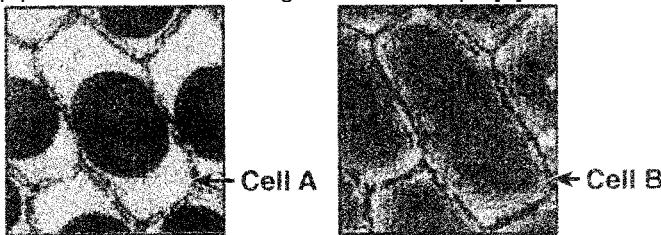
1. The graph below shows the relative concentrations of different ions inside and outside of an animal cell.



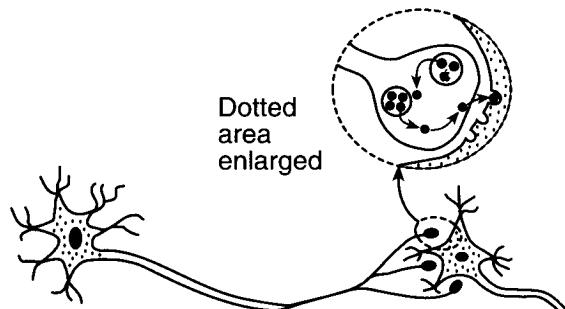
Which process is directly responsible for the net movement of K^+ and Mg^{++} into the animal cell?

- (1) electrophoresis (3) active transport
- (2) diffusion (4) circulation

2. The photos below show two red onion cells viewed with the high power of a compound light microscope. Describe the steps that could be used to make cell A resemble cell B using a piece of paper towel and an eydropper or a pipette without removing the cover slip. [3]



4. A process that occurs in the human body is represented in the diagram below.



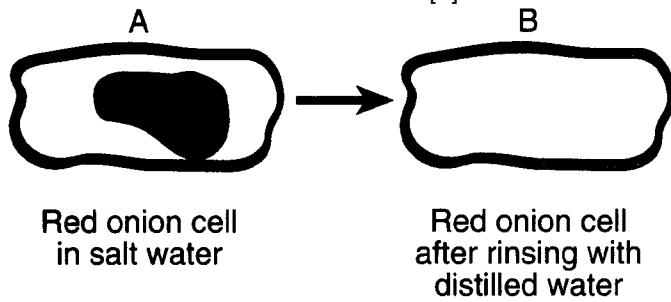
Which statement is most closely associated with the diagram?

- (1) Small molecules are obtained from large molecules during digestion.
- (2) Certain molecules are replicated by means of a template.
- (3) Receptor molecules play an important role in communication between cells.
- (4) Energy from nutrients is utilized for waste disposal.

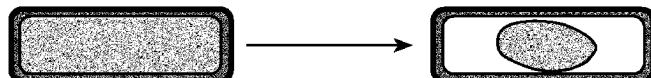
5. State one factor that influences which molecules can pass through the cell membrane of a human cell. [1]

6. A student prepared a wet-mount slide of some red onion cells and then added some salt water to the slide. The student observed the slide using a compound light microscope. Diagram A is typical of what the student observed after adding salt water.

Complete diagram B to show how the contents of the red onion cells should appear if the cell were then rinsed with distilled water for several minutes. [1]



7. A red onion cell has undergone a change, as represented in the diagram below.

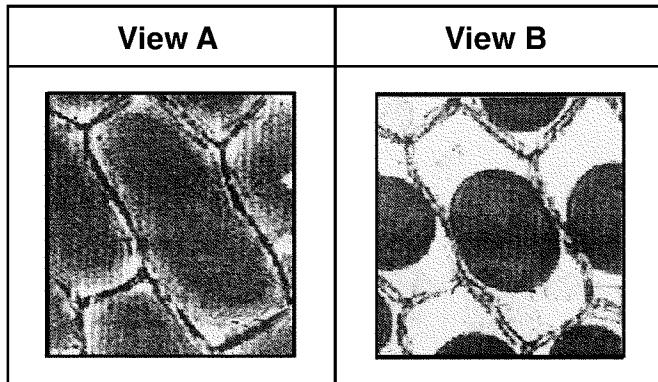


This change is most likely due to the cell being placed in

- (1) distilled water (3) salt water
- (2) light (4) darkness

Base your answers to questions 8 through 10 on the information and diagram below.

A student prepared a wet-mount slide of red onion skin and observed it under high power of a compound light microscope (view A). After adding a substance to the slide and waiting one minute, the student observed that there were changes in the cells (view B).



8. Identify one substance that could have been added to the cells on the slide in view A that would make them resemble the cells observed in view B. [1]

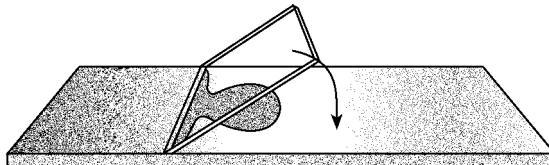
9. Identify the specific substance that diffused to cause the change in appearance from view A to view B. [1]

10. In the box below, sketch how view B would appear when viewed under lower power of the same compound light microscope. [1]



11. After a hormone enters the bloodstream, it is transported throughout the body, but the hormone affects only certain cells. The reason only certain cells are affected is that the membranes of these cells have specific

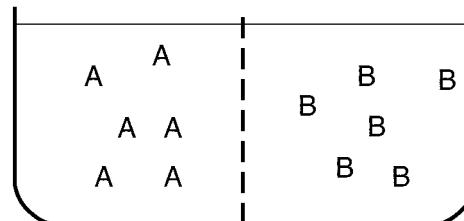
12. The diagram below shows how a coverslip should be lowered onto some single-celled organisms during the preparation of a wet mount.



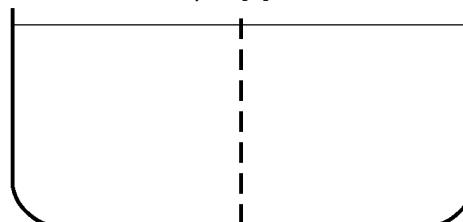
Why is this a preferred procedure?

- (1) The coverslip will prevent the slide from breaking.
 - (2) The organisms will be more evenly distributed.
 - (3) The possibility of breaking the coverslip is reduced.
 - (4) The possibility of trapping air bubbles is reduced.

13. The diagram below represents a container of water and two different kinds of molecules, A and B, separated into two chambers by a membrane through which only water and molecule A can pass.



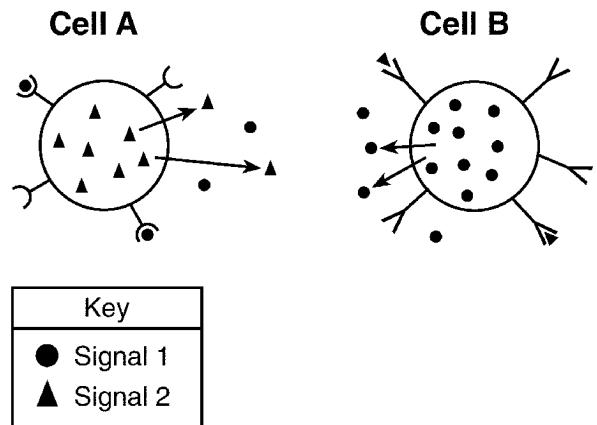
On the diagram of the container below, indicate the distribution of molecules A and B after the net movement of these molecules stops. [2]



14. Which row in the chart below best describes the active transport of molecule X through a cell membrane?

Row	Movement of Molecule X	ATP
(1)	high concentration → low concentration	used
(2)	high concentration → low concentration	not used
(3)	low concentration → high concentration	used
(4)	low concentration → high concentration	not used

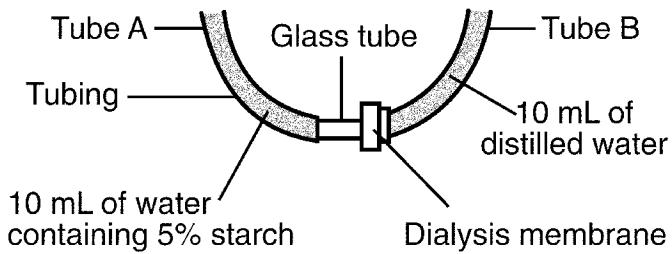
15. Cellular communication is illustrated in the diagram below.



Information can be sent from

- (1) cell A to cell B because cell B is able to recognize signal 1
- (2) cell A to cell B because cell A is able to recognize signal 2
- (3) cell B to cell A because cell A is able to recognize signal 1
- (4) cell B to cell A because cell B is able to recognize signal 2

16. The diagram below represents a laboratory setup used by a student during an investigation of diffusion.



Which statement best explains why the liquid in tube A will rise over a period of time?

- (1) The starch concentrations are equal on both sides of the membrane.
- (2) The water will pass from a region of lower starch concentration to one of higher starch concentration.
- (3) Water and starch volumes are the same in both tubes A and B.
- (4) The fluids in both tubes A and B will change from a higher temperature to a lower temperature.

17. Molecule X moves across a cell membrane by diffusion. Which row in the chart below best indicates the relationship between the relative concentrations of molecule X and the use of ATP for diffusion?

Row	Movement of Molecule X	Use of ATP
(1)	high concentration → low concentration	used
(2)	high concentration → low concentration	not used
(3)	low concentration → high concentration	used
(4)	low concentration → high concentration	not used

Base your answers to questions 18 and 19 on the information below and on your knowledge of biology.

In a class, each student made three models of the small intestine using three artificial membrane tubes. They filled each of the three tubes with equal amounts of water, starch, protein, and vitamin C. They added starch-digesting enzyme to tube 1. They added protein-digesting enzyme to tube 2. No enzyme was added to tube 3. The ends of the membrane tubes were sealed and the tubes were soaked for 24 hours in beakers of pure water. The beakers were numbered 1, 2, and 3, corresponding to the number of the tube they contained. At the end of the experiment, the students removed the tubes and tested the water in the beakers for the presence of nutrients.

18. Sugar would most likely be present in the

- (1) beaker 1, only
- (2) beaker 2, only
- (3) beakers 1 and 3, only
- (4) beakers 1, 2, and 3

19. Which statement would be a valid inference if vitamin C had been present in the water in each beaker?

- (1) The water synthesized vitamin C.
- (2) Vitamin C is a small molecule.
- (3) The membrane tube produced vitamin C.
- (4) The concentration of vitamin C is higher in the beaker than in the membrane tube.

Base your answers to questions 20 and 21 on the information below and on your knowledge of biology.

Students prepared four models of cells by using dialysis tubing containing the same blue solution. Each of the model cells originally weighed 10 grams. They then placed each model cell in a beaker containing a different concentration of water. After 24 hours, they recorded the mass of the model cells as shown in the data table below.

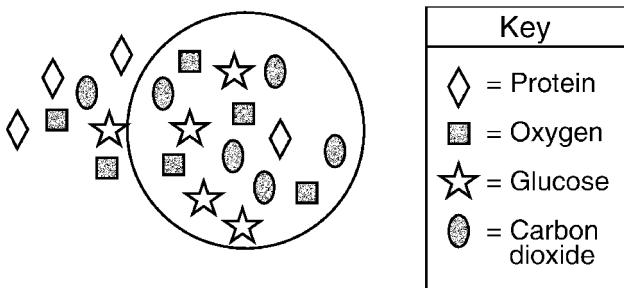
Data Table

Concentration of Water Surrounding the Model Cell	Mass of Model Cell
100%	12 grams
90%	11 grams
80%	10 grams
70%	9 grams

20. Why did the model cell that was placed in 100% water increase in mass? [1]

21. What was the concentration of water in the original blue solution? State evidence in support of your answer. [1]

22. The diagram below shows the relative concentration of molecules inside and outside of a cell.



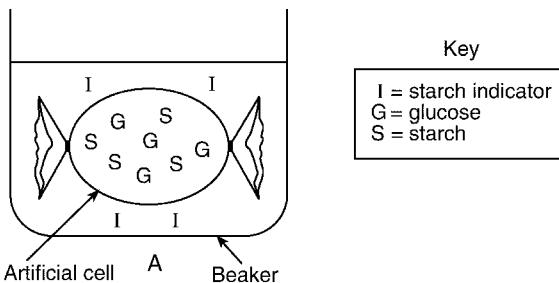
Which statement best describes the general direction of diffusion across the membrane of this cell?

- (1) Glucose would diffuse into the cell.
- (2) Protein would diffuse out of the cell.
- (3) Carbon dioxide would diffuse out of the cell.
- (4) Oxygen would diffuse into the cell.

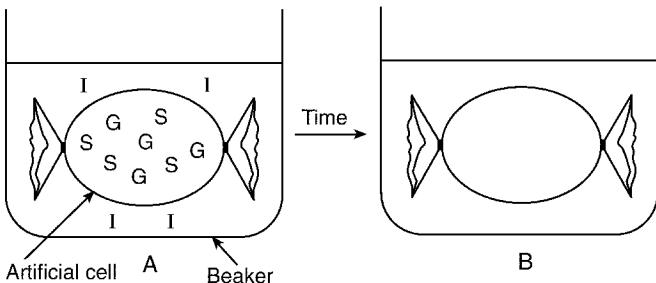
23. A protein on the surface of HIV can attach to proteins on the surface of healthy human cells. These attachment sites on the surface of the cells are known as

- (1) receptor molecules
- (2) genetic codes
- (3) molecular bases
- (4) inorganic catalysts

Base your answers to questions 24 and 25 on the information and diagram below and on your knowledge of biology. The diagram illustrates an investigation carried out in a laboratory activity on diffusion. The beaker and the artificial cell also contain water.



24. Predict what would happen over time by showing the location of molecules I, G, and S in diagram B below. [3]



25. State what is observed when there is a positive test for starch using the starch indicator. [1]

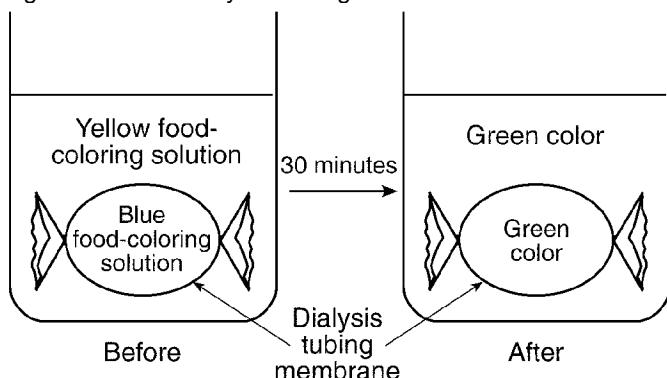
26. A student fills a dialysis membrane bag with a mixture of red dye, yellow dye, and water. He soaks the bag in pure water for 24 hours and then observes that the water outside the bag turns yellow. Which statement best explains the results of this experiment?

- (1) Water diffused into the membrane bag.
- (2) The dialysis membrane actively transported yellow dye molecules.
- (3) Only red dye diffused through the membrane.
- (4) The yellow dye molecules are smaller than the red dye molecules.

27. If frog eggs taken from a freshwater pond are placed in a saltwater aquarium, what will most likely happen?

- (1) Water will leave the eggs.
- (2) Salt will leave the eggs.
- (3) Water will neither enter nor leave the eggs.
- (4) The eggs will burst.

Base your answers to questions 28 and 29 on the diagram below and on your knowledge of biology. The diagram shows the changes that occurred in a beaker after 30 minutes. The beaker contained water, food coloring, and a bag made from dialysis tubing membrane.



28. When the colors yellow and blue are combined, they produce a green color. Which statement most likely describes the relative sizes of the yellow and blue food-coloring molecules in the diagram?

- (1) The yellow food-coloring molecules are small, while the blue food-coloring molecules are large.
- (2) The yellow food-coloring molecules are large, while the blue food-coloring molecules are small.
- (3) Both the yellow food-coloring molecules and the blue food-coloring molecules are large.
- (4) Both the yellow food-coloring molecules and the blue food-coloring molecules are small.

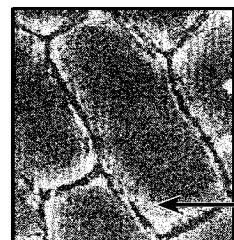
29. Which statement best explains the changes shown?

- (1) Molecular movement was aided by the presence of specific carbohydrate molecules on the surface of the membrane.
- (2) Molecular movement was aided by the presence of specific enzyme molecules on the surface of the membrane.
- (3) Molecules moved across the membrane without additional energy being supplied.
- (4) Molecules moved across the membrane only when additional energy was supplied.

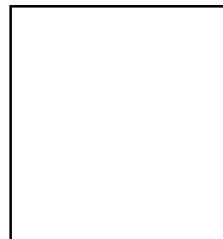
30. In the *Diffusion Through a Membrane* lab, the model cell membranes allowed certain substances to pass through based on which characteristic of the diffusing substance?

- | | |
|-----------|-----------------|
| (1) size | (3) color |
| (2) shape | (4) temperature |

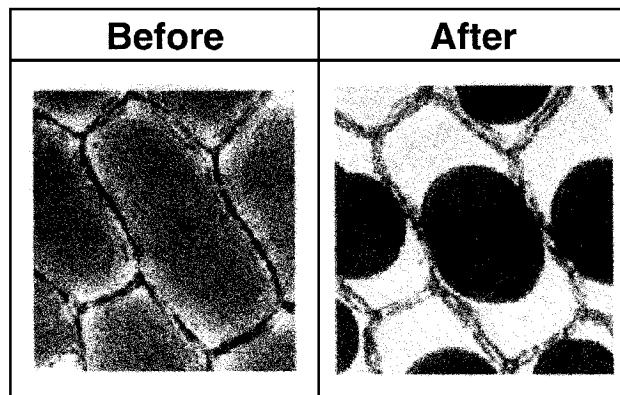
31. Cell A shown below is a typical red onion cell in water on a slide viewed with a compound light microscope.



Draw a diagram of how cell A would most likely look after salt water has been added to the slide and label the cell membrane in your diagram. [2]



Base your answers to question 32 on the information and diagram below and on your knowledge of biology. The diagram represents some cells on a microscope slide before and after a substance was added to the slide.



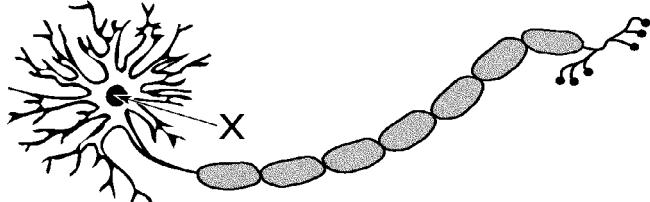
32. Identify a substance that was most likely added to the slide to cause the change observed. [1]

1. Which two organ systems provide materials required for the human body to produce ATP?

- (1) reproductive and excretory
- (2) digestive and respiratory
- (3) respiratory and immune
- (4) digestive and reproductive

2. Organ systems of the human body interact to maintain a balanced internal environment. As blood flows through certain organs of the body, the composition of the blood changes because of interactions with those organs. State one change in the composition of the blood as it flows through the digestive system. [1]

Base your answers to question 3 on the diagram below of a cell associated with coordination and on your knowledge of biology.



3. Which statement best describes a function of the entire structure shown in the diagram?

- (1) It unites with an egg cell during fertilization.
- (2) It synthesizes a hormone involved in the control of blood sugar level.
- (3) It releases chemicals involved in cellular communication.
- (4) It controls the replication of genetic material.

4. Describe one example of diffusion in the human body. In your description be sure to:

- identify the place where diffusion takes place [1]
 - identify a substance that diffuses there [1]
 - identify where that substance diffuses from and where it diffuses to, at that place [1]
-
-
-

5. Which order of metabolic processes converts nutrients consumed by an organism into cell parts?

- (1) digestion → absorption → circulation → diffusion → synthesis
- (2) absorption → circulation → digestion → diffusion → synthesis
- (3) digestion → synthesis → diffusion → circulation → absorption
- (4) synthesis → absorption → digestion → diffusion → circulation

6. Which statement best compares a multicellular organism to a single-celled organism?

- (1) A multicellular organism has organ systems that interact to carry out life functions, while a single-celled organism carries out life functions without using organ systems.
- (2) A single-celled organism carries out fewer life functions than each cell of a multicellular organism.
- (3) A multicellular organism always obtains energy through a process that is different from that used by a single-celled organism.
- (4) The cell of a single-celled organism is always much larger than an individual cell of a multicellular organism.

7. State one reason that most foods must be digested before they can enter a cell. [1]

8. An increase in heart rate will most likely result in

- (1) a decrease in metabolic rate
- (2) an increase in pulse rate
- (3) an increase in cell division
- (4) a decrease in body temperature

9. What will most likely happen to wastes containing nitrogen produced as a result of the breakdown of amino acids within liver cells of a mammal?

- (1) They will be digested by enzymes in the stomach.
- (2) They will be removed by the excretory system.
- (3) They will be destroyed by specialized blood cells.
- (4) They will be absorbed by mitochondria in nearby cells.

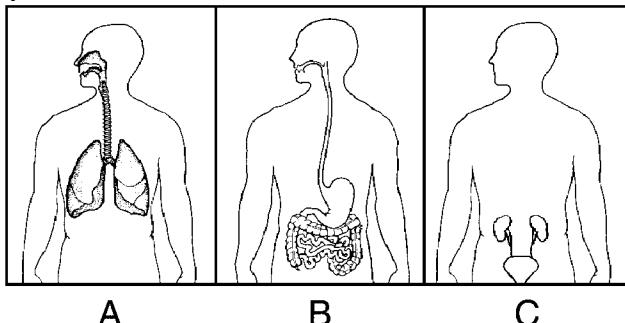
10. Which statement best describes a change that usually takes place in the human body when the heart rate increases as a result of exercise?

- (1) More oxygen is delivered to muscle cells.
- (2) Blood cells are excreted at a faster rate.
- (3) The rate of digestion increases.
- (4) No hormones are produced.

11. Contractile vacuoles maintain water balance by pumping excess water out of some single-celled pond organisms. In humans, the kidney is chiefly involved in maintaining water balance. These facts best illustrate that

- (1) tissues, organs, and organ systems work together to maintain homeostasis in all living things
- (2) interference with nerve signals disrupts cellular communication and homeostasis within organisms
- (3) a disruption in a body system may disrupt the homeostasis of a single-celled organism
- (4) structures found in single-celled organisms can act in a manner similar to tissues and organs in multicellular organisms

12. The diagram below represents three human body systems.



A

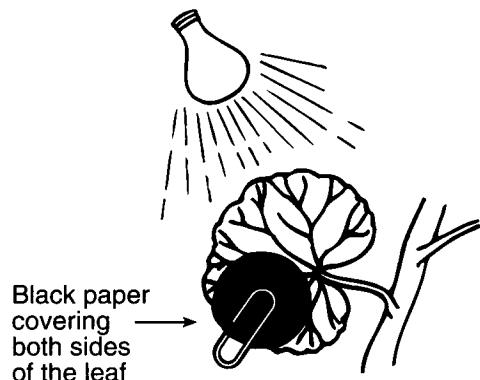
B

C

Which row in the chart below correctly shows what systems A, B, and C provide for the human body?

Row	System A	System B	System C
(1)	blood cells	glucose	hormones
(2)	oxygen	absorption	gametes
(3)	gas exchange	nutrients	waste removal
(4)	immunity	coordination	carbon dioxide

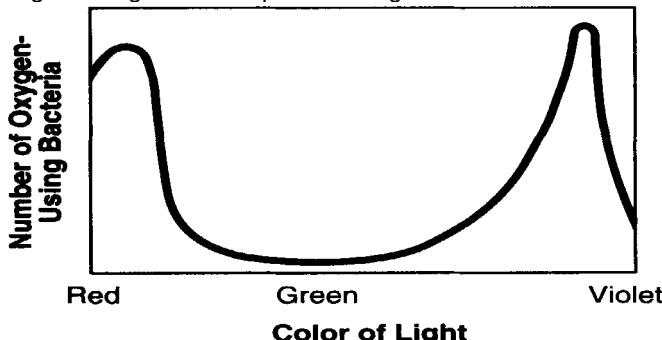
1. An experimental setup is shown below.



Which hypothesis would most likely be tested using this setup?

- (1) Light is needed for the process of reproduction.
- (2) Glucose is not synthesized by plants in the dark.
- (3) Protein synthesis takes place in leaves.
- (4) Plants need fertilizers for proper growth.

2. The graph below shows the results of an experiment in which a container of oxygen-using bacteria and strands of a green alga were exposed to light of different colors.



Which statement best explains the results of this experiment?

- (1) The rate of photosynthesis is affected by variations in the light.
- (2) In all environments light is a vital resource.
- (3) The activities of bacteria and algae are not related.
- (4) Uneven numbers and types of species can upset ecosystem stability.

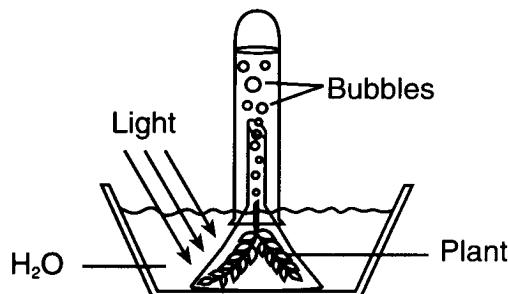
3. An enzyme known as rubisco enables plants to use large amounts of carbon dioxide. This enzyme is most likely active in the

- (1) nucleus
- (2) vacuoles
- (3) mitochondria
- (4) chloroplasts

4. Starch molecules present in a maple tree are made from materials that originally entered the tree from the external environment as

- (1) enzymes
- (2) simple sugars
- (3) amino acids
- (4) inorganic compounds

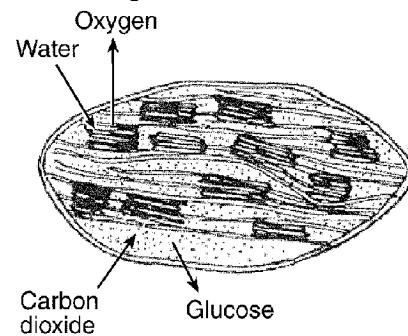
5. The green aquatic plant represented in the diagram below was exposed to light for several hours.



Which gas would most likely be found in the greatest amount in the bubbles?

- (1) oxygen
- (2) nitrogen
- (3) ozone
- (4) carbon dioxide

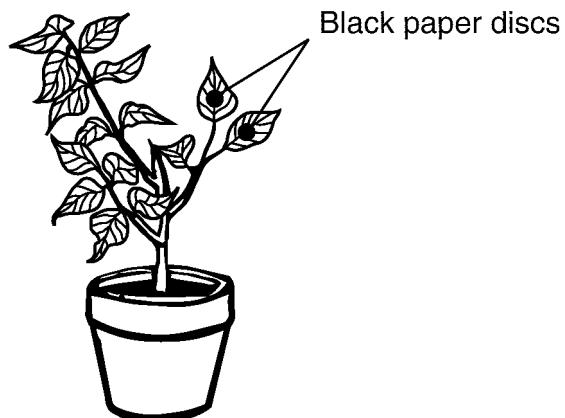
6. The diagram below illustrates the movement of materials involved in a process that is vital for the energy needs of organisms.



The process illustrated occurs within

- (1) chloroplasts
- (2) mitochondria
- (3) ribosomes
- (4) vacuoles

7. The diagram below represents the setup for an experiment. Two black paper discs are opposite each other on both sides of each of two leaves.



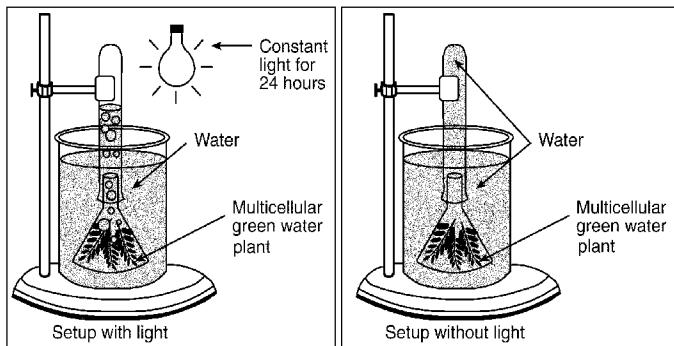
This experimental setup would most likely be used to show that

- (1) glucose is necessary for photosynthesis
- (2) protein is a product of photosynthesis
- (3) light is necessary for photosynthesis
- (4) carbon dioxide is a product of photosynthesis

8. Photosynthesis is an important process. Discuss photosynthesis and explain its importance to an organism. In your answer, be sure to:

- identify the organelle where this process occurs [1]
 - identify two raw materials necessary for this process [1]
 - identify one energy-rich molecule that is produced by this process [1]
 - state how organisms use the energy-rich molecule that is produced [1]
 - state how a gas produced by this process is recycled in nature [1]
-
-
-
-
-

11. An experimental setup is shown in the diagram below.



Which hypothesis would most likely be tested using this setup?

- (1) Green water plants release a gas in the presence of light.
- (2) Roots of water plants absorb minerals in the absence of light.
- (3) Green plants need light for cell division.
- (4) Plants grow best in the absence of light.

Base your answers to questions 12 through 13 on the data table below and on your knowledge of biology. The table contains information about glucose production in a species of plant that lives in the water of a salt marsh.

Temperature (°C)	Glucose Production (mg/hr)
10	5
20	10
30	15
40	5

12. At which temperature would the plants most likely use the greatest amount of carbon dioxide?

- (1) 10°C
- (2) 20°C
- (3) 30°C
- (4) 40°C

13. How much oxygen will plants that live in water at 10°C most likely produce?

- (1) twice the amount of oxygen produced at 20°C
- (2) the same amount of oxygen produced at 40°C
- (3) the most oxygen produced at any temperature
- (4) more oxygen than is produced at 30°C

14. In the transfer of energy from the Sun to ecosystems, which molecule is one of the first to store this energy?

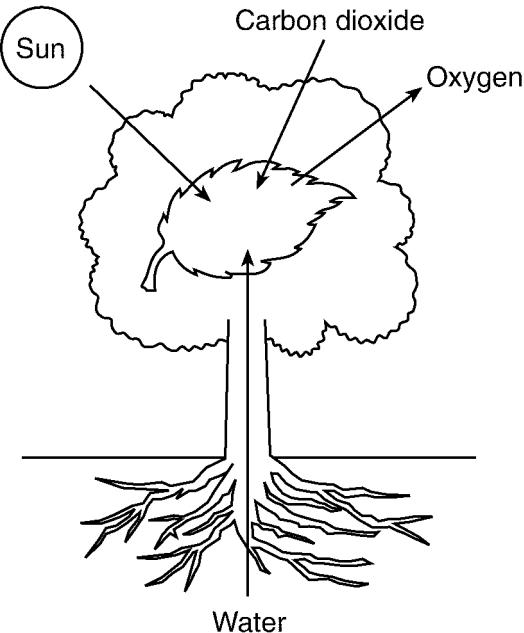
- (1) protein
- (2) fat
- (3) DNA
- (4) glucose

9. Identify one physical or biological process taking place within a river, other than temperature change, that would affect the level of dissolved oxygen and state whether this process would increase or decrease the level of dissolved oxygen. [1]

10. The dissolved carbon dioxide in a lake is used directly by

- | | |
|----------------|-----------------|
| (1) autotrophs | (3) fungi |
| (2) parasites | (4) decomposers |

15. The diagram below represents events associated with a biochemical process that occurs in some organisms.



Which statement concerning this process is correct?

- (1) The process represented is respiration and the primary source of energy for the process is the Sun.
- (2) The process represented is photosynthesis and the primary source of energy for the process is the Sun.
- (3) This process converts energy in organic compounds into solar energy which is released into the atmosphere.
- (4) This process uses solar energy to convert oxygen into carbon dioxide.

1. Respiration is an important process. Discuss respiration and explain its importance to an organism. In your answer, be sure to:

- identify the organelle where this process occurs [1]
- identify two raw materials necessary for this process [1]
- identify one energy-rich molecule that is produced by this process [1]
- state how organisms use the energy-rich molecule that is produced [1]
- state how a gas produced by this process is recycled in nature [1]

3. When organisms break the bonds of organic compounds, the organisms can

- (1) use the smaller molecules to plug the gaps in the cell membrane to slow diffusion
 - (2) use the energy obtained to digest molecules produced by respiration that uses oxygen
 - (3) obtain energy or reassemble the resulting materials to form different compounds
 - (4) excrete smaller amounts of solid waste materials during vigorous exercise

4. The energy demands of a cell or an organism are met as a result of interactions between several life functions.

- Identify two life functions involved in meeting the energy demands of a cell or an organism. [2]

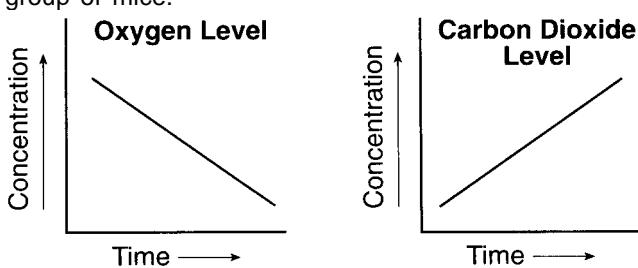
and

- Explain how these two life functions interact to make energy available. [2]

5. The production of energy-rich ATP molecules is the direct result of

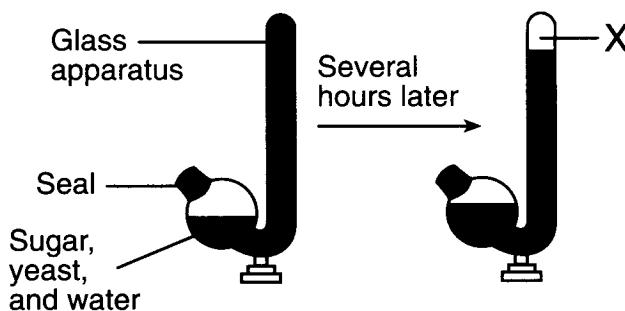
- (1) recycling light energy to be used in the process of photosynthesis
 - (2) releasing the stored energy of organic compounds by the process of respiration
 - (3) breaking down starch by the process of digestion
 - (4) copying coded information during the process of protein synthesis

6. An investigation was carried out and the results are shown below. Substance X resulted from a metabolic process that produces ATP in yeast (a single-celled fungus).



Which process in the mice most likely accounts for the changes shown?

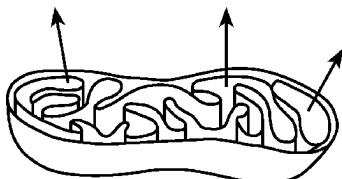
- (1) active transport (3) respiration
(2) evaporation (4) photosynthesis



Which statement best describes substance X?

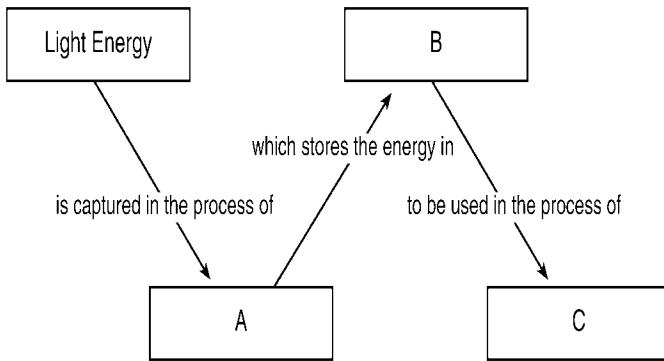
- (1) It is oxygen released by protein synthesis.
 - (2) It is glucose that was produced in photosynthesis.
 - (3) It is starch that was produced during digestion.
 - (4) It is carbon dioxide released by respiration.

7. The diagram below represents a cell organelle involved in the transfer of energy from organic compounds.



- The arrows in the diagram could represent the release of
- (1) ATP from a chloroplast carrying out photosynthesis
 - (2) oxygen from a mitochondrion carrying out photosynthesis
 - (3) glucose from a chloroplast carrying out respiration
 - (4) carbon dioxide from a mitochondrion carrying out respiration

8. Which set of terms best identifies the letters in the diagram below?



	A	B	C
(1)	photosynthesis	inorganic molecules	decomposition
(2)	respiration	organic molecules	digestion
(3)	photosynthesis	organic molecules	respiration
(4)	respiration	inorganic molecules	photosynthesis

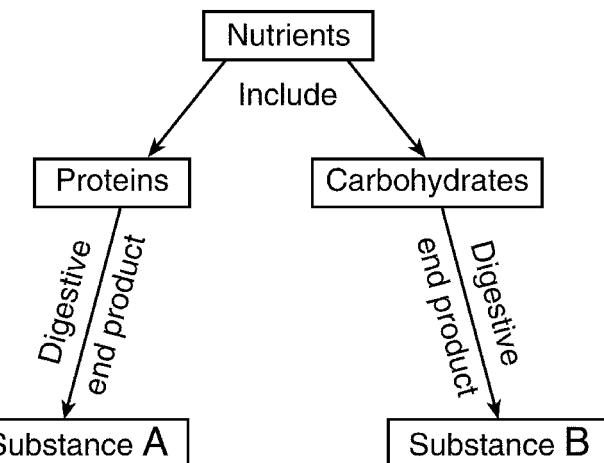
9. Which change in a sample of pond water could indicate that heterotrophic microbes were active?

- (1) increase in ozone level
- (2) increase in glucose level
- (3) decrease in oxygen level
- (4) decrease in carbon dioxide level

10. Which statement best describes cellular respiration?

- (1) It occurs in animal cells but not in plant cells.
- (2) It converts energy in food into a more usable form.
- (3) It uses carbon dioxide and produces oxygen.
- (4) It stores energy in food molecules.

Base your answers to questions 11 and 12 on the information in the diagram below and on your knowledge of biology.



11. In an autotrophic organism, substance B functions as a

- (1) source of energy
- (2) hormone
- (3) vitamin
- (4) biotic resource

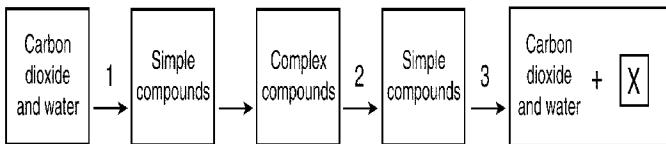
12. In a heterotrophic organism, substance A could be used directly for

- (1) photosynthesis
- (2) synthesis of enzymes
- (3) a building block of starch
- (4) a genetic code

13. When a person exercises, changes occur in muscle cells as they release more energy. Explain how increased blood flow helps these muscle cells release more energy. [1]

14. Identify one physical or biological process taking place within a river, other than temperature change, that would affect the level of dissolved oxygen and state whether this process would increase or decrease the level of dissolved oxygen. [1]

Base your answers to questions 15 through 18 on the diagram below and on your knowledge of biology. The arrows in the diagram represent biological processes.



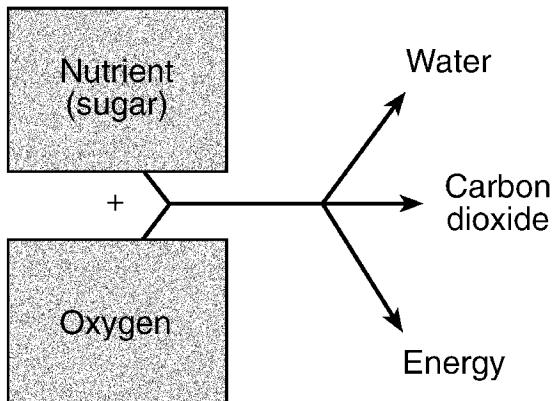
15. Identify one type of organism that carries out process 1. [1]

16. Explain why process 2 is essential in humans. [1]

17. Identify process 3. [1]

18. Identify what letter X represents. [1]

Base your answers to questions 19 and 20 on the diagram below and on your knowledge of biology. The diagram illustrates a process by which energy is released in organisms.



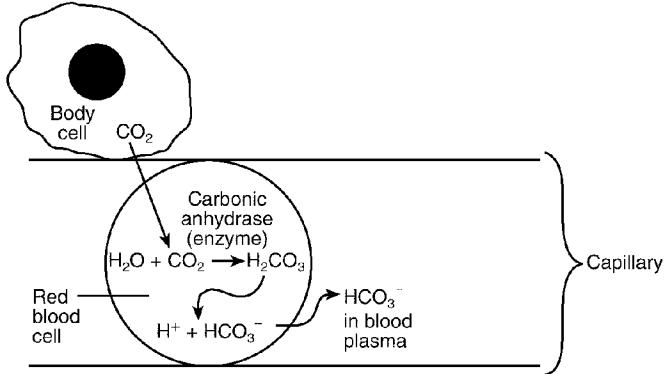
19. Cells usually transfer the energy that is released directly to

20. The energy released in this process was originally present in

- (1) sunlight and then transferred to sugar
 - (2) sunlight and then transferred to oxygen
 - (3) the oxygen and then transferred to sugar
 - (4) the sugar and then transferred to oxygen

21. Mice store only a small amount of the energy they obtain from plants they eat. State what might happen to some of the remaining energy they obtain from the plants.
[1]

Base your answers to questions 22 and 23 on the diagram below, which illustrates a transport pathway of CO₂ in the human body, and on your knowledge of biology.

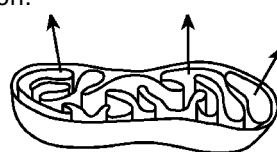


22. Identify the cellular process that most likely produced the CO₂ in the body cell. [1]

Ans: _____

23. Explain why carbon dioxide moves into red blood cells by diffusion rather than by active transport. [1]

24. The diagram below represents a structure involved in cellular respiration.



Mitochondrion

The release of which substance is represented by the arrows?

25. Which part of a molecule provides energy for life processes?

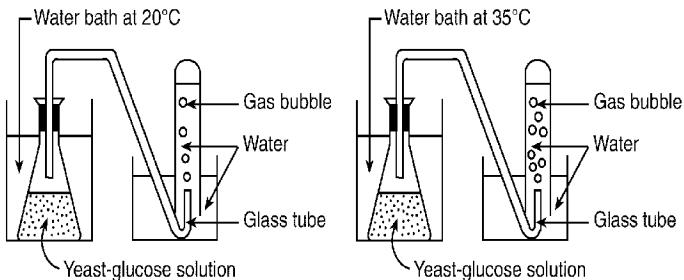
- (1) carbon atoms (3) chemical bonds
(2) oxygen atoms (4) inorganic nitrogen

26. Energy from organic molecules can be stored in ATP molecules as a direct result of the process of

- (1) cellular respiration (3) diffusion
(2) cellular reproduction (4) digestion

Base your answers to questions 27 through 31 on the information and diagrams below and on your knowledge of biology.

The laboratory setups represented below were used to investigate the effect of temperature on cellular respiration in yeast (a single-celled organism). Each of two flasks containing equal amounts of a yeast-glucose solution was submerged in a water bath, one kept at 20°C and one kept at 35°C. The number of gas bubbles released from the glass tube in each setup was observed and the results were recorded every 5 minutes for a period of 25 minutes. The data are summarized in the table below.

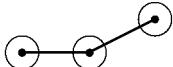


Data Table

Time (minutes)	Total Number of Bubbles Released	
	20°C	35°C
5	0	5
10	5	15
15	15	30
20	30	50
25	45	75

Directions (27–29) : Using the information in the data table, construct a line graph on the grid, following the directions below.

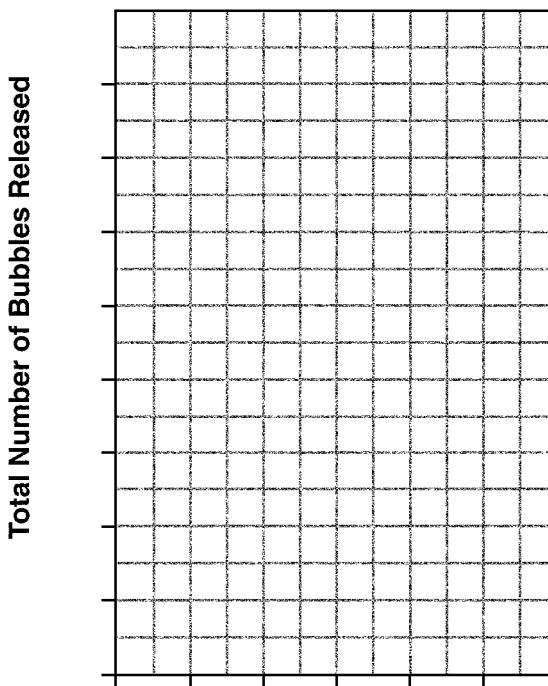
27. Mark an appropriate scale on each axis. [1]
28. Plot the data for the total number of bubbles released at 20°C on the grid on the next page. Surround each point with a small circle and connect the points. [1]

Example: 

29. Plot the data for the total number of bubbles released at 35°C on the grid. Surround each point with a small triangle and connect the points. [1]

Example: 

The Effect of Temperature on Respiration in Yeast



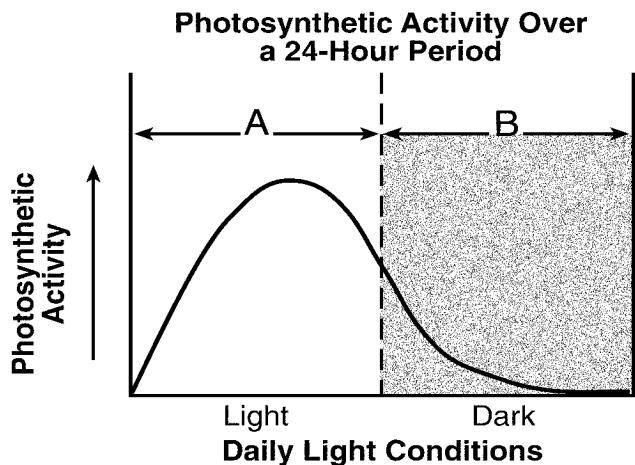
Time (minutes)

Key	
	Yeast respiration at 20°C
	Yeast respiration at 35°C

30. State one relationship between temperature and the rate of gas production in yeast. [1]
-
-

31. Identify the gas that would be produced by the process taking place in both laboratory setups. [1]
-
-

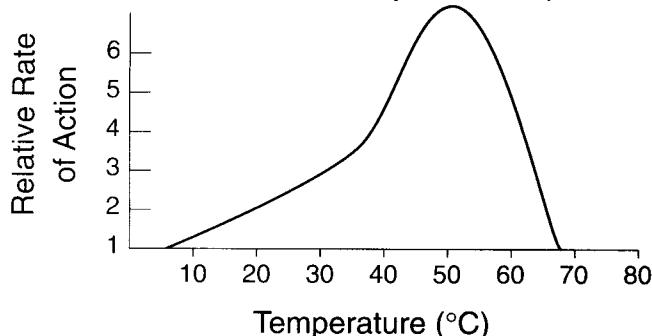
32. The graph below shows photosynthetic activity in an ecosystem over a 24-hour period.



Data for a study on respiration in this ecosystem should be collected during

- (1) interval A, from only the producers in the ecosystem
- (2) intervals A and B, from only the consumers in the ecosystem
- (3) intervals A and B, from both the producers and consumers in the ecosystem
- (4) interval A only, from abiotic but not biotic components of the ecosystem

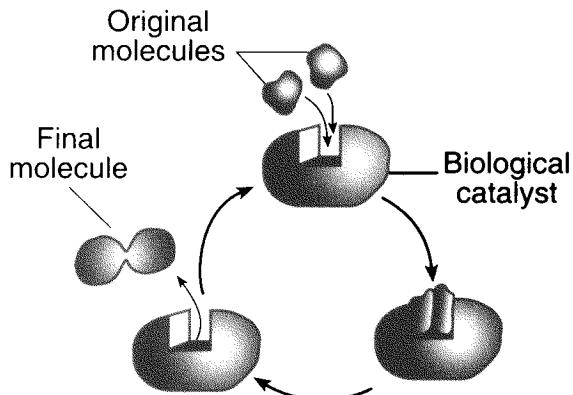
1. The graph below shows the effect of temperature on the relative rate of action of enzyme X on a protein.



Which change would not affect the relative rate of action of enzyme X?

- (1) the addition of cold water when the reaction is at 50°C
- (2) an increase in temperature from 70°C to 80°C
- (3) the removal of the protein when the reaction is at 30°C
- (4) a decrease in temperature from 40°C to 10°C

2. The diagram below represents a series of reactions that can occur in an organism.



This diagram best illustrates the relationship between

- (1) enzymes and synthesis
- (2) amino acids and glucose
- (3) antigens and immunity
- (4) ribosomes and sugars

3. In the body of a human, the types of chemical activities occurring within cells are most dependent on the

- (1) biological catalysts present
- (2) size of the cell
- (3) number of chromosomes in the cell
- (4) kind of sugar found on each chromosome

4. All cells of an organism are engaged in many different chemical reactions. This fact is best supported by the presence in each cell of thousands of different kinds of

- (1) enzymes
- (3) chloroplasts
- (2) nuclei
- (4) organelles

5. All chemical breakdown processes in cells directly involve

- (1) reactions that are controlled by catalysts
- (2) enzymes that are stored in mitochondria
- (3) the production of catalysts in vacuoles
- (4) enzymes that have the same genetic base sequence

Base your answers to questions 6 and 7 on the statement below and on your knowledge of biology.

Some internal environmental factors may interfere with the ability of an enzyme to function efficiently.

6. Identify two internal environmental factors that directly influence the rate of enzyme action. [2]
-
-

7. Explain why changing the shape of an enzyme could affect the ability of the enzyme to function. [1]
-
-

8. Meat tenderizer contains an enzyme that interacts with meat. If meat is coated with tenderizer and then placed in a refrigerator for a short time, how would the enzyme be affected?

- (1) It would be broken down.
- (2) Its activity would slow down.
- (3) Its shape would change.
- (4) It would no longer act as an enzyme.

9. Which row in the chart below contains correct information concerning synthesis?

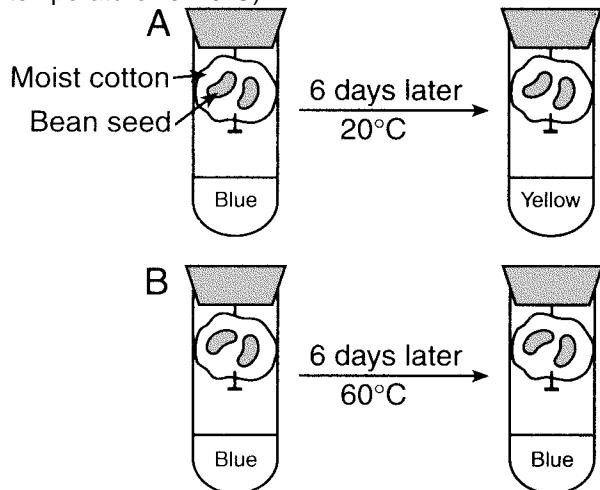
Row	Building Blocks	Substance Synthesized Using the Building Blocks
(1)	glucose molecules	DNA
(2)	simple sugars	protein
(3)	amino acids	enzyme
(4)	molecular bases	starch

10. Which condition is necessary for enzymes and hormones to function properly in the human body?

- (1) These chemicals must have a specific shape.
- (2) These chemicals must be able to replicate.
- (3) Body temperature must be above 40°C.
- (4) Body pH must be above 10.

Base your answers to questions 11 and 12 on the information and diagram below and on your knowledge of biology.

Two test tubes, A and B, were set up as shown in the diagram below. Bromothymol blue, which turns from blue to yellow in the presence of carbon dioxide, was added to the water at the bottom of each tube before the tubes were sealed. The tubes were maintained at the temperatures shown for six days. (Average room temperature is 20°C)



11. Identify the life process responsible for the change in tube A. [1]

12. Explain how the temperature difference could lead to the different results in tubes A and B after six days. [1]

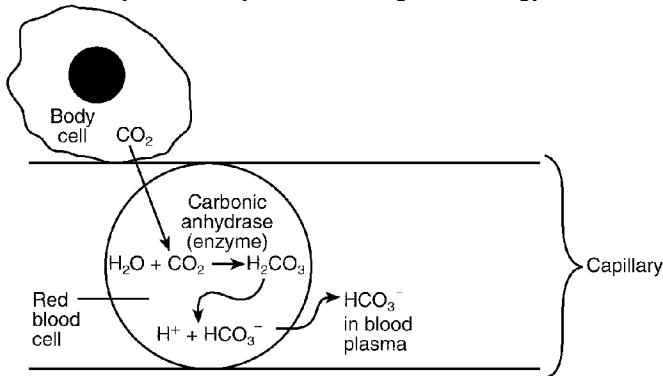
13. Experiments revealed the following information about a certain molecule:

- It can be broken down into amino acids.
- It can break down proteins into amino acids.
- It is found in high concentrations in the small intestine of humans.

This molecule is most likely

- (1) an enzyme
- (2) an inorganic compound
- (3) a hormone
- (4) an antigen

Base your answers to question 14 on the diagram below, which illustrates a transport pathway of CO₂ in the human body, and on your knowledge of biology.



14. State what would happen to the production of bicarbonate ions (HCO₃⁻) if the carbonic anhydrase were not present in red blood cells. [1]

Base your answer to question 15 on the data table below and on your knowledge of biology. The table contains information about glucose production in a species of plant that lives in the water of a salt marsh.

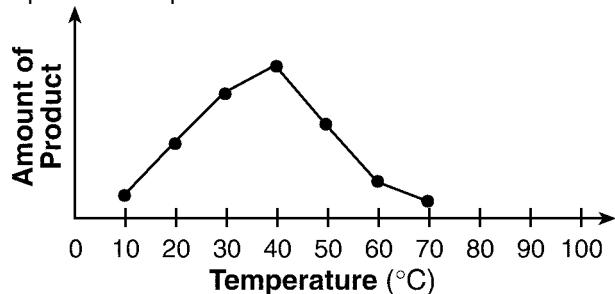
Temperature (°C)	Glucose Production (mg/hr)
10	5
20	10
30	15
40	5

15. State one possible reason for the change in glucose production when the temperature was increased from 30°C to 40°C. [1]

16. The rate at which all organisms obtain, transform, and transport materials depends on an immediate supply of

- (1) ATP and enzymes
- (2) solar energy and carbon dioxide
- (3) carbon dioxide and enzymes
- (4) ATP and solar energy

17. The graph below illustrates the relative amounts of product formed by the action of an enzyme in a solution with a pH of 6 at seven different temperatures. Which statement best expresses the amount of product that will be formed at each temperature if the experiment is repeated at a pH of 4?



- (1) The amount of product formed will be equal to that produced at pH 6.
- (2) The amount of product formed will be greater than that produced at pH 6.
- (3) The amount of product formed will be less than that produced at pH 6.
- (4) The amount of product formed can not be accurately predicted.

1. Feedback interactions in the human body are important because they

- (1) determine the diversity necessary for evolution to occur
- (2) direct the synthesis of altered genes that are passed on to every cell in the body
- (3) regulate the shape of molecules involved in cellular communication
- (4) keep the internal body environment within its normal range

2 After a hormone enters the bloodstream, it is transported throughout the body, but the hormone affects only certain cells. The reason only certain cells are affected is that the membranes of these cells have specific

- | | |
|---------------|-------------------|
| (1) receptors | (3) antibodies |
| (2) tissues | (4) carbohydrates |

Base your answers to questions 3 through 7 on the information and data table below and on your knowledge of biology.

The results of blood tests for two individuals are shown in the data table below. The blood glucose level before breakfast is normally 80–90 mg/100 mL of blood. A blood glucose level above 110 mg/100 mL of blood indicates a failure in a feedback mechanism.

Injection of chemical X, a chemical normally produced in the body, may be required to correct this problem.

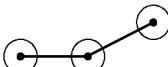
Data Table

Time	Blood Glucose (mg/100 mL)	
	Individual 1	Individual 2
7:00 a.m.	90	150
7:30 a.m.	120	180
8:00 a.m.	140	220
8:30 a.m.	110	250
9:00 a.m.	90	240
9:30 a.m.	85	230
10:00 a.m.	90	210
10:30 a.m.	85	190
11:00 a.m.	90	170

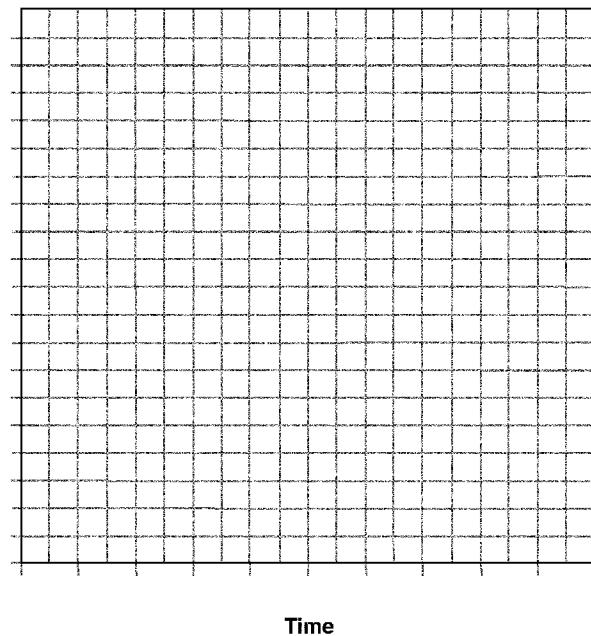
Directions (3–4): Using the information in the data table, construct a line graph on the grid in the next column, following the directions below.

3. Mark an appropriate scale on each labeled axis. [1]

4. Plot the blood glucose levels for the individual who will most likely need injections of chemical X. Surround each point with a small circle and connect the points. [2]

Example: 

Blood Glucose Levels



5. Identify chemical X. [1]

Ans: _____

6. State one reason for the change in blood glucose level between 7:00 a.m. and 8:00 a.m. [1]

7. What term refers to the relatively constant level of blood glucose of individual 1 between 9:00 a.m. and 11:00 a.m.? [1]

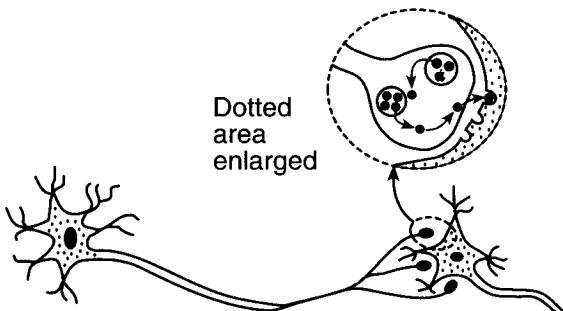
Ans: _____

8. Identify two body systems that help maintain glucose levels in the blood and describe how each system is involved. [2]

(1) _____

(2) _____

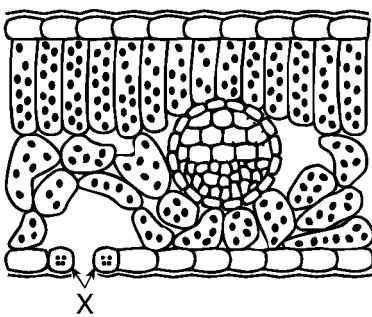
9. A process that occurs in the human body is represented in the diagram below.



Which statement is most closely associated with the diagram?

- (1) Small molecules are obtained from large molecules during digestion.
- (2) Certain molecules are replicated by means of a template.
- (3) Receptor molecules play an important role in communication between cells.
- (4) Energy from nutrients is utilized for waste disposal.

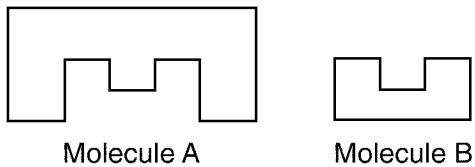
10. The diagram below represents a cross section of part of a leaf.



Which life functions are directly regulated through feedback mechanisms associated with the actions of the structures labeled X?

- (1) excretion and immunity
- (2) digestion and coordination
- (3) circulation and reproduction
- (4) respiration and photosynthesis

11. The diagram below represents two molecules that can interact with each other to cause a biochemical process to occur in a cell.



Molecules A and B most likely represent

- (1) a protein and a chromosome
- (2) a receptor and a hormone
- (3) a carbohydrate and an amino acid
- (4) an antibody and a hormone

12. Acetylcholine is a chemical secreted at the ends of nerve cells. This chemical helps to send nerve signals across synapses (spaces between nerve cells). After the signal passes across a synapse, an enzyme breaks down the acetylcholine. LSD is a drug that blocks the action of this enzyme. Describe one possible effect of LSD on the action of acetylcholine. [1]

Base your answers to questions 13 through 15 on the data table below and on your knowledge of biology.

A group of students obtained the following data:

Data Table

Student Tested	Pulse Rate at Rest	Pulse Rate After Exercising
1	70	97
2	75	106
3	84	120
4	60	91
5	78	122

13. The activity of which body system was measured to obtain these data? [1]

Ans: _____

14. The activity of which other body system would be altered as a direct result of the exercise? [1]

Ans: _____

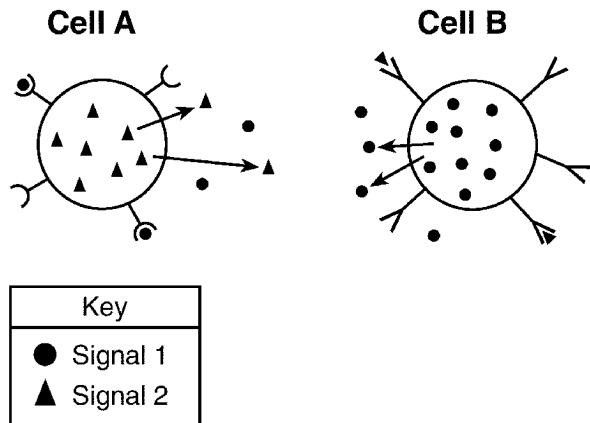
15. What effect would exercise have on the system you identified in question 68? [1]

16. Explain how this change in pulse rate helps maintain homeostasis in muscle cells. [1]

17. Which process illustrates a feedback mechanism in plants?

- (1) Chloroplasts take in more nitrogen, which increases the rate of photosynthesis.
- (2) Chloroplasts release more oxygen in response to a decreased rate of photosynthesis.
- (3) Guard cells change the size of leaf openings, regulating the exchange of gases.
- (4) Guard cells release oxygen from the leaf at night.

18. Cellular communication is illustrated in the diagram below.



Information can be sent from

- (1) cell A to cell B because cell B is able to recognize signal 1
- (2) cell A to cell B because cell A is able to recognize signal 2
- (3) cell B to cell A because cell A is able to recognize signal 1
- (4) cell B to cell A because cell B is able to recognize signal 2

Base your answers to questions 19 and 20 on the information below and on your knowledge of biology.

Cells of the immune system and the endocrine system of the human body contribute to the maintenance of homeostasis. The methods and materials these two systems use as they carry out this critical function are different.

19. Identify the substance produced by the cells of all the endocrine glands that helps maintain homeostasis. [1]

20. Identify one specific product of one of the endocrine glands and state how it aids in the maintenance of homeostasis. [1]

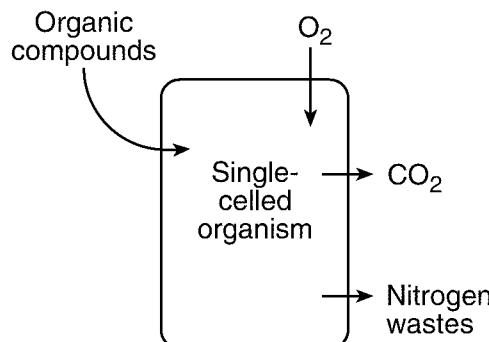
21. The interaction between guard cells and a leaf opening would not be involved in

- (1) diffusion of carbon dioxide
- (2) maintaining homeostasis
- (3) heterotrophic nutrition
- (4) feedback mechanisms

22. Which situation indicates that a disruption of homeostasis has taken place?

- (1) the presence of hormones that keep the blood sugar level steady
- (2) the maintenance of a constant body temperature
- (3) cell division that is involved in normal growth
- (4) a rapid rise in the number of red blood cells

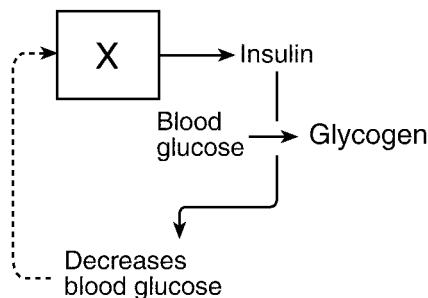
23. The arrows in the diagram below indicate the movement of materials into and out of a single-celled organism.



The movements indicated by all the arrows are directly involved in

- (1) the maintenance of homeostasis
- (2) respiration, only
- (3) excretion, only
- (4) the digestion of proteins

Base your answers to questions 24 and 25 on the diagram below and on your knowledge of biology.



24. Identify the organ labeled X. [1]

25. The dashed line in the diagram represents

- (1) a digestive process
- (2) a feedback mechanism
- (3) cellular differentiation
- (4) recycling of organic chemicals

1. Which activity is not a function of white blood cells in response to an invasion of the body by bacteria?

- (1) engulfing these bacteria
 - (2) producing antibodies to act against this type of bacteria
 - (3) preparing for future invasions of this type of bacteria
 - (4) speeding transmissions of nerve impulses to detect these bacteria

2. Many people become infected with the chicken pox virus during childhood. After recovering from chicken pox, these people are usually immune to the disease for the rest of their lives. However, they may still be infected by viruses that cause other diseases, such as measles.

Discuss the immune response to the chicken pox virus. In your answer, be sure to include:

- the role of antigens in the immune response [1]
 - the role of white blood cells in the body's response to the virus [1]
 - an explanation of why recovery from an infection with the chicken pox virus will not protect a person from getting a different disease, such as measles [1]
 - an explanation of why a chicken pox vaccination usually does not cause a person to become ill with chicken pox [1]

3. Antibody molecules and receptor molecules are similar in that they both

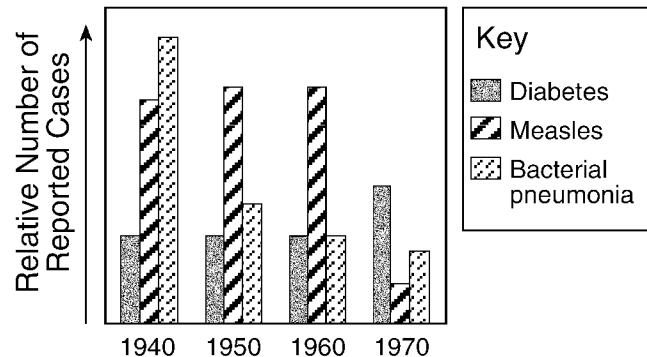
- (1) control transport through the cell membrane
 - (2) have a specific shape related to their specific function
 - (3) remove wastes from the body
 - (4) speed up chemical reactions in cells

4. Vaccinations help prepare the body to fight invasions of a specific pathogen by

- (1) inhibiting antigen production
 - (2) stimulating antibody production
 - (3) inhibiting white blood cell production
 - (4) stimulating red blood cell production

Base your answers to questions 5 through 7 on the graph below and on your knowledge of biology.

Incidence of Three Human Diseases in Four Different Years



5. The greatest difference between the incidence of measles and the incidence of bacterial pneumonia occurred in

6. Which statement best explains a change in the incidence of disease in 1970?

- (1) Children were vaccinated against measles.
 - (2) New drugs cured diabetes.
 - (3) The bacteria that cause pneumonia developed a resistance to drugs.
 - (4) New technology helped to reduce the incidence of all three diseases.

7. Which statement provides the best possible reason for the decrease in number of cases of bacterial pneumonia from 1940 to 1970?

- (1) As a result of genetic engineering, humans became immune to the bacteria.
 - (2) Antibiotics were made available for the treatment of bacterial infections.
 - (3) The bacteria did not respond to medical treatments.
 - (4) As a result of sexual reproduction, the bacteria evolved into a harmless form.

8. State one specific way white blood cells help to protect the human body from pathogens. [1]

Base your answers to questions 11 and 12 on the information below and on your knowledge of biology.

9. The purpose of introducing weakened microbes into the body of an organism is to stimulate the

- (1) production of living microbes that will protect the organism from future attacks
- (2) production of antigens that will prevent infections from occurring
- (3) immune system to react and prepare the organism to fight future invasions by these microbes
- (4) replication of genes that direct the synthesis of hormones that regulate the number of microbes

10. Not all diseases are caused by pathogenic organisms. Other factors, such as inheritance, poor nutrition, and toxic substances, may also cause disease. Describe a disease or disorder that can occur as a result of one of these other factors.

Your answer must include at least:

- the name of the disease [1]
- one specific factor that causes this disease [1]
- one major effect of this disease on the body, other than death [1]
- one way this disease can be prevented, treated, or cured [1]

Where is the Beef? Out Being Irradiated

E. coli bacteria in food cause an estimated 73,000 cases of infection leading to some deaths in the United States each year. Until recently, the only way to guarantee meat free of E. coli was to heat it to 160°F, which kills E. coli. The rare hamburgers preferred by many people are not heated to this temperature, and just a few E. coli may cause severe illness.

Recently, ground beef has been decontaminated by irradiation using electron beam technology. The packaged ground beef is scanned by an electron beam that disrupts the genetic structure of the pathogens. This kills them or leaves them unable to reproduce.

This process is considered safe and has been endorsed by various governmental groups in this country as well as the World Health Organization. Irradiation is effective in preserving only certain foods, such as herbs, wheat flour, fresh fruits, vegetables, and some meats. Although some methods of irradiation can change the taste of some foods, this is not an effect of electron beam technology on ground beef.

Opponents of irradiating food are concerned that the process may result in the formation of chemicals that may be harmful or result in a loss of vitamins.

Supporters claim that irradiation is safe and should be considered as just another technique for preservation of food.

11. Identify one specific pathogen found in ground beef. [1]

Ans: _____

12. Identify the specific group of molecules in bacteria whose function would be interfered with by heating them to 160°F. [1]

Ans: _____

13. Allergic reactions usually occur when the immune system produces

- (1) antibiotics against usually harmless antigens
- (2) antigens against usually harmless antibodies
- (3) antibodies against usually harmless antigens
- (4) enzymes against usually harmless antibodies

14. Some human white blood cells help destroy pathogenic bacteria by

- (1) causing mutations in the bacteria
- (2) engulfing and digesting the bacteria
- (3) producing toxins that compete with bacterial toxins
- (4) inserting part of their DNA into the bacterial cells

15. Which transplant method would prevent the rejection of tissue after an organ transplant?

- (1) using organs cloned from the cells of the patient
- (2) using organs produced by genetic engineering to get rid of all proteins in the donated organs
- (3) using organs only from pigs or monkeys
- (4) using an organ donated by a close relative because the proteins will always be identical to those of the recipient

16. Scientists have genetically altered a common virus so that it can destroy the most lethal type of brain tumor without harming the healthy tissue nearby. This technology is used for all of the following except

- (1) treating the disease
- (2) curing the disease
- (3) controlling the disease
- (4) diagnosing the disease

Base your answers to question 17 on the information below and on your knowledge of biology.

Cells of the immune system and the endocrine system of the human body contribute to the maintenance of homeostasis. The methods and materials these two systems use as they carry out this critical function are different.

17. State two ways cells of the immune system fight disease. [2]

18. Which statement best describes how a vaccination can help protect the body against disease?

- (1) Vaccines directly kill the pathogen that causes the disease.
- (2) Vaccines act as a medicine that cures the disease.
- (3) Vaccines cause the production of specific molecules that will react with and destroy certain microbes.
- (4) Vaccines contain white blood cells that engulf harmful germs and prevent them from spreading throughout the body.

19. Enzyme molecules normally interact with substrate molecules. Some medicines work by blocking enzyme activity in pathogens. These medicines are effective because they

- (1) are the same size as the enzyme
- (2) are the same size as the substrate molecules
- (3) have a shape that fits into the enzyme
- (4) have a shape that fits into all cell receptors

Base your answer to question 20 on the information below and on your knowledge of biology.

Until the middle of the 20th century, transplanting complex organs, such as kidneys, was rarely successful. The first transplant recipients did not survive. It was not until 1954 that the first successful kidney transplant was performed. Success with transplants increased as research scientists developed techniques such as tissue typing and the use of immunosuppressant drugs. These are drugs that suppress the immune system to prevent the rejection of a transplanted organ. In 2002, there were nearly 15,000 kidney transplants performed in the United States with a greater than 95% success rate.

20. Describe the relationship of the immune system to organ transplants and the use of immunosuppressant drugs to prevent the rejection of a transplanted organ. In your answer be sure to:

- state one way the immune system is involved in the rejection of transplanted organs [1]
- explain why the best source for a donated kidney would be the identical twin of the recipient [1]
- explain why immunosuppressant drugs might be needed to prevent rejection of a kidney received from a donor other than an identical twin [1]
- state one reason a person may get sick more easily when taking an immunosuppressant drug [1]

21. The immune system of humans may respond to chemicals on the surface of an invading organism by

- (1) releasing hormones that break down these chemicals
- (2) synthesizing antibodies that mark these organisms to be destroyed
- (3) secreting antibiotics that attach to these organisms
- (4) altering a DNA sequence in these organisms

1. Which sequence of terms represents a decrease from the greatest number of structures to the least number of structures present in a cell?

- (1) nucleus → gene → chromosome
- (2) gene → nucleus → chromosome
- (3) gene → chromosome → nucleus
- (4) chromosome → gene → nucleus

2. A characteristic of a DNA molecule that is not characteristic of a protein molecule is that the DNA molecule

- (1) can replicate itself
- (2) can be very large
- (3) is found in nuclei
- (4) is composed of subunits

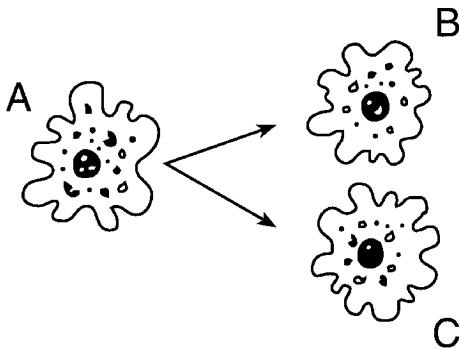
3. Hereditary information is stored inside the

- (1) ribosomes, which have chromosomes that contain many genes
- (2) ribosomes, which have genes that contain many chromosomes
- (3) nucleus, which has chromosomes that contain many genes
- (4) nucleus, which has genes that contain many chromosomes

4. Hereditary traits are transmitted from generation to generation by means of

- (1) specific sequences of bases in DNA in reproductive cells
- (2) proteins in body cells
- (3) carbohydrates in body cells
- (4) specific starches making up DNA in reproductive cells

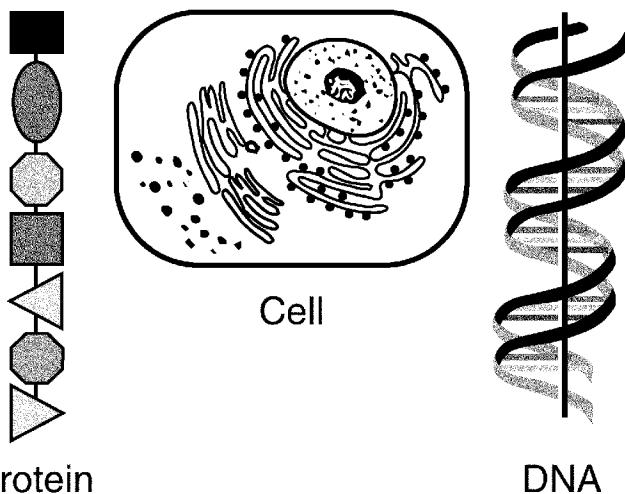
5. The diagram below represents single-celled organism A dividing by mitosis to form cells B and C.



Cells A, B, and C all produced protein X. What can best be inferred from this observation?

- (1) Protein X is found in all organisms.
- (2) The gene for protein X is found in single-celled organisms, only.
- (3) Cells A, B, and C ingested food containing the gene to produce protein X.
- (4) The gene to produce protein X was passed from cell A to cells B and C.

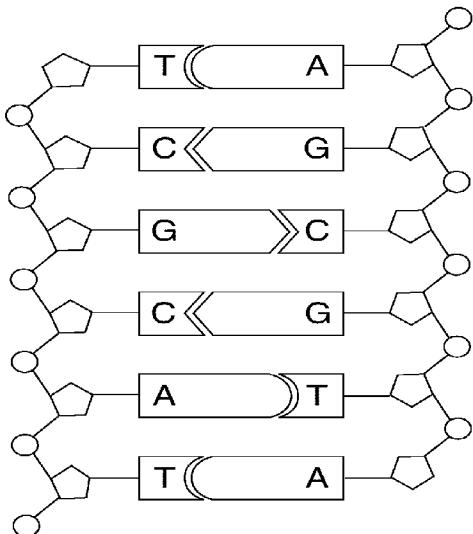
1. Three structures are represented in the diagram below.



What is the relationship between these three structures?

- (1) DNA is made up of proteins that are synthesized in the cell.
- (2) Protein is composed of DNA that is stored in the cell.
- (3) DNA controls the production of protein in the cell.
- (4) The cell is composed only of DNA and protein.

2. The diagram below represents a portion of an organic molecule.



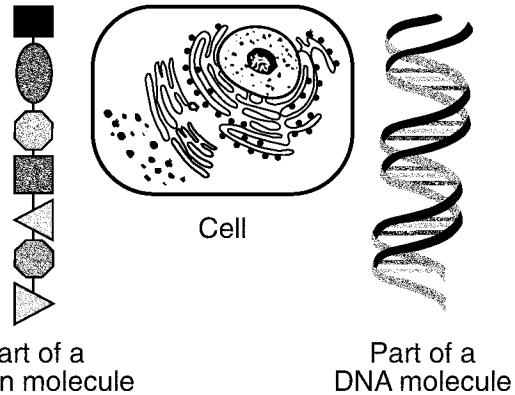
This molecule controls cellular activity by directing the synthesis of

- (1) carbohydrates
- (2) minerals
- (3) fats
- (4) proteins

3. Which statement concerning proteins is not correct?

- (1) Proteins are long, usually folded, chains.
- (2) The shape of a protein molecule determines its function.
- (3) Proteins can be broken down and used for energy.
- (4) Proteins are bonded together, resulting in simple sugars.

4. Which statement best expresses the relationship between the three structures represented below?



- (1) DNA is produced from protein absorbed by the cell.
- (2) Protein is composed of DNA that is produced in the cell.
- (3) DNA controls the production of protein in the cell.
- (4) Cells make DNA by digesting protein.

5. Which statement best describes the relationship between cells, DNA, and proteins?

- (1) Cells contain DNA that controls the production of proteins.
- (2) DNA is composed of proteins that carry coded information for how cells function.
- (3) Proteins are used to produce cells that link amino acids together into DNA.
- (4) Cells are linked together by proteins to make different kinds of DNA molecules.

6. In plants, simple sugars are least likely to be

- (1) linked together to form proteins
- (2) broken down into carbon dioxide and water
- (3) used as a source of energy
- (4) stored in the form of starch molecules

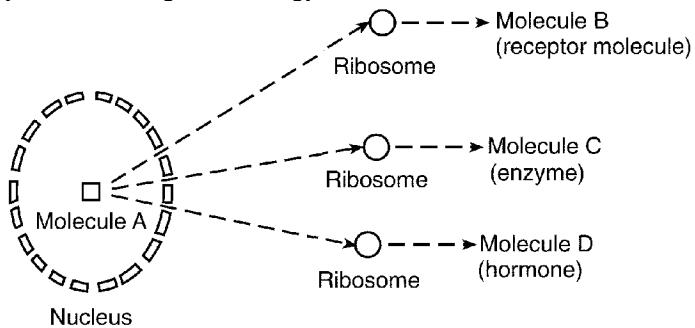
7. Two proteins in the same cell perform different functions. This is because the two proteins are composed of

- (1) chains folded the same way and the same sequence of simple sugars
- (2) chains folded the same way and the same sequence of amino acids
- (3) chains folded differently and a different sequence of simple sugars
- (4) chains folded differently and a different sequence of amino acids

8. A certain protein is found in mitochondria, chloroplasts, and bacteria. This provides evidence that plants and bacteria

- (1) have some similar DNA base sequences
- (2) can use carbon dioxide to make proteins
- (3) digest proteins into simple sugars
- (4) contain certain pathogenic microbes

Base your answers to questions 9 and 10 on the diagram below, which represents a sequence of events in a biological process that occurs within human cells and on your knowledge of biology.



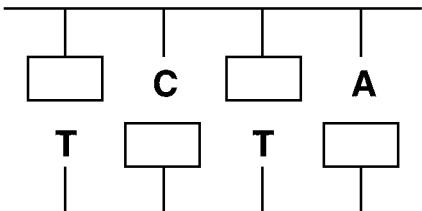
9. Molecule A contains the

- (1) starch necessary for ribosome synthesis in the cytoplasm
- (2) organic substance that is broken down into molecules B, C, and D
- (3) proteins that form the ribosome in the cytoplasm
- (4) directions for the synthesis of molecules B, C, and D

10. Molecules B, C, and D are similar in that they are usually

- (1) composed of genetic information
- (2) involved in the synthesis of antibiotics
- (3) composed of amino acids
- (4) involved in the diffusion of oxygen into the cell

11. The diagram below represents an incomplete section of a DNA molecule. The boxes represent unidentified bases.



When the boxes are filled in, the total number of bases represented by the letter A (both inside and outside the boxes) will be

- (1) 1
- (2) 2
- (3) 3
- (4) 4

1. Which process is least likely to add to the variety of traits in a population?

- (1) deletion of bases from DNA
- (2) genetic engineering
- (3) accurate replication of DNA
- (4) exchange of segments between chromosomes

2. Down syndrome is a genetic disorder caused by the presence of an extra chromosome in the body cells of humans. This extra chromosome occurs in a gamete as a result of

- (1) an error in the process of cloning
- (2) an error in meiotic cell division
- (3) a gene mutation
- (4) replication of a single chromosome during mitosis

Base your answers to questions 3 through 6 on the information below and on your knowledge of biology.

Insecticides are used by farmers to destroy crop-eating insects. Recently, scientists tested several insecticides to see if they caused damage to chromosomes. Six groups of about 200 cells each were examined to determine the extent of chromosome damage after each group was exposed to a different concentration of one of two insecticides.

The results are shown in the data table below.

Cell Damage After Exposure to Insecticide

Insecticide	Insecticide Concentration (ppm)	Number of Cells with Damaged Chromosomes
Methyl parathion	0.01	7
	0.10	15
	0.20	30
Malathion	0.01	3
	0.10	4
	0.20	11

Directions (3–4): Using the information in the data table, construct a line graph on the grid below, following the directions below.

3. Mark an appropriate scale on the axis labeled, "Number of Cells with Damaged Chromosomes." [1]

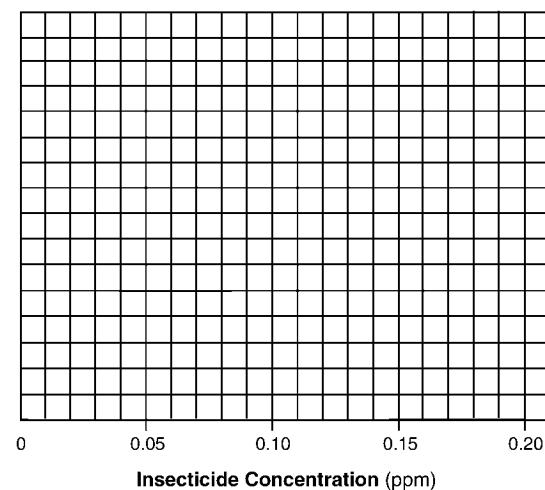
4. Plot the data for methyl parathion on the grid. Surround each point with a small circle and connect the points. [1]

Example:

5. Plot the data for malathion on the grid. Surround each point with a small triangle and connect the points. [1]

Example:

Cell Damage After Exposure to Insecticide



= Methyl parathion

= Malathion

6. Which insecticide has a more damaging effect on chromosomes? Support your answer. [1]

Base your answers to questions 7 through 9 on the information below and on your knowledge of biology.

Mutations are often referred to as the "raw materials" of evolution.

7. State one reason that mutations are often referred to as the "raw materials" of evolution. [1]

8. Use appropriate letters to write a 9-base DNA sequence that could represent a portion of a gene. [1]

9. Show one example of what could happen to the 9-base DNA sequence you wrote in question 57 if a mutation occurred in that gene. [1]

10. Genes involved in the production of abnormal red blood cells have an abnormal sequence of

- (1) ATP molecules
- (3) sugars
- (2) amino acids
- (4) bases

11. Plants inherit genes that enable them to produce chlorophyll, but this pigment is not produced unless the plants are exposed to light. This is an example of how the environment can

- (1) cause mutations to occur
- (2) influence the expression of a genetic trait
- (3) result in the appearance of a new species
- (4) affect one plant species, but not another

12. Synthesis of a defective protein may result from an alteration in

- (1) vacuole shape
- (2) the number of mitochondria
- (3) a base sequence code
- (4) cellular fat concentration

13. In one variety of corn, the kernels turn red when exposed to sunlight. In the absence of sunlight, the kernels remain yellow. Based on this information, it can be concluded that the color of these corn kernels is due to the

- (1) process of selective breeding
- (2) rate of photosynthesis
- (3) effect of environment on gene expression
- (4) composition of the soil

Base your answer to question 14 on the portion of the mRNA codon chart and information below.

AUU AUC AUA AUG]	ILE (Isoleucine)	ACU ACC ACA ACG	THR (Threonine)	AAU AAC AAA AAG	ASN (Asparagine)	AGU AGC AGA AGG	SER (Serine)	ARG (Arginine)
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Series I represents three mRNA codons. Series II includes a mutation of series I.

Series I AGAUCGAGU

Series II ACAUCGAGU

14. How would the amino acid sequence produced by the mutant strand (series II) compare to the amino acid sequence produced by series I?

- (1) The amino acid sequence would be shorter.
- (2) One amino acid in the sequence would change.
- (3) The amino acid sequence would remain unchanged.
- (4) More than one amino acid in the sequence would change.

15. Which process can produce new inheritable characteristics within a multicellular species?

- (1) cloning of the zygote
- (2) mitosis in muscle cells
- (3) gene alterations in gametes
- (4) differentiation in nerve cells

16. Which statement indicates that different parts of the genetic information are used in different kinds of cells, even in the same organism?

- (1) The cells produced by a zygote usually have different genes.
- (2) As an embryo develops, various tissues and organs are produced.
- (3) Replicated chromosomes separate during gamete formation.
- (4) Offspring have a combination of genes from both parents.

Base your answers to questions 17 and 18 on the information below and on your knowledge of biology.

Where is the Beef? Out Being Irradiated

E. coli bacteria in food cause an estimated 73,000 cases of infection leading to some deaths in the United States each year. Until recently, the only way to guarantee meat free of E. coli was to heat it to 160°F, which kills E. coli. The rare hamburgers preferred by many people are not heated to this temperature, and just a few E. coli may cause severe illness.

Recently, ground beef has been decontaminated by irradiation using electron beam technology. The packaged ground beef is scanned by an electron beam that disrupts the genetic structure of the pathogens. This kills them or leaves them unable to reproduce.

This process is considered safe and has been endorsed by various governmental groups in this country as well as the World Health Organization. Irradiation is effective in preserving only certain foods, such as herbs, wheat flour, fresh fruits, vegetables, and some meats. Although some methods of irradiation can change the taste of some foods, this is not an effect of electron beam technology on ground beef.

Opponents of irradiating food are concerned that the process may result in the formation of chemicals that may be harmful or result in a loss of vitamins. Supporters claim that irradiation is safe and should be considered as just another technique for preservation of food.

17. Explain how irradiation helps preserve meat. [1]

18. Explain how irradiation could interfere with the process of reproduction in bacteria that survive the irradiation. [1]

19. Which statement best explains the fact that some identical twins appear different from one another?
- Their DNA is essentially the same and the environment plays little or no role in the expression of their genes.
 - Their DNA is very different and the environment plays a significant role in the expression of their genes.
 - Their DNA is very different and the environment plays little or no role in the expression of their genes.
 - Their DNA is essentially the same and the environment plays a significant role in the expression of their genes.

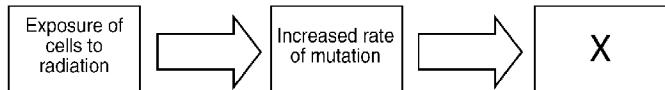
20. Genes are inherited, but their expressions can be modified by the environment. This statement explains why

- some animals have dark fur only when the temperature is within a certain range
- offspring produced by means of sexual reproduction look exactly like their parents
- identical twins who grow up in different homes have the same characteristics
- animals can be cloned, but plants cannot

21. An error in genetic information present in a body cell of a mammal would most likely produce

- rapid evolution of the organism in which the cell is found
- a mutation that will affect the synthesis of a certain protein in the cell
- an adaptation that will be passed on to other types of cells
- increased variation in the type of organelles present in the cell

22. Which phrase belongs in box X of the flowchart below?



- Increased chance of cancer
- Increase in the production of functional gametes
- Decrease in genetic variability of offspring
- Decreased number of altered genes

23. Which statement best explains the observation that clones produced from the same organism may not be identical?

- Events in meiosis result in variation.
- Gene expression can be influenced by the environment.
- Differentiated cells have different genes.
- Half the genetic information in offspring comes from each parent.

24. A change in the base subunit sequence during DNA replication can result in

- variation within an organism
- rapid evolution of an organism
- synthesis of antigens to protect the cell
- recombination of genes within the cell

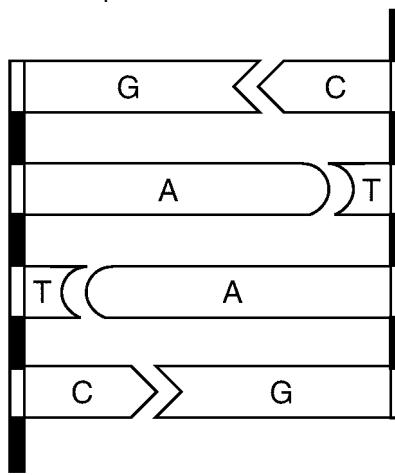
25. Even though each body cell in an individual contains the same DNA, the functions of muscle cells and liver cells are not the same because

- mutations usually occur in genes when muscle cells divide
- liver tissue develops before muscle tissue
- liver cells produce more oxygen than muscle cells
- liver cells use different genes than muscle cells

26. The brown summer feathers of ptarmigans, small Arctic birds, are replaced by white feathers after winter arrives. Which statement best explains this observation?

- The expression of genes can be modified by the environment.
- Holes in the ozone layer vary in size depending on the season.
- Acids in rain bleach the brown feathers of the birds.
- Mutations occur only during certain seasons.

27. The diagram below represents a portion of a type of organic molecule present in the cells of organisms.



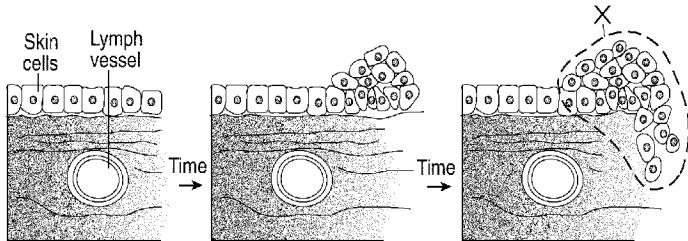
What will most likely happen if there is a change in the base sequence of this molecule?

- The molecule will be converted into an inorganic compound.
- The amino acid sequence may be altered during protein synthesis.
- The chromosome number will decrease in future generations.
- The chromosome number may increase within the organisms.

28. All cells in an embryo have the same DNA. However, the embryonic cells form organs, such as the brain and the kidneys, which have very different structures and functions. These differences are the result of

- (1) having two types of cells, one type from each parent
 - (2) rapid mitosis causing mutations in embryo cells
 - (3) new combinations of cells resulting from meiosis
 - (4) certain genes being expressed in some cells and not in others

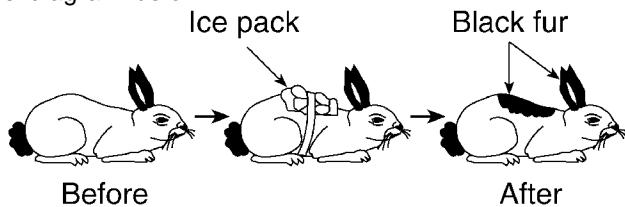
29. The diagram below shows the growth pattern of some skin cells in the human body after they have been exposed to ultraviolet radiation.



The cells in area X are most likely

- (1) red blood cells (3) white blood cells
(2) cancer cells (4) sex cells

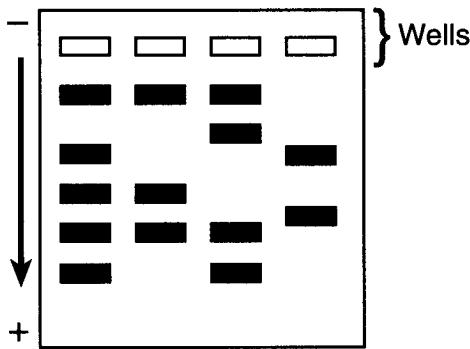
30. Which statement best explains the change shown in the diagram below?



- (1) Gene expression in an organism can be modified by interactions with the environment.
 - (2) Certain rabbits produce mutations that affect genes in specific areas of the body.
 - (3) Sorting and recombination of genes can be influenced by very cold temperatures.
 - (4) Molecular arrangement in existing proteins can be altered by environmental factors.

Base your answers to questions 1 through 4 on the information and diagram below and on your knowledge of biology.

The four wells represented in the diagram were each injected with fragments that were prepared from DNA samples using identical techniques.



1. This laboratory procedure is known as

- (1) cloning
- (2) gel electrophoresis
- (3) chromatography
- (4) use of a dichotomous key

2. The arrow represents the direction of the movement of the DNA fragments. What is responsible for the movement of the DNA in this process? [1]

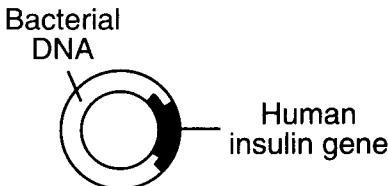
3. The four samples of DNA were taken from four different individuals. Explain how this is evident from the results shown in the diagram. [1]

4. Identify the substance that was used to treat the DNA to produce the fragments that were put into the wells. [1]

5. One variety of strawberry is resistant to a damaging fungus, but produces small fruit. Another strawberry variety produces large fruit, but is not resistant to the same fungus. The two desirable qualities may be combined in a new variety of strawberry plant by

- (1) cloning
- (2) direct harvesting
- (3) asexual reproduction
- (4) selective breeding

6. A product of genetic engineering technology is represented below.



Which substance was needed to join the insulin gene to the bacterial DNA as shown?

- (1) a specific carbohydrate
- (2) a specific enzyme
- (3) hormones
- (4) antibodies

Base your answer to question 7 on the information below and on your knowledge of biology.

Scientists found members of a plant species they did not recognize. They wanted to determine if the unknown species was related to one or more of four known species, A, B, C, and D.

The relationship between species can be determined most accurately by comparing the results of gel electrophoresis of the DNA from different species.

The chart below represents the results of gel electrophoresis of the DNA from the unknown plant species and the four known species.

Results of Gel Electrophoresis of DNA from Five Plant Species

Unknown Species	Species A	Species B	Species C	Species D
—			—	—
—	—	—	—	—
—		—	—	
—	—	—	—	—
—	—		—	—

Key
— = Band in the gel

7. The unknown species is most closely related to which of the four known species? Support your answer. [1]

8. Researchers Cohn and Boyer transferred a gene from an African clawed frog into a bacterium. To accomplish this, these scientists had to use

- (1) enzymes to cut out and insert the gene
- (2) hereditary information located in amino acids
- (3) radiation to increase the gene mutation rate of the bacterial cells
- (4) cancer cells to promote rapid cell division

Base your answers to questions 9 through 13 on the passage below and on your knowledge of biology.

Better Rice

The production of new types of food crops will help raise the quantity of food grown by farmers. Research papers released by the National Academy of Sciences announced the development of two new superior varieties of rice—one produced by selective breeding and the other by biotechnology.

One variety of rice, called Nerica (New Rice for Africa), is already helping farmers in Africa. Nerica combines the hardiness and weed resistance of rare African rice varieties with the productivity and faster maturity of common Asian varieties.

Another variety, called Stress-Tolerant Rice, was produced by inserting a pair of bacterial genes into rice plants for the production of trehalose (a sugar). Trehalose helps plants maintain healthy cell membranes, proteins, and enzymes during environmental stress. The resulting plants survive drought, low temperatures, salty soils, and other stresses better than standard rice varieties.

9. Why is the production of new varieties of food crops necessary?

- (1) Essential food crops are rapidly becoming extinct.
- (2) Technology for producing fresh water for agriculture has improved.
- (3) Burning fossil fuels has decreased agricultural areas.
- (4) World population continues to increase.

10. Which substance from bacteria was most likely inserted into rice plants in the development of the trehalose-producing rice?

- | | |
|-------------|---------------|
| (1) sugar | (3) DNA |
| (2) enzymes | (4) trehalose |

11. Nerica was most likely produced by

- (1) crossing a variety of African rice with a variety of Asian rice
- (2) cloning genes for hardiness and weed resistance from Asian rice
- (3) using Asian rice to compete with rare African varieties
- (4) inserting genes for productivity and faster maturity into Asian rice

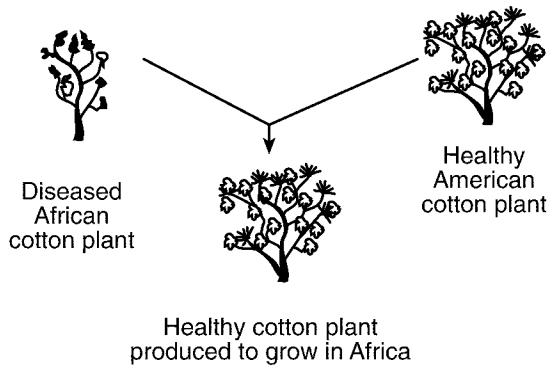
12. Which strain of rice was produced as a result of genetic engineering? Support your answer. [1]

13. State one reason that further testing must be done before rice plants that produce trehalose are approved for human consumption. [1]

14. One variety of wheat is resistant to disease. Another variety contains more nutrients of benefit to humans. Explain how a new variety of wheat with disease resistance and high nutrient value could be developed. In your answer, be sure to:

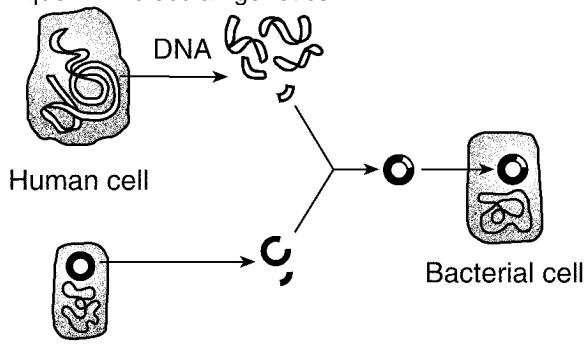
- identify one technique that could be used to combine disease resistance and high nutrient value in a new variety of wheat [1]
- describe how this technique would be carried out to produce a wheat plant with the desired characteristics [1]
- describe one specific difficulty (other than stating that it does not always work) in developing a new variety using this technique [1]

15. Which statement provides accurate information about the technique illustrated below?



- (1) This technique results in offspring that are genetically identical to the parents.
- (2) New varieties of organisms can be developed by this technique known as selective breeding.
- (3) This technique is used by farmers to eliminate mutations in future members of the species.
- (4) Since the development of cloning, this technique is no longer used in agriculture.

16. The diagram below represents a common laboratory technique in molecular genetics.



- One common use of this technology is the
- (1) production of a human embryo to aid women who are unable to have children
 - (2) change of single-celled organisms to multicellular organisms
 - (3) introduction of a toxic substance to kill bacterial cells
 - (4) production of hormones or enzymes to replace missing human body chemicals

17. Some farmers currently grow genetically engineered crops. An argument against the use of this technology is that

- (1) it increases crop production
- (2) it produces insect-resistant plants
- (3) its long-term effects on humans are still being investigated
- (4) it always results in crops that do not taste good

Base your answers to questions 18 and 19 on the passage below and on your knowledge of biology.

In Search of a Low-Allergy Peanut

Many people are allergic to substances in the environment. Of the many foods that contain allergens (allergy-inducing substances), peanuts cause some of the most severe reactions. Mildly allergic people may only get hives. Highly allergic people can go into a form of shock. Some people die each year from reactions to peanuts.

A group of scientists is attempting to produce peanuts that lack the allergy-inducing proteins by using traditional selective breeding methods. They are searching for varieties of peanuts that are free of the allergens. By crossing those varieties with popular commercial types, they hope to produce peanuts that will be less likely to cause allergic reactions and still taste good. So far, they have found one variety that has 80 percent less of one of three complex proteins linked to allergic reactions. Removing all three of these allergens may be impossible, but even removing one could help.

Other researchers are attempting to alter the genes that code for the three major allergens in peanuts. All of this research is seen as a possible long-term solution to peanut allergies.

18. How does altering the DNA of a peanut affect the proteins in peanuts that cause allergic reactions?

- (1) The altered DNA is used to synthesize changed forms of these proteins.
- (2) The altered DNA leaves the nucleus and becomes part of the allergy-producing protein.
- (3) The altered DNA is the code for the antibodies against the allergens.
- (4) The altered DNA is used as an enzyme to break down the allergens in peanuts.

19. Explain how selective breeding is being used to try to produce commercial peanuts that will not cause allergic reactions in people. [1]
-
-
-
-

Base your answers to questions 20 through 22 on the Universal Genetic Code Chart below and on your knowledge of biology.

Universal Genetic Code Chart
Messenger RNA Codons and the Amino Acids They Code For

		SECOND BASE				
		U	C	A	G	
U	UUU	PHE	UCU	UAU	UGU	CYS
	UUC		UCC	UAC	UGC	
	UUA	LEU	UCA	UAA	UGA	STOP
	UUG		UCG	UAG	UGG	TRP
F I R S T	CUU	LEU	CCU	CAU	CGU	U
	CUC		CCC	CAC	CGC	T
	CUA	LEU	CCA	CAA	CGA	C
	CUG		CCG	CAG	CGG	H
B A S E	AUU	ILE	ACU	AAU	AGU	A
	AUC		ACC	AAC	AGC	B
	AUA	MET or START	ACA	AAA	AGA	S
	AUG		ACG	AAG	AGG	E
G	GUU	VAL	GCU	GAU	GGU	U
	GUC		GCC	GAC	GGC	C
	GUU		GCA	GAA	GGA	A
	GUG		GCG	GAG	GGG	G

Some DNA, RNA, and amino acid information from four similar sequences of four plant species is shown in the chart below.

20. Using the information given, fill in the missing mRNA base sequence for species B in the chart below. [1]

21. Using the Universal Genetic Code Chart, fill in the missing amino acid sequence for species C in the chart below. [1]

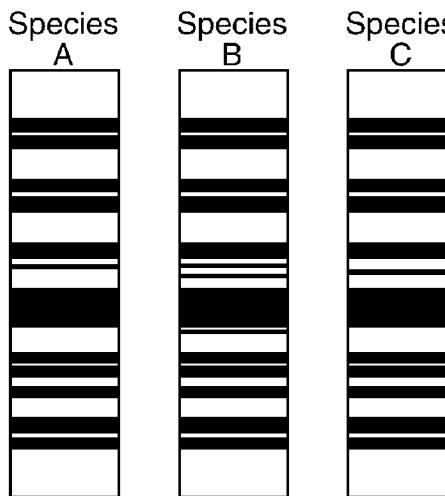
Species A	DNA base sequence	CCG	TGC	ATA	CAG	GTA
	mRNA base sequence	GGC	ACG	UAU	GUC	CAU
	Amino acid sequence	GLY	THR	TYR	VAL	HIS
Species B	DNA base sequence	TGC	TGC	ATA	CAG	GTA
	mRNA base sequence	—	—	—	—	—
	Amino acid sequence	THR	THR	TYR	VAL	HIS
Species C	DNA base sequence	CCG	TGC	ATA	CAG	GTT
	mRNA base sequence	GGC	ACG	UAU	GUC	CAA
	Amino acid sequence	—	—	—	—	—
Species D	DNA base sequence	CCT	TGT	ATG	CAC	GTC
	mRNA base sequence	GGA	ACA	UAC	GUG	CAG
	Amino acid sequence	GLY	THR	TYR	VAL	GLN

22. According to these amino acid sequences, which two plant species are the most closely related? Support your answer. [1]

Species _____ and _____

Base your answers to questions 23 and 24 on the information and diagram below and on your knowledge of biology.

The DNA of three different species of birds was analyzed to help determine if there is an evolutionary relationship between these species. The diagram shows the results of this analysis.



23. Identify the technique normally used to separate the DNA fragments to produce the patterns shown in the diagram. [1]

24. The chart below contains amino acid sequences for part of a protein that is found in the feathers on each of these three species of birds.

Species	Amino Acid Sequence
A	Arg-Leu-Glu-Gly-His-His-Pro-Lys-Arg
B	Arg-Gly-Glu-Gly-His-His-Pro-Lys-Arg
C	Arg-Leu-Glu-Gly-His-His-Pro-Lys-Arg

State one way this data supports the inference that these three bird species may be closely related. [1]

Base your answers to questions 25 through 28 on the information below and on your knowledge of biology.

To demonstrate techniques used in DNA analysis, a student was given two paper strip samples of DNA. The two DNA samples are shown below.

Sample 1:

ATTC~~CCGG~~TAA~~CCCG~~TAA~~GGGG~~AATAACT~~CCGG~~TAA~~ATC~~

Sample 2:

ATTC~~CCGG~~TAA~~CCCG~~TAA~~GGGG~~AATAACT~~CCGG~~TAA~~ATC~~

The student cut between the C and G in each of the shaded ~~CCGG~~ sequences in sample 1 and between the As in each of the shaded ~~TAA~~ sequences in sample 2. Both sets of fragments were then arranged on a paper model of a gel.

25. The action of what kind of molecules was being demonstrated when the DNA samples were cut? [1]

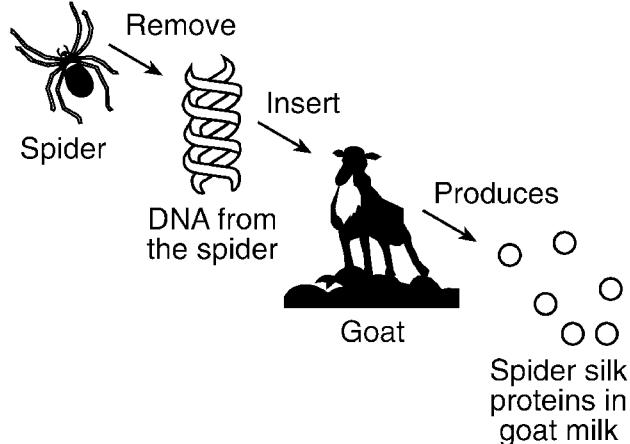
26. Identify the technique that was being demonstrated when the fragments were arranged on the gel model. [1]

27. The results of this type of DNA analysis are often used to help determine

- (1) the number of DNA molecules in an organism
- (2) if two species are closely related
- (3) the number of mRNA molecules in DNA
- (4) if two organisms contain carbohydrate molecules

28. State one way that the arrangement of the two samples on the gel model would differ. [1]

29. Which process is illustrated in the diagram below?



- (1) chromatography
- (2) direct harvesting
- (3) meiosis
- (4) genetic engineering

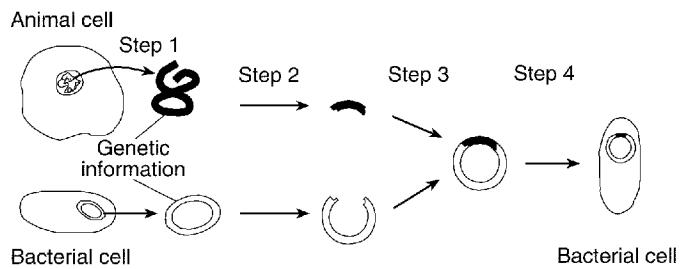
Base your answers to questions 30 and 31 on the statement below and on your knowledge of biology.

Selective breeding has been used to improve the racing ability of horses.

30. Define selective breeding and state how it would be used to improve the racing ability of horses. [2]

31. State one disadvantage of selective breeding. [1]

Base your answers to questions 32 and 33 on the diagram below, which illustrates some steps in genetic engineering and on your knowledge of biology.



32. What is the result of step 3?

- (1) a new type of molecular base is formed
- (2) different types of minerals are joined together
- (3) DNA from the bacterial cell is cloned
- (4) DNA from different organisms is joined together

33. State one way that enzymes are used in step 2. [1]

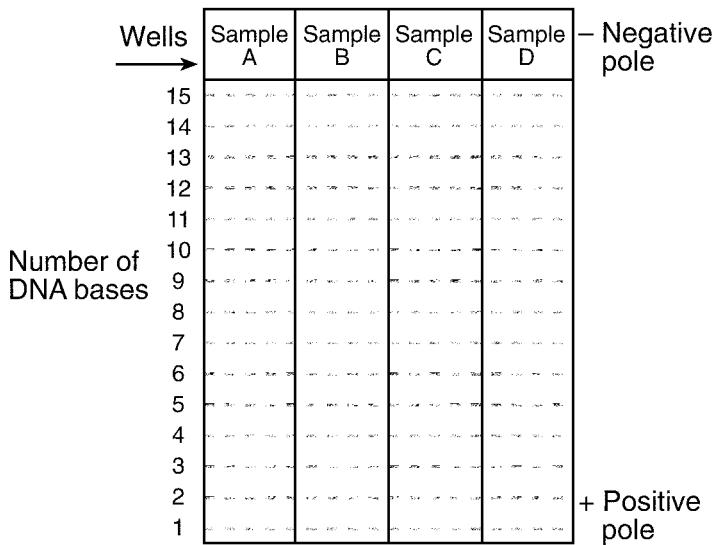
Base your answers to questions 34 through 36 on the information below and on your knowledge of biology.

In an investigation, DNA samples from four organisms, A, B, C, and D, were cut into fragments. The number of bases in the resulting DNA fragments for each sample is shown below.

Data Table

Sample	Number of Bases in DNA Fragments
A	3, 9, 5, 14
B	8, 4, 12, 10
C	11, 7, 6, 8
D	4, 12, 8, 11

34. The diagram below represents the gellike material through which the DNA fragments moved during gel electrophoresis. Draw lines to represent the position of the fragments from each DNA sample when electrophoresis is completed. [1]



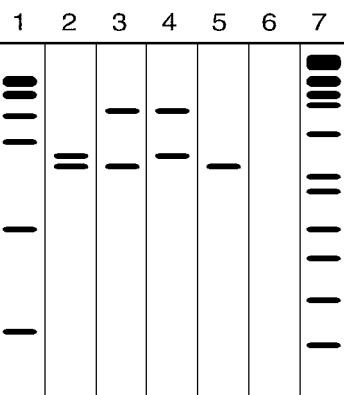
35. Which two DNA samples are the most similar? Support your answer using data from this investigation. [1]

Samples _____ and _____

36. State one specific use for the information obtained from the results of gel electrophoresis. [1]

Base your answers to questions 37 through 39 on the diagram below and on your knowledge of biology. The diagram shows the results of a technique used to analyze DNA.

DNA Samples



37. This technique used to analyze DNA directly results in
(1) synthesizing large fragments of DNA
(2) separating DNA fragments on the basis of size
(3) producing genetically engineered DNA molecules
(4) removing the larger DNA fragments from the samples
38. This laboratory technique is known as
(1) gel electrophoresis
(2) DNA replication
(3) protein synthesis
(4) genetic recombination
39. State one specific way the results of this laboratory technique could be used. [1]

40. The flounder is a species of fish that can live in very cold water. The fish produces an "antifreeze" protein that prevents ice crystals from forming in its blood. The DNA for this protein has been identified. An enzyme is used to cut and remove this section of flounder DNA that is then spliced into the DNA of a strawberry plant. As a result, the plant can now produce a protein that makes it more resistant to the damaging effects of frost. This process is known as

- (1) sorting of genes
(2) genetic engineering
(3) recombination of chromosomes
(4) mutation by deletion of genetic material

41. Knowledge of human genes gained from research on the structure and function of human genetic material has led to improvements in medicine and health care for humans.

- state two ways this knowledge has improved medicine and health care for humans [2]
- identify one specific concern that could result from the application of this knowledge [1]

42. Viruses frequently infect bacteria and insert new genes into the genetic material of the bacteria. When these infected bacteria reproduce asexually, which genes would most likely be passed on?

- (1) only the new genes
- (2) only the original genes
- (3) both the original and the new genes
- (4) neither the original nor the new genes

1. Strawberries can reproduce by means of runners, which are stems that grow horizontally along the ground. At the region of the runner that touches the ground, a new plant develops. The new plant is genetically identical to the parent because

- (1) it was produced sexually
- (2) nuclei traveled to the new plant through the runner to fertilize it
- (3) it was produced asexually
- (4) there were no other strawberry plants in the area to provide fertilization

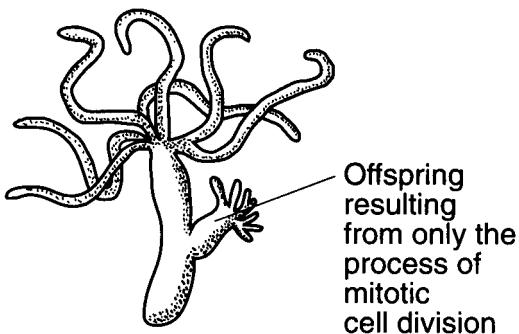
Base your answer to question 2 on the information below and on your knowledge of biology.

Gaurs, which are large oxlike animals found in South Asia, have been hunted for sport for many generations. Most recently, as human populations have increased, the gaur's habitats of forests, bamboo jungles, and grasslands have dwindled. The gaur is now considered an endangered species.

Scientists have succeeded in preserving endangered species by cloning. Recently, a gaur was cloned and the resulting embryo was placed inside a domestic cow, which then gave birth to a baby gaur.

2. Describe how gaurs produced through normal means are different from gaurs produced by cloning. [1]

3. The organism represented below is multicellular, heterotrophic, and completely aquatic.



Which other characteristics could be used to describe this organism?

- (1) carries out photosynthesis and needs oxygen
- (2) deposits cellular wastes on land and decomposes dead organisms
- (3) reproduces asexually and is a consumer
- (4) reproduces in a water habitat and is a producer

4. Which statement describes asexual reproduction?
- (1) Adaptive traits are usually passed from parent to offspring without genetic modification.
 - (2) Mutations are not passed from generation to generation.
 - (3) It always enables organisms to survive in changing environmental conditions.
 - (4) It is responsible for many new variations in offspring.

5. Sexually produced offspring often resemble, but are not identical to, either of their parents. Explain why they resemble their parents but are not identical to either parent. [1]
-
-

6. Which row in the chart below best describes asexual reproduction?

Row	Number of Parents	Comparison of Offspring to Parents
(1)	one	identical
(2)	one	different
(3)	two	identical
(4)	two	different

7. When a planarian (a type of worm) is cut in half, each half usually grows back into a complete worm over time. This situation most closely resembles

- (1) asexual reproduction in which a mutation has occurred
- (2) sexual reproduction in which each half represents one parent
- (3) asexual reproduction of a single-celled organism
- (4) sexual reproduction of a single-celled organism

8. Steps in a reproductive process used to produce a sheep with certain traits are listed below.

Step 1 — The nucleus was removed from an unfertilized egg taken from sheep A.

Step 2 — The nucleus of a body cell taken from sheep B was then inserted into this unfertilized egg from sheep A.

Step 3 — The resulting cell was then implanted into the uterus of sheep C.

Step 4 — Sheep C gave birth to sheep D.

Which sheep would be most genetically similar to sheep D?

- (1) sheep A, only
- (2) sheep B, only
- (3) both sheep A and B
- (4) both sheep A and C

9. Scientists have successfully cloned sheep and cattle for several years. A farmer is considering the advantages and disadvantages of having a flock of sheep cloned from a single individual. Discuss the issues the farmer should take into account before making a decision. Your response should include:

- how a cloned flock would be different from a noncloned flock [1]
 - one advantage of having a cloned flock [1]
 - one disadvantage of having a cloned flock [1]
 - one reason that the farmer could not mate these cloned sheep with each other to increase the size of his flock [1]
 - one reason that the offspring resulting from breeding these sheep with an unrelated sheep would not all be the same [1]
-
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10. In an environment that undergoes frequent change, species that reproduce sexually may have an advantage over species that reproduce asexually because the sexually reproducing species produce

- (1) more offspring in each generation
- (2) identical offspring
- (3) offspring with more variety
- (4) new species of offspring in each generation

11. A certain bacterial colony originated from the division of a single bacterial cell. Each cell in this colony will most likely

- (1) express adaptations unlike those of the other cells
- (2) replicate different numbers of genes
- (3) have a resistance to different antibiotics
- (4) synthesize the same proteins and enzymes

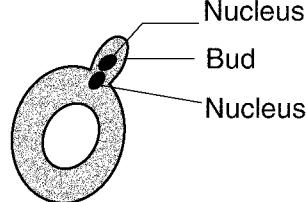
12. A single pair of goldfish in an aquarium produced a large number of offspring. These offspring showed variations in body shape and coloration. The most likely explanation for these variations is that the

- (1) offspring were adapting to different environments
- (2) offspring were produced from different combinations of genes
- (3) parent fish had not been exposed to mutagenic agents
- (4) parent fish had not reproduced sexually

13. A tree produces only seedless oranges. A small branch cut from this tree produces roots after it is planted in soil. When mature, this new tree will most likely produce

- (1) oranges with seeds, only
- (2) oranges without seeds, only
- (3) a majority of oranges with seeds and only a few oranges without seeds
- (4) oranges and other kinds of fruit

14. The diagram below represents a yeast cell that is in the process of budding, a form of asexual reproduction.



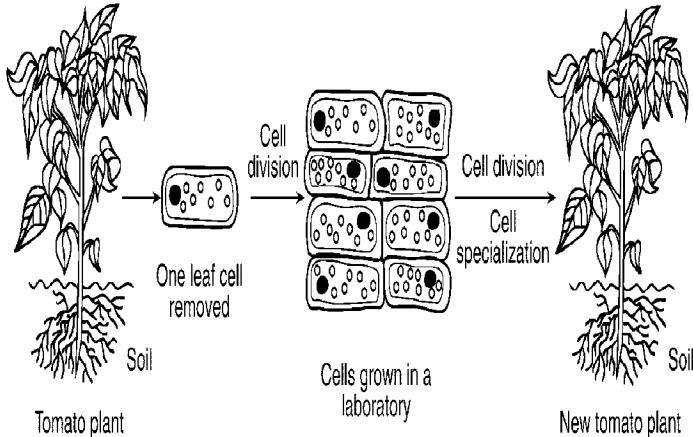
Which statement describes the outcome of this process?

- (1) The bud will develop into a zygote.
- (2) The two cells that result will each contain half the species number of chromosomes.
- (3) The two cells that result will have identical DNA.
- (4) The bud will start to divide by the process of meiotic cell division.

15. The least genetic variation will probably be found in the offspring of organisms that reproduce using

- (1) mitosis to produce a larger population
- (2) meiosis to produce gametes
- (3) fusion of eggs and sperm to produce zygotes
- (4) internal fertilization to produce an embryo

16. A technique used to produce new plants is represented in the diagram below.



Which statement is best supported by the information in the diagram?

- (1) The one leaf cell removed formed a zygote that developed into a new plant by mitotic cell division.
- (2) This procedure is used to produce new tomato plants that are clones of the original tomato plant.
- (3) The cell taken from the leaf produced eight cells, each having one-half of the genetic information of the original leaf cell.
- (4) The new tomato plant will not be able to reproduce sexually because it was produced by mitotic cell division.

1. Which statement is true of both mitosis and meiosis?

 - Both are involved in asexual reproduction.
 - Both occur only in reproductive cells.
 - The number of chromosomes is reduced by half.
 - DNA replication occurs before the division of the nucleus.

2. Meiosis and fertilization are important for the survival of many species because these two processes result in

 - large numbers of gametes
 - increasingly complex multicellular organisms
 - cloning of superior offspring
 - genetic variability of offspring

3. Reproduction in humans usually requires

 - the process of cloning
 - mitotic cell division of gametes
 - gametes with chromosomes that are not paired
 - the external fertilization of sex cells

4. The diagram below illustrates the process of cell division.

The diagram shows a cell undergoing division through six stages: Interphase (parent cell), Prophase, Metaphase, Anaphase, Telophase, and Interphase (daughter cells). In Prophase, the chromosomes are visible as pairs (XX). In Metaphase, the chromosomes are aligned at the center. In Anaphase, the chromosomes are moving toward opposite poles. In Telophase, the cell is splitting into two daughter cells, each containing two chromosomes. The label '4 chromosomes' points to the initial state of the cell.

What is the significance of anaphase in this process?

 - Anaphase usually ensures that each daughter cell has the same number of chromosomes as the parent cell.
 - Anaphase usually ensures that each daughter cell has twice as many chromosomes as the parent cell.
 - In anaphase, the cell splits in half.
 - In anaphase, the DNA is being replicated.

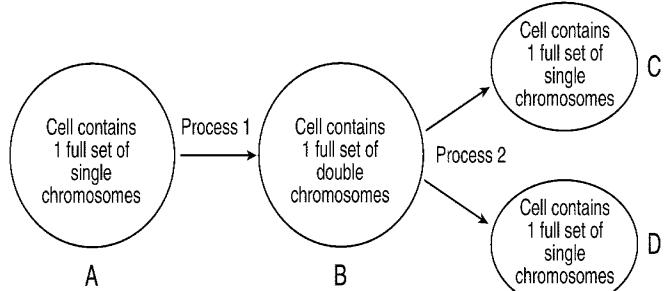
5. Which statement correctly describes the genetic makeup of the sperm cells produced by a human male?

 - Each cell has pairs of chromosomes and the cells are usually genetically identical.
 - Each cell has pairs of chromosomes and the cells are usually genetically different.
 - Each cell has half the normal number of chromosomes and the cells are usually genetically identical.
 - Each cell has half the normal number of chromosomes and the cells are usually genetically different.

6. Which cell process occurs only in organisms that reproduce sexually?

(1) mutation	(3) meiosis
(2) replication	(4) mitosis

Base your answers to questions 7 through 10 on the diagram below and on your knowledge of biology. The diagram represents a single-celled organism, such as an ameba, undergoing the changes shown.



7. As a result of these processes, the single-celled organism accomplishes

(1) gamete production (3) sexual reproduction
(2) energy production (4) asexual reproduction

8. Process 1 is known as

(1) replication (3) differentiation
(2) meiosis (4) digestion

9. Process 1 and process 2 are directly involved in

(1) meiotic cell division (3) fertilization
(2) mitotic cell division (4) recombination

10. The genetic content of C is usually identical to the genetic content of

(1) B but not D (3) D but not A
(2) both B and D (4) both A and D

What is the significance of anaphase in this process?

- (1) Anaphase usually ensures that each daughter cell has the same number of chromosomes as the parent cell.

(2) Anaphase usually ensures that each daughter cell has twice as many chromosomes as the parent cell.

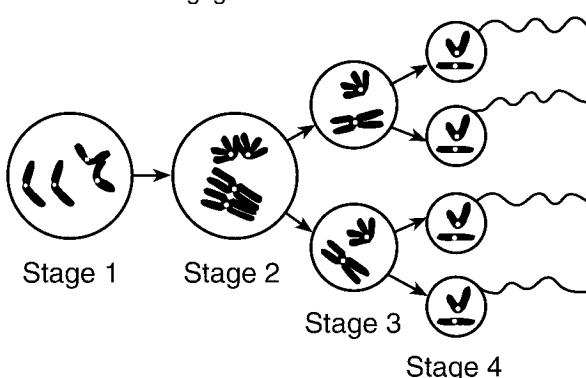
(3) In anaphase, the cell splits in half.

(4) In anaphase, the DNA is being replicated.

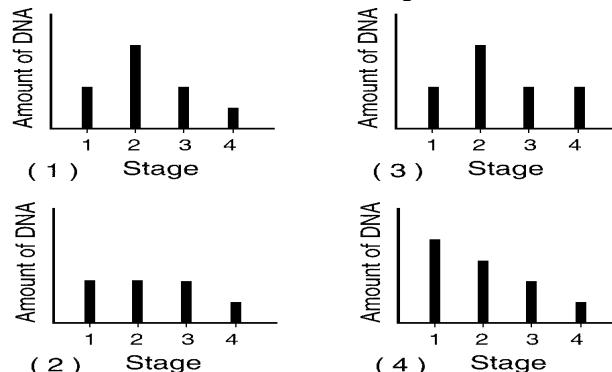
5. Which statement correctly describes the genetic makeup of the sperm cells produced by a human male?

 - (1) Each cell has pairs of chromosomes and the cells are usually genetically identical.
 - (2) Each cell has pairs of chromosomes and the cells are usually genetically different.
 - (3) Each cell has half the normal number of chromosomes and the cells are usually genetically identical.
 - (4) Each cell has half the normal number of chromosomes and the cells are usually genetically different.

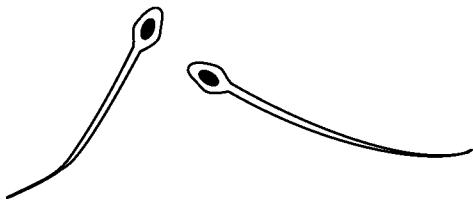
6. Which cell process occurs only in organisms that reproduce sexually?



Which graph best represents the changes in the amount of DNA in one of the cells at each stage?



12. Which statement about the gametes represented in the diagram below is correct?

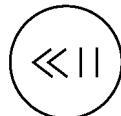


- (1) They are produced by females.
- (2) They are fertilized in an ovary.
- (3) They transport genetic material.
- (4) They are produced by mitosis.

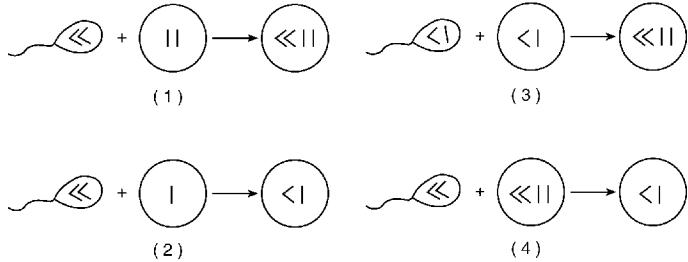
13. Marine sponges contain a biological catalyst that blocks a certain step in the separation of chromosomes. Which cellular process would be directly affected by this catalyst?

- (1) mitosis
- (2) diffusion
- (3) respiration
- (4) photosynthesis

14. The diagram below represents a nucleus containing the normal chromosome number for a species.



Which diagram best illustrates the normal formation of a cell that contains all of the genetic information needed for growth, development, and future reproduction of this species?



15. Which cell is normally produced as a direct result of meiosis?

- (1) a uterine cell having half the normal species number of chromosomes
- (2) an egg having the full species number of chromosomes
- (3) a zygote having the full species number of chromosomes
- (4) a sperm having half the normal species number of chromosomes

16. As a human red blood cell matures, it loses its nucleus. As a result of this loss, a mature red blood cell lacks the ability to

- (1) take in material from the blood
- (2) release hormones to the blood
- (3) pass through artery walls
- (4) carry out cell division

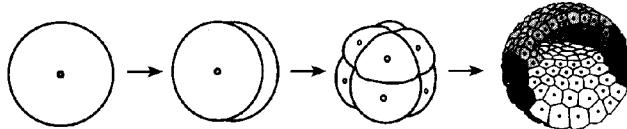
1. Research has shown that certain body cells, known as stem cells, can develop into a variety of specialized cells. Various factors can cause stem cells to develop into different types of mature cells. These different types of mature cells result from

- (1) different antibodies and mitotic cell division
- (2) identical genetic codes and meiotic cell division
- (3) different environments of the cells and the functioning of different parts of the genetic code
- (4) similar steps in the development of the cells and a reduction in the number of chromosomes in each cell

2. A cell resulting from the fertilization of an egg begins to divide. Two cells are formed that normally remain attached and could develop into a new individual. If the two cells become separated, which statement describes what would most likely occur?

- (1) The cells would each have all of the needed genetic information, and both could survive.
- (2) The cells would each have only one-half of the needed genetic information, so both would die.
- (3) One cell would have all of the needed genetic information and would survive, but the other would have none of the needed genetic information and would die.
- (4) Each cell would have some of the needed genetic information, but would be unable to share it, so both would die.

3. Part of embryonic development in a species is illustrated in the diagram below.



Fertilized egg

Embryo

Which set of factors plays the most direct role in controlling the events shown in the diagram?

- (1) genes, hormones, and cell location
- (2) antibodies, insulin, and starch
- (3) ATP, amino acids, and inorganic compounds
- (4) abiotic resources, homeostasis, and selective breeding

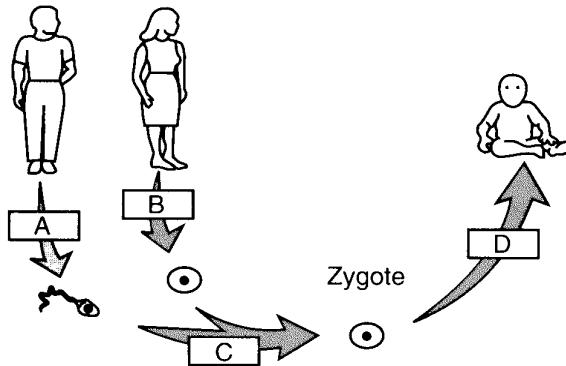
4. The enzyme pepsin is produced in the cells of the stomach but not in the cells of the small intestine. The small intestine produces a different enzyme, trypsin. The reason that the stomach and small intestine produce different enzymes is that the gene that codes for pepsin is

- (1) in the cells of the stomach, but not in the cells of the small intestine
- (2) expressed in the stomach but not expressed in the small intestine
- (3) mutated in the small intestine
- (4) digested by the trypsin in the small intestine

5. A human liver cell is very different in structure and function from a nerve cell in the same person. This is best explained by the fact that

- (1) different genes function in each type of cell
- (2) liver cells can reproduce while the nerve cells cannot
- (3) liver cells contain fewer chromosomes than nerve cells
- (4) different DNA is present in each type of cell

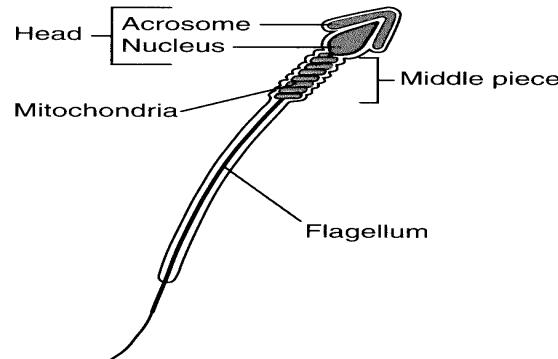
6. The diagram below represents processes involved in human reproduction.



Which row in the chart below correctly identifies the processes represented by the letters in the diagram?

Row	A	B	C	D
(1)	mitosis	meiosis	fertilization	differentiation
(2)	meiosis	meiosis	fertilization	differentiation
(3)	meiosis	mitosis	differentiation	fertilization
(4)	mitosis	mitosis	differentiation	fertilization

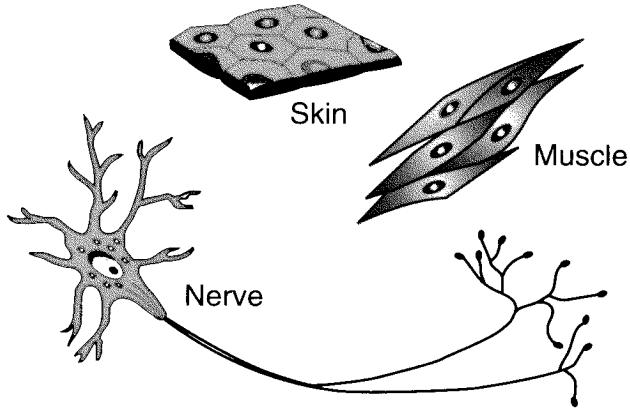
7. A sperm cell from an organism is represented in the diagram below.



Which statement regarding this sperm cell is not correct?

- (1) The acrosome contains half the normal number of chromosomes.
- (2) Energy to move the flagellum originates in the middle piece.
- (3) The head may contain a mutation.
- (4) This cell can unite with another cell resulting in the production of a new organism.

8. The types of human cells shown below are different from one another, even though they all originated from the same fertilized egg and contain the same genetic information.

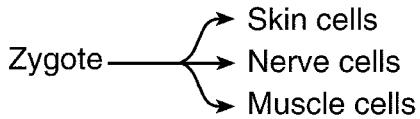


Explain why these genetically identical cells can differ in structure and function. [1]

9. The reproductive cycle of a human is usually regulated by

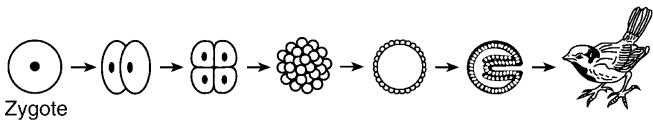
- | | |
|--------------|-----------------------|
| (1) gametes | (3) natural selection |
| (2) hormones | (4) immune responses |

10. Which developmental process is represented by the diagram below?



- | | |
|---------------------|---------------|
| (1) fertilization | (3) evolution |
| (2) differentiation | (4) mutation |

11. The diagram below represents a series of events in the development of a bird.



Which series of terms best represents the sequence of processes shown?

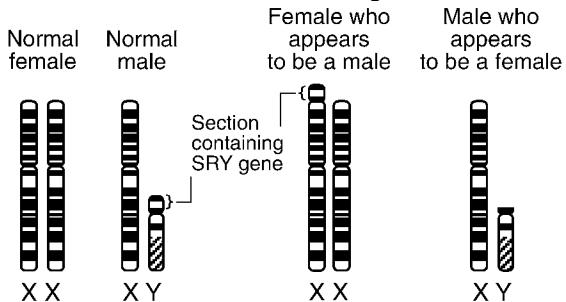
- | |
|---|
| (1) meiosis → growth → differentiation |
| (3) mitosis → meiosis → differentiation |
| (2) meiosis → differentiation → growth |
| (4) mitosis → differentiation → growth |

12. After the union of sperm and egg, the single-celled zygote develops into a multicellular organism with specialized cells by the processes of

- | |
|---|
| (1) meiosis and replication |
| (2) mitosis and differentiation |
| (3) cloning and growth |
| (4) fertilization and gamete production |

13. The Y-chromosome carries the SRY gene that codes for the production of testosterone in humans.

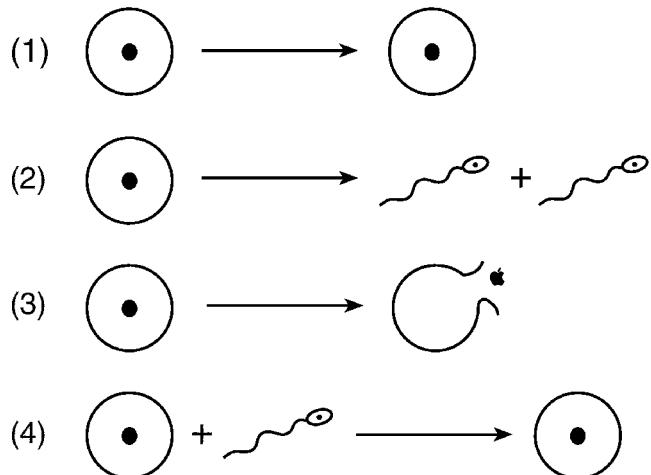
Occasionally a mutation occurs resulting in the SRY gene being lost from the Y-chromosome and added to the X-chromosome, as shown in the diagram below.



Based on the diagram, which statement is correct?

- (1) The production of testosterone influences the development of male characteristics.
- (2) Reproductive technology has had an important influence on human development.
- (3) Normal female characteristics develop from a single X-chromosome.
- (4) Male characteristics only develop in the absence of X-chromosomes.

14. Which diagram best illustrates an event in sexual reproduction that would most directly lead to the formation of a human embryo?



15. Offspring that result from meiosis and fertilization each have

- | |
|---|
| (1) twice as many chromosomes as their parents |
| (2) one-half as many chromosomes as their parents |
| (3) gene combinations different from those of either parent |
| (4) gene combinations identical to those of each parent |

16. Which two structures of a frog would most likely have the same chromosome number?

- | |
|---------------------------------------|
| (1) skin cell and fertilized egg cell |
| (2) zygote and sperm cell |
| (3) kidney cell and egg cell |
| (4) liver cell and sperm cell |

17. Tissues develop from a zygote as a direct result of the processes of

- (1) fertilization and meiosis
- (2) fertilization and differentiation
- (3) mitosis and meiosis
- (4) mitosis and differentiation

18. The data in the table below indicate the presence of specific reproductive hormones in blood samples taken from three individuals. An X in the hormone column indicates a positive lab test for the appropriate levels necessary for normal reproductive functioning in that individual.

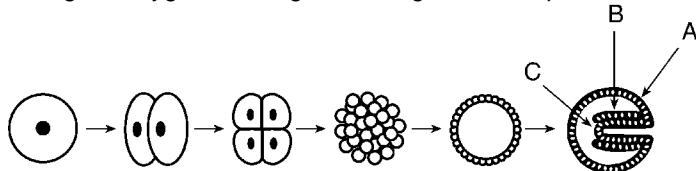
Data Table

Individuals	Hormones Present		
	Testosterone	Progesterone	Estrogen
1		X	X
2			X
3	X		

Which processes could occur in individual 3?

- (1) production of sperm, only
- (2) production of sperm and production of eggs
- (3) production of eggs and embryonic development
- (4) production of eggs, only

19. The diagram and chart below represent some of the changes a zygote undergoes during its development.



Layer	Develops Into
A	skin and nervous system
B	muscles and blood vessels
C	digestive and respiratory systems

The processes that are most directly responsible for these changes are

- (1) sorting and recombination of genetic information
- (2) mitosis and differentiation
- (3) meiosis and adaptation
- (4) fertilization and cycling of materials

Name: _____ Topic 4D

1. Define fertilization and describe the resulting development of a human embryo. In your answer, be sure to include a definition of fertilization and the functions of the ovary, uterus, and placenta. Circle the terms fertilization, ovary, uterus, and placenta in your description. [4]

2. The human reproductive system is regulated by
 - (1) restriction enzymes
 - (3) complex carbohydrates
 - (2) antigens
 - (4) hormones
 3. Most mammals have adaptations for
 - (1) internal fertilization and internal development of the fetus
 - (2) internal fertilization and external development of the fetus
 - (3) external fertilization and external development of the fetus
 - (4) external fertilization and internal development of the fetus
 4. Which reproductive structure is correctly paired with its function?
 - (1) uterus—usual site of fertilization
 - (2) testis—usual location for egg development
 - (3) ovary—delivers nutrients to the embryo
 - (4) sperm—transports genetic material

5. Toxins can harm a developing fetus. They usually enter the fetus by the process of

- (1) blood flow from the mother to the fetus
 - (2) active transport from the ovary
 - (3) diffusion across placental membranes
 - (4) recombination of genes from the fetus and mother

6. Estrogen has a direct effect on the

 - (1) formation of a zygote
 - (2) changes within the uterus
 - (3) movement of an egg toward the sperm
 - (4) development of a placenta within the ovary

Base your answers to questions 7 and 8 on the information below and on your knowledge of biology.

The reproductive cycle in a human female is not functioning properly. An imbalance of hormones is diagnosed as the cause.

7. Identify one hormone directly involved in the human female reproductive system that could cause this problem. [1]

8. Explain why some cells in a female's body respond to reproductive hormones while other cells do not. [1]

9. Which statement describes the reproductive system of a human male?

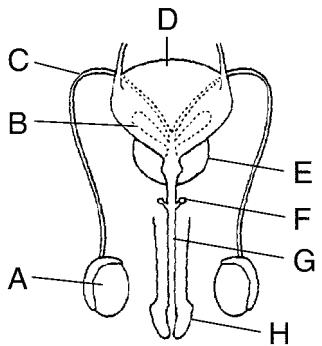
- (1) It releases sperm that can be used only in external fertilization.
 - (2) It synthesizes progesterone that regulates sperm formation.
 - (3) It produces gametes that transport food for embryo formation.
 - (4) It shares some structures with the excretory system.

10. Removal of one ovary from a human female would most likely

- (1) affect the production of eggs
 - (2) make fertilization impossible
 - (3) make carrying a fetus impossible
 - (4) decrease her ability to provide essential nutrients to an embryo

11. Which substance usually passes in the greatest amount through the placenta from the blood of the fetus to the blood of the mother?

Base your answers to questions 12 through 14 on the diagram below, which represents systems in a human male and on your knowledge of biology.



12. Which sequence represents the path of sperm leaving the body?

- (1) A → C → G
- (2) A → C → B
- (3) E → F → H
- (4) D → F → G

13. Which structures aid in the transport of sperm by secreting fluid?

- (1) A and H
- (2) B and E
- (3) C and D
- (4) D and H

14. Which structure has both reproductive and excretory functions?

- (1) A
- (2) G
- (3) C
- (4) D

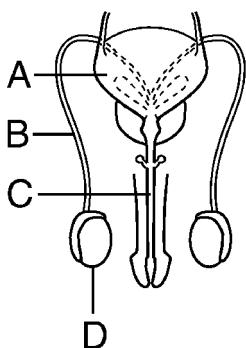
15. Which statement describes one function of the placenta in mammals?

- (1) It allows blood of the mother to mix with the blood of the fetus.
- (2) It contains fluid that protects the embryo from harm.
- (3) It removes waste products that are produced in the cells of the fetus.
- (4) It synthesizes food for the embryo.

16. The diagram below represents a human reproductive system.

Meiosis occurs within structure

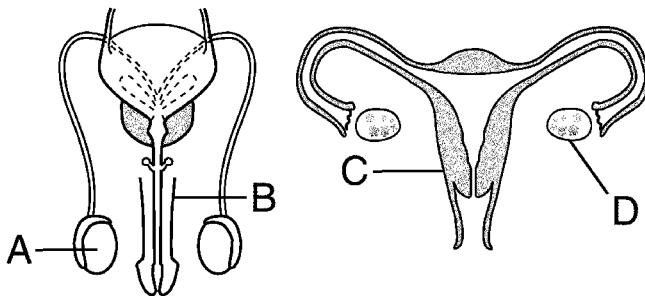
- (1) A
- (2) B
- (3) C
- (4) D



17. The human female reproductive system is adapted for

- (1) production of zygotes in ovaries
- (2) external fertilization of gametes
- (3) production of milk for a developing embryo
- (4) transport of oxygen through a placenta to a fetus

18. The diagram below represents human reproductive systems. Which statement best describes part of the human reproductive process?



(1) Testosterone produced in A is transferred to D, where it influences embryonic development.

(2) Testosterone produced in D influences formation of sperm within B.

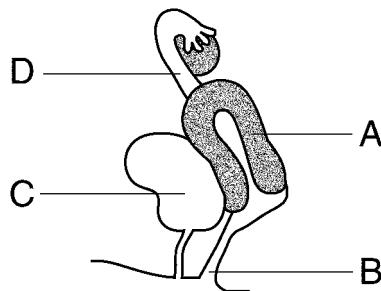
(3) Estrogen and progesterone influence the activity of C.

(4) Progesterone stimulates the division of the egg within C.

19. As women age, their reproductive cycles stop due to decreased

- (1) digestive enzyme production
- (2) production of ATP
- (3) levels of specific hormones
- (4) heart rate

20. The letters in the diagram below represent structures in a human female.

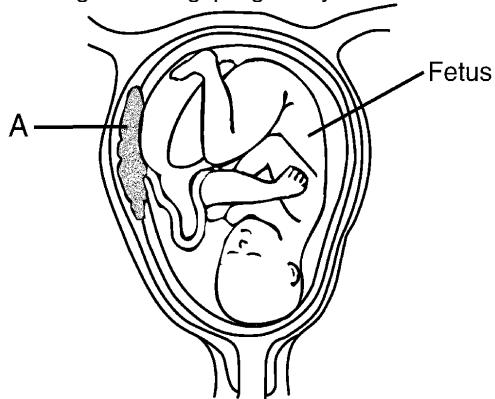


Estrogen and progesterone increase the chance for successful fetal development by regulating activities within structure

- (1) A
- (2) B
- (3) C
- (4) D

Base your answers to questions 1 and 2 on the statement and diagram below and on your knowledge of biology.

Women are advised to avoid consuming alcoholic beverages during pregnancy.



4 To prevent harm to the fetus, women should avoid tobacco, alcohol, and certain medications during pregnancy. State one specific way that one of these substances could harm the fetus. [1]

1. Identify the structure labeled A and explain how the functioning of structure A is essential for the normal development of the fetus. [2]

Structure A: _____

2. Explain why consumption of alcoholic beverages by a pregnant woman is likely to be more harmful to her fetus than to herself. [1]

3 Which statement about embryonic organ development in humans is accurate?

- (1) It is affected primarily by the eating habits and general health of the father.
- (2) It may be affected by the diet and general health of the mother.
- (3) It will not be affected by any medication taken by the mother in the second month of pregnancy.
- (4) It is not affected by conditions outside the embryo.

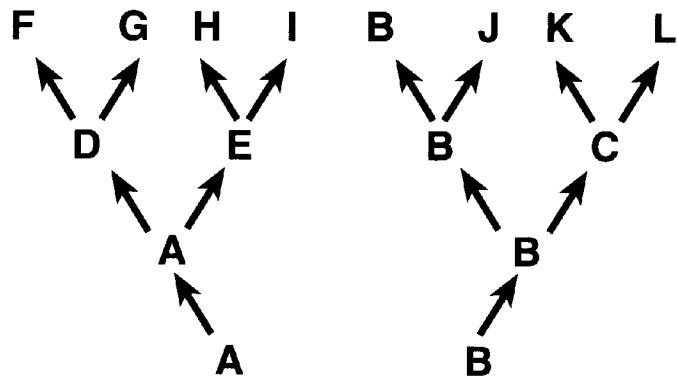
1. The chart below contains a number of characteristics for three different organisms. The characteristics can be used in classifying these organisms.

Characteristics	Organism A	Organism B	Organism C
Number of cells	unicellular	multicellular	unicellular
Type of nutrition	autotrophic	autotrophic	heterotrophic
Nuclear membrane	absent	present	absent
DNA	present	present	present

Which two organisms would be expected to have the most similar genetic material? Support your answer using information from the chart. [2]

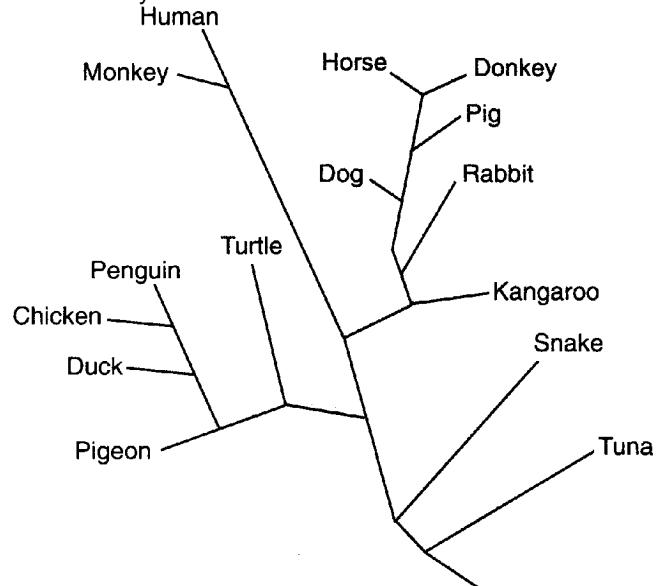
_____ and _____

Base your answers to questions 2 through 4 on the diagram below and on your knowledge of biology. Letters A through L represent different species of organisms. The arrows represent long periods of geologic time.



Base your answers to questions 5 through 7 on the information below and on your knowledge of biology.

Based on their analysis of the differences in amino acid sequences of one kind of protein, scientists prepared the evolutionary tree shown below.



5. According to this diagram, the DNA of which pair of organisms would show the greatest similarity?

(1) penguin and turtle (3) snake and tuna
(2) horse and donkey (4) turtle and rabbit

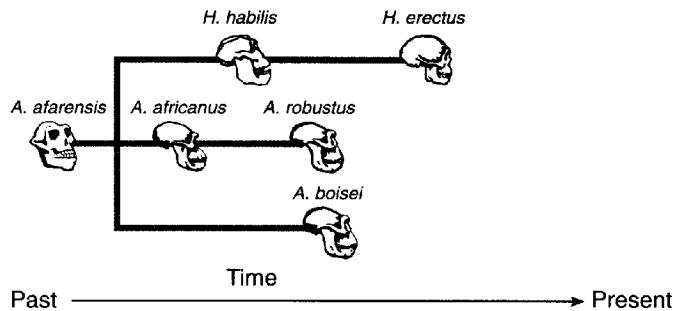
6. Older systems of classification always placed penguins, chickens, ducks, and pigeons in the bird group and turtles and snakes in the reptile group. Does this diagram support the older system of classification? Explain your answer. [1]

7. According to this diagram, is the pig more closely related to the dog or the kangaroo? Justify your answer.
[1]

8. Scientists hypothesize that cabbage, broccoli, cauliflower, and radishes developed along a common evolutionary pathway. Which observation would best support this hypothesis?

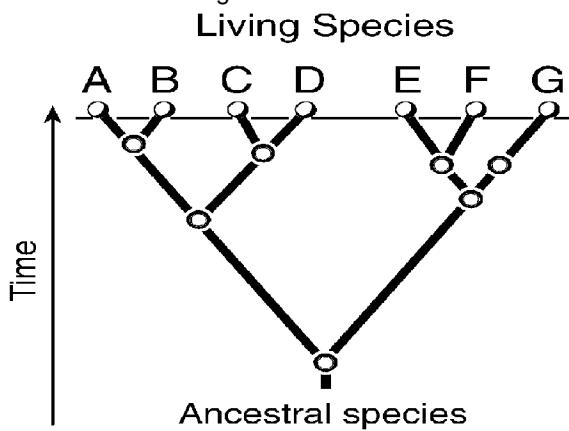
- (1) Fossils of these plants were found in the same rock layer.
 - (2) Chloroplasts of these plants produce a gas.
 - (3) These plants live in the same environment.
 - (4) These plants have similar proteins.

9. According to the diagram below, which three species lived on Earth during the same time period?



- (1) robustus, africanus, afarensis
- (2) habilis, erectus, afarensis
- (3) habilis, robustus, boisei
- (4) africanus, boisei, erectus

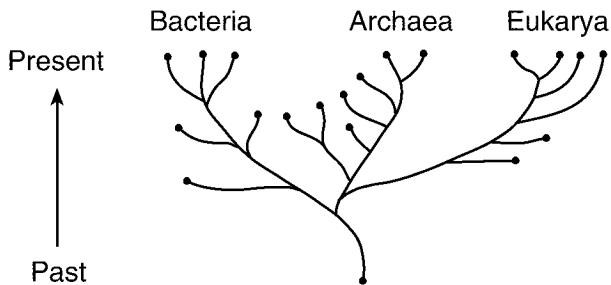
10. The evolutionary pathways of seven living species are shown in the diagram below.



Which two species are likely to have the most similar DNA base sequences?

- (1) B and G
- (2) E and G
- (3) B and C
- (4) C and D

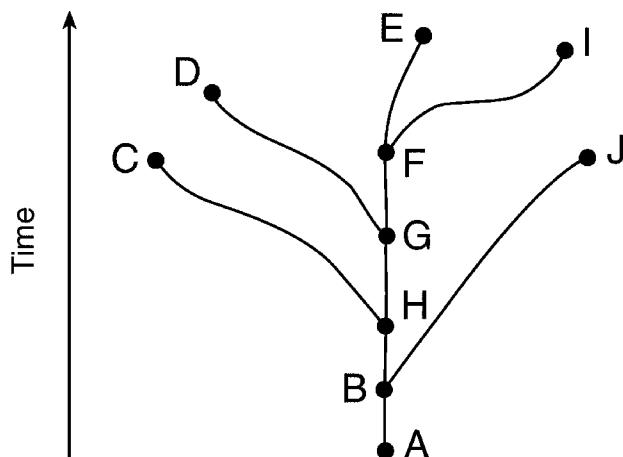
11. A current proposal in the field of classification divides life into three broad categories called domains. This idea is illustrated below.



Which concept is best supported by this diagram?

- (1) Evolutionary pathways proceed only in one set direction over a short period of time.
- (2) All evolutionary pathways will eventually lead to present-day organisms.
- (3) All evolutionary pathways are the same length and they all lead to present-day organisms.
- (4) Evolutionary pathways can proceed in several directions with only some pathways leading to present-day organisms.

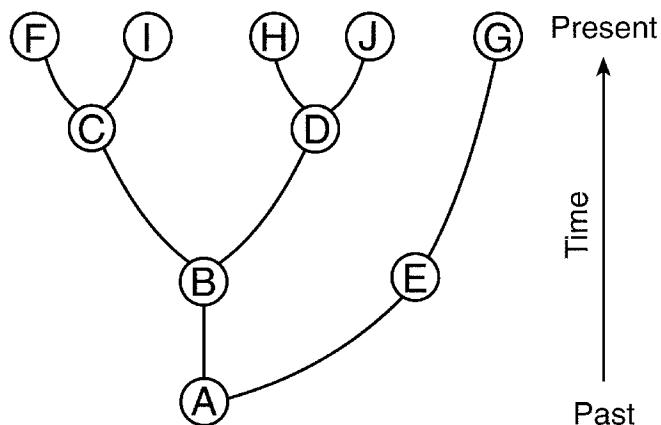
12. The evolutionary pathways of ten different species are represented in the diagram below.



Which two species are the most closely related?

- (1) C and D
- (2) E and I
- (3) G and J
- (4) A and F

Base your answers to questions 13 through 15 on the diagram below that shows some evolutionary pathways. Each letter represents a different species.



13. Which two organisms are most closely related?

- (1) F and I
- (2) F and H
- (3) A and G
- (4) G and J

14. The most recent ancestor of organisms D and F is

- (1) A
- (2) B
- (3) C
- (4) I

15. If A represents a simple multicellular heterotrophic organism, B would most likely represent

- (1) a single-celled photosynthetic organism
- (2) an autotrophic mammal
- (3) a complex multicellular virus
- (4) another type of simple multicellular heterotroph

Base your answers to questions 16 and 17 on the information and chart below and on your knowledge of biology.

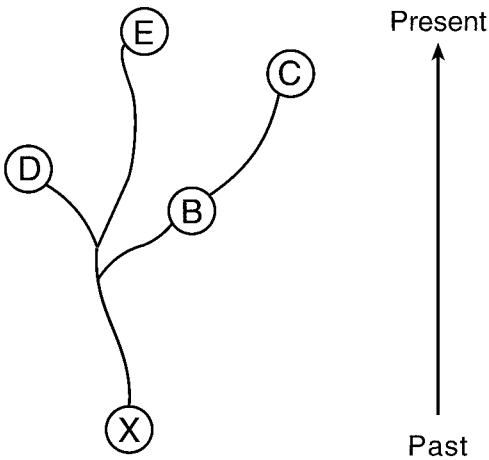
16. The chart below contains amino acid sequences for part of a protein that is found in the feathers on each of these three species of birds.

Species	Amino Acid Sequence
A	Arg-Leu-Glu-Gly-His-His-Pro-Lys-Arg
B	Arg-Gly-Glu-Gly-His-His-Pro-Lys-Arg
C	Arg-Leu-Glu-Gly-His-His-Pro-Lys-Arg

State one way this data supports the inference that these three bird species may be closely related. [1]

17. State one type of additional information that could be used to determine if these three species are closely related. [1]

18. The evolutionary pathways of five species are represented in the diagram below.



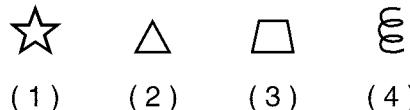
Which statement is supported by the diagram?

- (1) Species C is the ancestor of species B.
- (2) Species D and E evolved from species B.
- (3) Species X evolved later than species D but before species B.
- (4) Both species C and species D are related to species X.

19. A classification system is shown in the table below.

Classification	Examples
Kingdom — animal	△, ○, □, ☆, □, ◇, ☰, ▽
Phylum — chordata	△, □, ☰, ☆, ▽
Genus — <i>Felis</i>	□, ☰
Species — <i>domestica</i>	□

This classification scheme indicates that □ is most closely related to

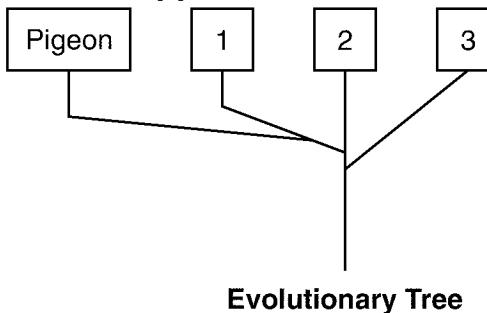


Base your answer to question 20 on the information and data table below and on your knowledge of biology.

Body Structures and Reproductive Characteristics of Four Organisms

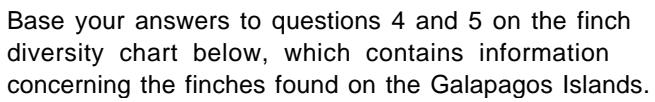
Organism	Body Structures	Reproductive Characteristics
pigeon	feathers, scales 2 wings, 2 legs	lays eggs
A	scales 4 legs	lays eggs
B	fur 2 leathery wings, 2 legs	gives birth to live young provides milk for offspring
C	fur 4 legs	lays eggs provides milk for offspring

20. Explain why it would be difficult to determine which one of the other three organisms from the table should be placed in box 1. [1]

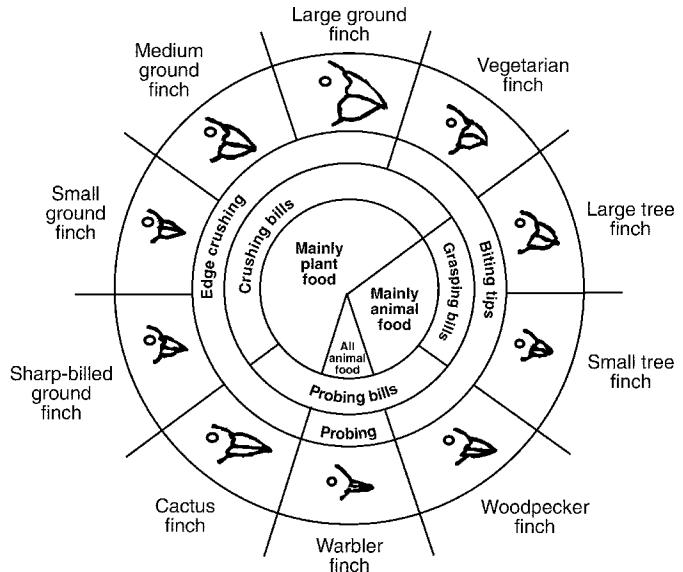


1. A hawk has a genetic trait that gives it much better eyesight than other hawks of the same species in the same area. Explain how this could lead to evolutionary change within this species of hawk over a long period of time. In your answer, be sure to include an explanation of:

- competition within the hawk population [1]
 - survival of various individuals in the population [1]
 - how the frequency of the better-eyesight trait would be expected to change over time within the population [1]
 - what would most likely happen to the hawks having the better-eyesight trait if they also had unusually weak wing muscles [1]



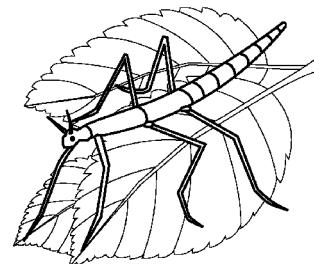
Finch Diversity



4. Identify one bird that would most likely compete for food with the large tree finch. Support your answer. [1]

5. Identify one trait, other than beak characteristics, that would contribute to the survival of a finch species and state one way this trait contributes to the success of this species. [2]

6. The illustration below shows an insect resting on some green leaves.



The size, shape, and green color of this insect are adaptations that would most likely help the insect to

- (1) compete successfully with all birds
 - (2) make its own food
 - (3) hide from predators
 - (4) avoid toxic waste materials

2. Which factor could be the cause of the other three in an animal species?

- (1) the inability of the species to adapt to changes
 - (2) a lack of genetic variability in the species
 - (3) extinction of the species
 - (4) a decrease in the survival rate of the species

3. Natural selection and its evolutionary consequences provide a scientific explanation for each of the following except

- (1) the fossil record
 - (2) protein and DNA similarities between different organisms
 - (3) similar structures among different organisms
 - (4) a stable physical environment

Base your answers to questions 7 and 8 on the passage below and on your knowledge of biology.

When Charles Darwin traveled to the Galapagos Islands, he observed 14 distinct varieties of finches on the islands. Darwin also observed that each finch variety ate a different type of food and lived in a slightly different habitat from the other finches. Darwin concluded that the finches all shared a common ancestor but had developed different beak structures.

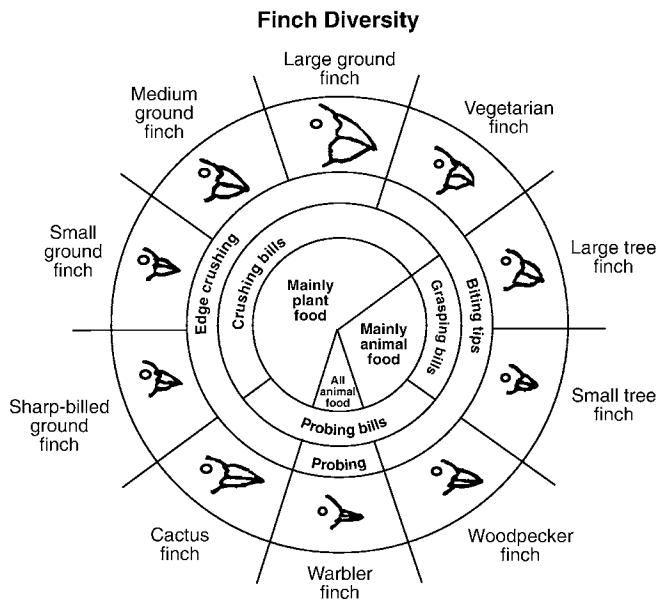
7. The 14 varieties of finches are most likely the result of

- (1) absence of biodiversity
- (2) biological evolution
- (3) asexual reproduction
- (4) lack of competition

8. The different beak structures mentioned in the last sentence were most likely influenced by

- (1) selection for favorable variations
- (2) environmental conditions identical to those of the common ancestor
- (3) abnormal mitotic cell division
- (4) characteristics that are acquired during the bird's lifetime

9. The diagram below shows variations in beak sizes and shapes for several birds on the Galapagos Islands.



Using information provided in the chart, identify two birds that would most likely compete for food in times of food shortage and explain why they would compete. [2]

10. Which factor contributed most to the extinction of many species?

- (1) changes in the environment
- (2) lethal mutations
- (3) inability to evolve into simple organisms
- (4) changes in migration patterns

11. A new chemical was discovered and introduced into a culture containing one species of bacteria. Within a day, most of the bacteria were dead, but a few remained alive. Which statement best explains why some of the bacteria survived?

- (1) They had a genetic variation that gave them resistance to the chemical.
- (2) They were exposed to the chemical long enough to develop a resistance to it.
- (3) They mutated and became a different species after exposure to the chemical.
- (4) They absorbed the chemical and broke it down in their digestive systems.

12. In members of a bird species living on a remote island, the greatest number of beak variations in the population would most likely be found when

- (1) there is a high level of competition for limited resources
- (2) homeostasis is limited by a severe climate
- (3) they have a large and varied food supply
- (4) they are prey for a large number of predators

13. Galapagos finches evolved partly due to

- (1) cloning and recombination
- (2) migration and selective breeding
- (3) mutation and asexual reproduction
- (4) variation and competition

14. Beak structures differ between individuals of one species of bird. These differences most likely indicate

- (1) the presence of a variety of food sources
- (2) a reduced rate of reproduction
- (3) a large supply of one kind of food
- (4) an abundance of predators

15. Which statement is most closely related to the modern theory of evolution?

- (1) Characteristics that are acquired during life are passed to offspring by sexual reproduction.
- (2) Evolution is the result of mutations and recombination, only.
- (3) Organisms best adapted to a changed environment are more likely to reproduce and pass their genes to offspring.
- (4) Asexual reproduction increases the survival of species.

Base your answers to questions 16 and 17 on the information below and on your knowledge of biology.

In birds, the ability to crush and eat seeds is related to the size, shape, and thickness of the beak. Birds with larger, thicker beaks are better adapted to crush and open seeds that are larger.

One species of bird found in the Galapagos Islands is the medium ground finch. It is easier for most of the medium ground finches to pick up and crack open smaller seeds rather than larger seeds. When food is scarce, some of the birds have been observed eating larger seeds.

16. Describe one change in beak characteristics that would most likely occur in the medium ground finch population after many generations when an environmental change results in a permanent shortage of small seeds.

[1]

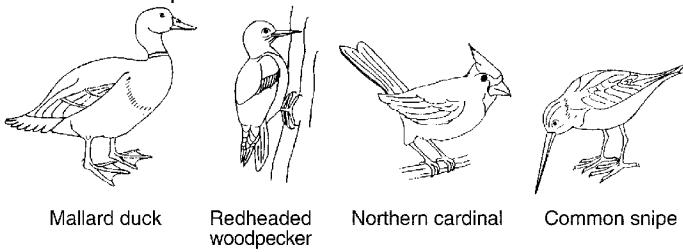
17. Explain this long-term change in beak characteristics using the concepts of:

- competition [1]
- survival of the fittest [1]
- inheritance [1]

18. A certain species has little genetic variation. The rapid extinction of this species would most likely result from the effect of

- (1) successful cloning
- (3) environmental change
- (2) gene manipulation
- (4) genetic recombination

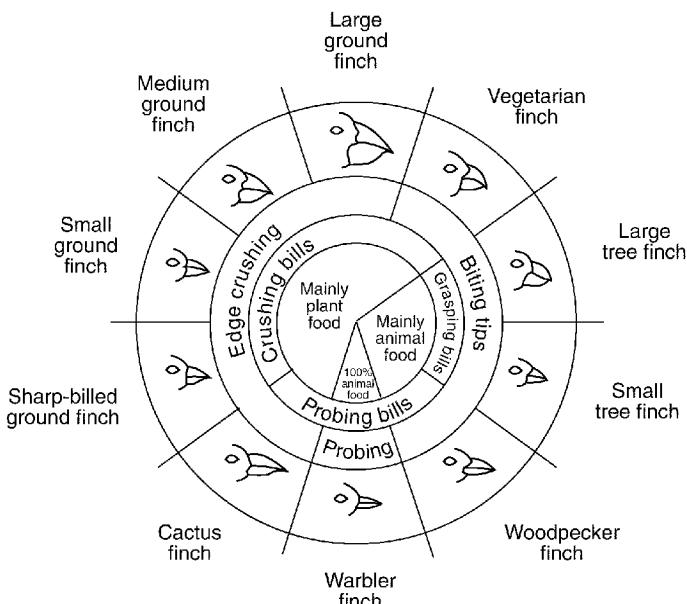
19. The diagram below represents four different species of wild birds. Each species has feet with different structural adaptations.



The development of these adaptations can best be explained by the concept of

- (1) inheritance of resistance to diseases that affect all these species
- (2) inheritance of characteristics acquired after the birds hatched from the egg
- (3) natural selection
- (4) selective breeding

20. The cactus finch, warbler finch, and woodpecker finch all live on one island. Based on the information in the diagram below, which one of these finches is least likely to compete with the other two for food? Support your answer with an explanation. [1]



21. Woolly mammoths became extinct thousands of years ago, while other species of mammals that existed at that time still exist today. These other species of mammals most likely exist today because, unlike the mammoths, they

- (1) produced offspring that all had identical inheritable characteristics
- (2) did not face a struggle for survival
- (3) learned to migrate to new environments
- (4) had certain inheritable traits that enabled them to survive

Base your answers to questions 22 through 24 on the information below and on your knowledge of biology.

In the Beaks of Finches laboratory activity, students were each assigned a tool to use to pick up seeds. In round one, students acting as birds used their assigned tools to pick up small seeds from their own large dishes (the environment) and place them in smaller dishes (their stomachs). The seeds collected by each student were counted. Some students were able to collect many seeds, while others collected just a few.

In round two, students again used their assigned tools to collect seeds. This time several students were picking up seeds from the same dish of seeds.

22. Explain how this laboratory activity illustrates the process of natural selection. [1]

23. One factor that influences the evolution of a species that was not part of this laboratory activity is

- (1) struggle for survival (3) competition
- (2) variation (4) overproduction

24. Identify one trait, other than beak characteristics, that could contribute to the ability of a finch to feed successfully. [1]

Base your answer to question 1 on the information below and on your knowledge of biology.

Mutations are often referred to as the "raw materials" of evolution.

1. State one reason that mutations are often referred to as the "raw materials" of evolution. [1]
-
-
-
-

2. A mutation occurs in the liver cells of a certain field mouse. Which statement concerning the spread of this mutation through the mouse population is correct?

- (1) It will spread because it is beneficial.
- (2) It will spread because it is a dominant gene.
- (3) It will not spread because it is not in a gamete.
- (4) It will not spread because it is a recessive gene.

3. Which factor is least likely to contribute to an increase in the rate of evolution?

- (1) presence of genetic variations in a population
- (2) environmental selection of organisms best adapted to survive
- (3) chromosomal recombinations
- (4) a long period of environmental stability

4. Thousands of years ago, giraffes with short necks were common within giraffe populations. Nearly all giraffe populations today have long necks. This difference could be due to

- (1) giraffes stretching their necks to keep their heads out of reach of predators
- (2) giraffes stretching their necks so they could reach food higher in the trees
- (3) a mutation in genetic material controlling neck size occurring in some skin cells of a giraffe
- (4) a mutation in genetic material controlling neck size occurring in the reproductive cells of a giraffe

5. Which two processes result in variations that commonly influence the evolution of sexually reproducing species?

- (1) mutation and genetic recombination
- (2) mitosis and natural selection
- (3) extinction and gene replacement
- (4) environmental selection and selective breeding

6. A child has brown hair and brown eyes. His father has brown hair and blue eyes. His mother has red hair and brown eyes. The best explanation for the child having brown hair and brown eyes is that

- (1) a gene mutation occurred that resulted in brown hair and brown eyes
- (2) gene expression must change in each generation so evolution can occur
- (3) the child received genetic information from each parent
- (4) cells from his mother's eyes were present in the fertilized egg

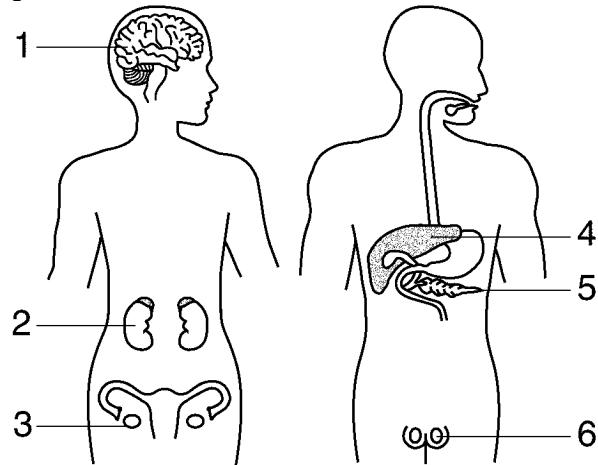
7. Mutations that occur in skin or lung cells have little effect on the evolution of a species because mutations in these cells

- (1) usually lead to the death of the organism
- (2) cannot be passed on to offspring
- (3) are usually beneficial to the organism
- (4) lead to more serious mutations in offspring

8. Mutations that occur in skin or lung cells have little effect on the evolution of a species because mutations in these cells

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- (2) cannot be passed on to offspring
- (3) are usually beneficial to the organism
- (4) lead to more serious mutations in offspring

9. Some human body structures are represented in the diagram below.



In which structures would the occurrence of mutations have the greatest effect on human evolution?

- (1) 1 and 3
- (2) 2 and 5
- (3) 3 and 6
- (4) 4 and 6

10. Variation in the offspring of sexually reproducing organisms is the direct result of

- (1) sorting and recombining of genes
- (2) replication and cloning
- (3) the need to adapt and maintain homeostasis
- (4) overproduction of offspring and competition

11. In a group of mushrooms exposed to a poisonous chemical, only a few of the mushrooms survived. The best explanation for the resistance of the surviving mushrooms is that the resistance

- (1) was transmitted to the mushrooms from the poisonous chemical
- (2) resulted from the presence of mutations in the mushrooms
- (3) was transferred through the food web to the mushrooms
- (4) developed in response to the poisonous chemical

12. A mutation changes a gene in a cell in the stomach of an organism. This mutation could cause a change in

- (1) both the organism and its offspring
- (2) the organism, but not its offspring
- (3) its offspring, but not the organism itself
- (4) neither the organism nor its offspring

13. A basketball player develops speed and power as a result of practice. This athletic ability will not be passed on to her offspring because

- (1) muscle cells do not carry genetic information
- (2) mutations that occur in body cells are not inherited
- (3) gametes do not carry complete sets of genetic information
- (4) base sequences in DNA are not affected by this activity

1. The presence of some similar structures in all vertebrates suggests that these vertebrates

- (1) all develop at the same rate
- (2) evolved from different animals that appeared on Earth at the same time
- (3) all develop internally and rely on nutrients supplied by the mother
- (4) may have an evolutionary relationship

Base your answers to questions 2 through 4 on the information below and on your knowledge of biology.

Sickle-cell anemia is an inherited disease that occurs mainly in people from parts of Africa where malaria is common. It is caused by a gene mutation that may be harmful or beneficial.

A person with two mutant genes has sickle-cell disease. The hemoglobin of a person with sickle-cell disease twists red blood cells into a crescent shape. These blood cells cannot circulate normally. Symptoms of the disease include bleeding and pain in bones and muscles. People with sickle-cell disease suffer terribly in childhood and, until modern medicine offered treatment, most of them died before reproducing. An individual who has one mutant gene is protected from malaria because the gene changes the hemoglobin structure in a way that speeds removal of malaria-infected cells from circulation. A person with two normal genes has perfectly good red blood cells, but lacks resistance to malaria.

2. Define the term mutation. [1]

3. Which statement about having one sickle-cell gene is correct?

- (1) It is fatal to anyone who inherits the gene.
- (2) It is beneficial to anyone who inherits the gene.
- (3) It is beneficial in certain environments.
- (4) It is beneficial or harmful depending on whether it is common or rare.

4. Explain why the percentage of the population with one mutant sickle-cell gene is higher in areas where malaria is common. [1]

Base your answers to questions 5 and 6 on the information below and on your knowledge of biology.

Evolutionary changes have been observed in beak size in a population of medium ground finches in the Galapagos Islands. Given a choice of small and large seeds, the medium ground finch eats mostly small seeds, which are easier to crush. However, during dry years, all seeds are in short supply. Small seeds are quickly consumed, so the birds are left with a diet of large seeds. Studies have shown that this change in diet may be related to an increase in the average size of the beak of the medium ground finch.

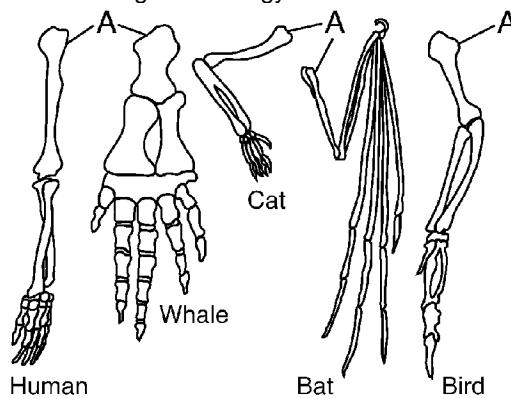
5. The most likely explanation for the increase in average beak size of the medium ground finch is that the

- (1) trait is inherited and birds with larger beaks have greater reproductive success
- (2) birds acquired larger beaks due to the added exercise of feeding on large seeds
- (3) birds interbred with a larger-beaked species and passed on the trait
- (4) lack of small seeds caused a mutation which resulted in a larger beak

6. In exceptionally dry years, what most likely happens in a population of medium ground finches?

- (1) There is increased cooperation between the birds.
- (2) Birds with large beaks prey on birds with small beaks.
- (3) The finches develop parasitic relationships with mammals.
- (4) There is increased competition for a limited number of small seeds.

Base your answer to question 7 on the diagram below and on your knowledge of biology.



7. The similarities of the bones labeled A provide evidence that

- (1) the organisms may have evolved from a common ancestor
- (2) all species have one kind of bone structure
- (3) the cells of the bones contain the same type of mutations
- (4) all structural characteristics are the same in animals

8. The teeth of carnivores are pointed and are good for puncturing and ripping flesh. The teeth of herbivores are flat and are good for grinding and chewing. Which statement best explains these observations?

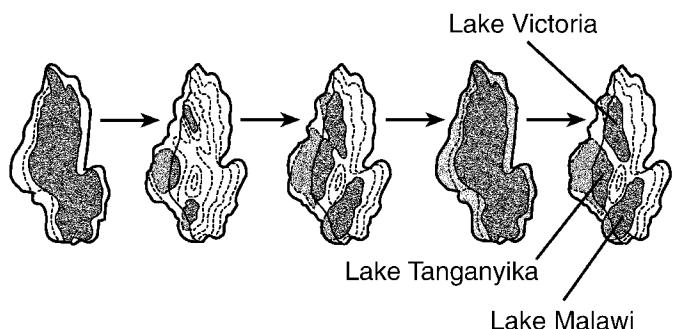
- (1) Herbivores have evolved from carnivores.
- (2) Carnivores have evolved from herbivores.
- (3) The two types of teeth most likely evolved as a result of natural selection.
- (4) The two types of teeth most likely evolved as a result of the needs of an organism.

9. In 1993, there were only 30 panthers in Florida. They were all closely related and many had reproductive problems. To avoid extinction and restore health to the population, biologists introduced 8 female panthers from Texas. Today, there are more than 80 panthers in Florida and most individuals have healthy reproductive systems. The success of this program was most likely due to the fact that the introduced females

- (1) produced more reproductive cells than the male panthers in Texas
- (2) solved the reproductive problems of the species by asexual methods
- (3) increased the genetic variability of the panther population in Florida
- (4) mated only with panthers from Texas

Base your answers to questions 1 through 3 on the information below and on your knowledge of biology.

Variations in Lake Water Level



Past → Present

The three great lakes in Africa (Victoria, Tanganyika, and Malawi) contain a greater number of fish species than any other lakes in the world. Lake Malawi alone has 200 species of cichlid fish. The diversity of cichlid species in these African lakes could have been caused by changes in water level over thousands of years.

According to one hypothesis, at one time the three lakes were connected as one large lake and all the cichlids could interbreed. When the water level fell, groups of cichlids were isolated in smaller lakes as shown in the diagram. Over time, the groups of cichlids developed genetic differences. When the water levels rose again, the isolated populations were brought back into contact. Due to significant genetic differences, these populations were unable to interbreed. Variations in water level over thousands of years resulted in today's diversity of cichlid species.

1. Which discovery would support this explanation of cichlid diversity?

- The water level changed little over time.
- The local conditions in each of the small lakes were very different.
- Differences between cichlid species are small and interbreeding is possible.
- Once formed, the lakes remained isolated from each other.

2. As the water level of the lakes changed, many species of cichlids survived while others became extinct. State why some species survived while others became extinct. [1]

3. Each cichlid population is genetically different from the other cichlid populations. State one reason for these genetic differences. [1]

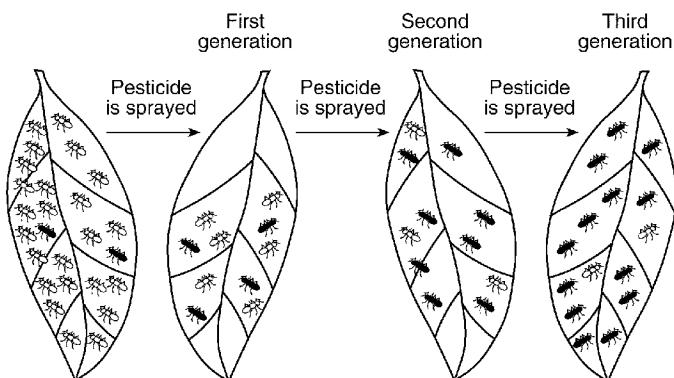
4. Which statement describing a cause of extinction includes the other three?

- Members of the extinct species were unable to compete for food.
- Members of the extinct species were unable to conceal their presence by camouflage.
- Members of the extinct species lacked adaptations essential for survival.
- Members of the extinct species were too slow to escape from predators.

5. Scientists compared fossil remains of a species that lived 5,000 years ago with members of the same species living today. Scientists concluded that this species had changed very little over the entire time period. Which statement best accounts for this lack of change?

- The environment changed significantly and those offspring without favorable characteristics died.
- The environment changed significantly, but the species had no natural enemies for a long period of time.
- The environment did not change significantly and those offspring expressing new characteristics survived their natural enemies.
- The environment did not change significantly and those offspring expressing new characteristics did not survive.

6. The diagram below shows the effect of spraying a pesticide on a population of insects over three generations.



Which concept is represented in the diagram?

- survival of the fittest
- dynamic equilibrium
- succession
- extinction

7. A certain plant species, found only in one particular stream valley in the world, has a very shallow root system. An earthquake causes the stream to change its course so that the valley in which the plant species lives becomes very dry. As a result, the species dies out completely. The effect of this change on this plant species is known as

8. Extinction of a species could result from

- (1) evolution of a type of behavior that produces greater reproductive success
 - (2) synthesis of a hormone that controls cellular communication
 - (3) limited genetic variability in the species
 - (4) fewer unfavorable mutations in the species

9. An insect pest known as the medfly significantly reduced the orange crop in California.

Pesticides were used to control the medfly. Using the concept of natural selection, explain how the continued use of a certain pesticide may become ineffective in controlling this fly. Your answer must include the concepts of:

- variation [1]
 - adaptive value of a variation (adaptation) [1]
 - survival [1]
 - reproduction [1]

1. What impact do the amounts of available energy, water, and oxygen have on an ecosystem?
- (1) They act as limiting factors.
 - (2) They are used as nutrients.
 - (3) They recycle the residue of dead organisms.
 - (4) They control environmental temperature.
2. Ten breeding pairs of rabbits are introduced onto an island with no natural predators and a good supply of water and food. What will most likely happen to the rabbit population?
- (1) It will remain relatively constant due to equal birth and death rates.
 - (2) It will die out due to an increase in the mutation rate.
 - (3) It will increase until it exceeds carrying capacity.
 - (4) It will decrease and then increase indefinitely.
3. Even though the finches on the various Galapagos Islands require different biotic and abiotic factors for their survival, these finches would most likely be grouped in the same
- (1) species, but found in different habitats
 - (2) kingdom, but found in different ecological niches
 - (3) species and found in the same biosphere
 - (4) population, but found in different ecosystems

Base your answers to questions 4 through 7 on the information and data table below and on your knowledge of biology.

A student grew two separate cultures of single-celled organisms. One culture contained *Paramecium caudatum* and the other contained *Paramecium aurelia*. The cultures were grown under the same conditions and the number of paramecia (per drop) in each culture was estimated every 2 days for a period of 16 days. The results are shown in data table 1 below.

Data Table 1: Growth of *Paramecium aurelia* and *Paramecium caudatum* in Individual Cultures

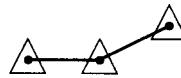
Days	Number of <i>Paramecium caudatum</i> (per drop)	Number of <i>Paramecium aurelia</i> (per drop)
0	4	4
2	10	10
4	30	46
6	48	66
8	58	70
10	62	69
12	60	71
14	61	71
16	60	71

Directions (4–5): Using the information in the data table, construct a line graph on the grid provided in the next column, following the directions below.

4. Mark a scale on each labeled axis appropriate for the data for *Paramecium caudatum* that has already been plotted on the grid. [1]

5. Plot the data for *Paramecium aurelia* on the grid. Surround each point with a small triangle and connect the points. [1]

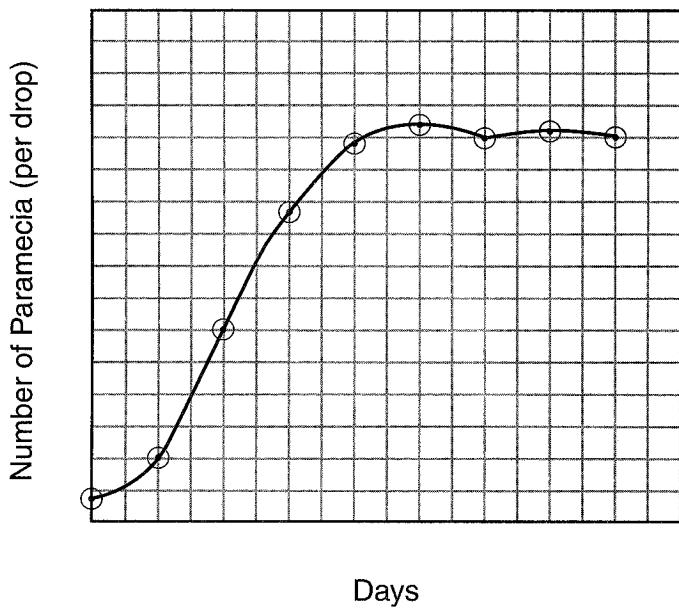
Example:



Key:

- = *Paramecium caudatum*
- ▲ = *Paramecium aurelia*

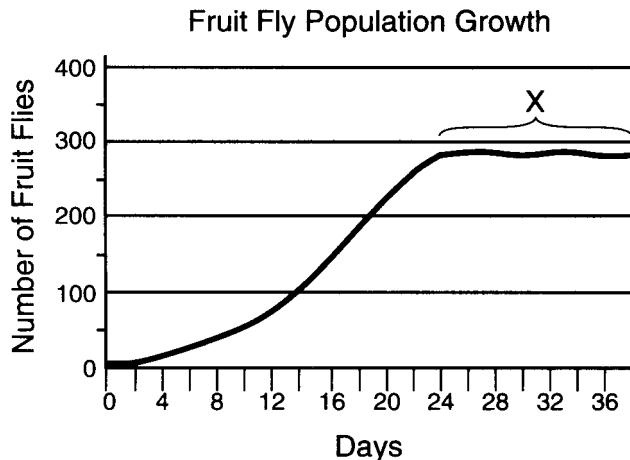
Growth of *Paramecium aurelia* and *Paramecium caudatum* in Individual Cultures



6. Describe the change in the two populations between days 0 and 8. [1]
-
-
-

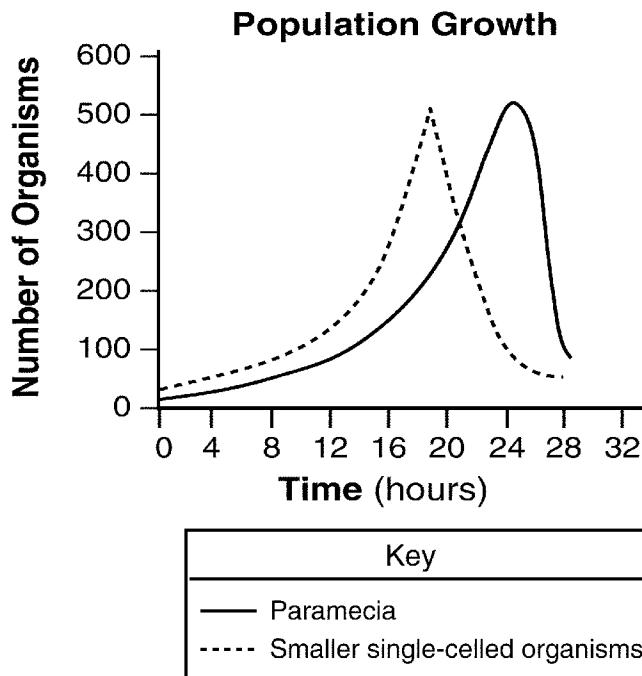
7. State one possible reason for the difference in the rates of change in the two populations of paramecia between days 0 and 8. [1]
-
-
-

8. Which statement best describes the fruit fly population in the part of the curve labeled X in the graph shown below?

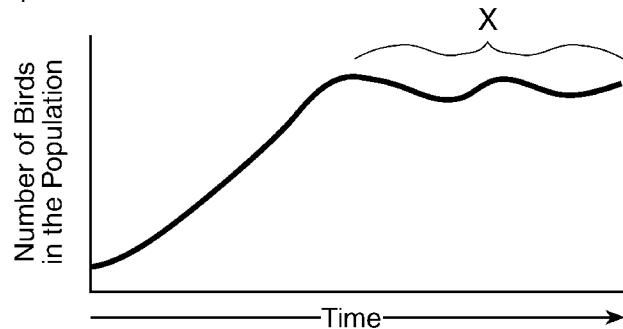


Base your answers to questions 11 and 12 on the information and graph below and on your knowledge of biology.

A population of paramecia (single-celled aquatic organisms) was grown in a 200-mL beaker of water containing some smaller single-celled organisms. Population growth of the organisms for 28 hours is shown in the graph below.



9. The graph below shows the number of birds in a population.



Which statement best explains section X of the graph?

- (1) Interbreeding between members of this population increased the mutation rate.
- (2) An increase in the bird population caused an increase in the producer population.
- (3) The population reached a state of dynamic equilibrium due to limiting factors.
- (4) Another species came to the area and provided food for the birds.

10. Four environmental factors are listed below.

- A. energy
- B. water
- C. oxygen
- D. minerals

Which factors limit environmental carrying capacity in a land ecosystem?

- (1) A, only
- (2) B, C, and D, only
- (3) A, C, and D, only
- (4) A, B, C, and D

11. Which factor most likely accounts for the change in the paramecium population from 8 to 20 hours?

- (1) an increase in the nitrogen content of water
- (2) an increase in wastes produced
- (3) an increase in available food
- (4) an increase in water pH

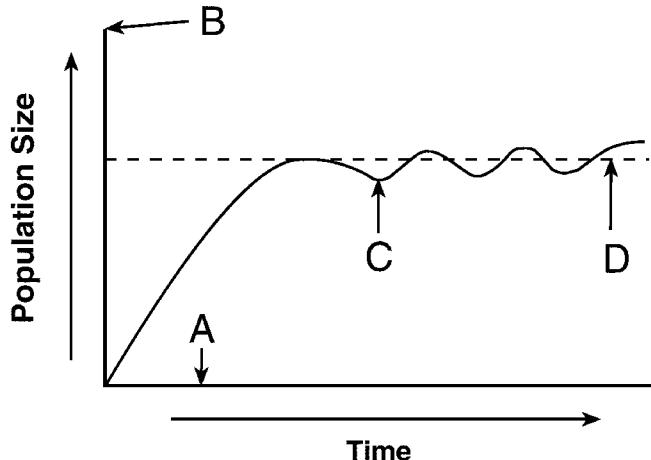
12. One likely explanation for the change in the paramecium population from 26 hours to 28 hours is that the

- (1) carrying capacity of the beaker was exceeded
- (2) rate of reproduction increased
- (3) time allowed for growth was not sufficient
- (4) oxygen level was too high

13. In an ocean, the growth and survival of seaweed, small fish, and sharks depends on abiotic factors such as

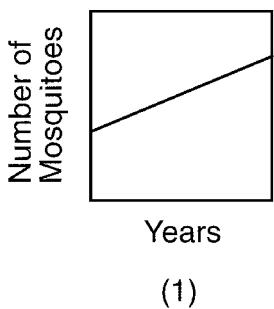
- (1) sunlight, temperature, and minerals
- (2) sunlight, pH, and type of seaweed
- (3) number of decomposers, carbon dioxide, and nitrogen
- (4) number of herbivores, carbon, and food

14. The growth of a population is shown in the graph below.

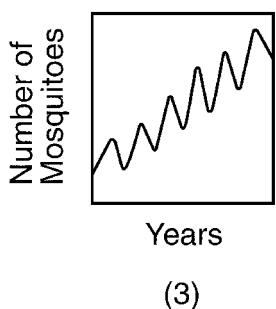


Which letter indicates the carrying capacity of the environment for this population?

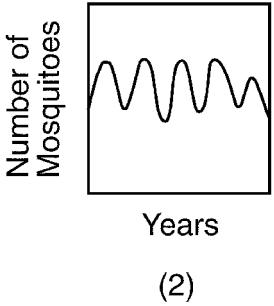
15. Which graph illustrates changes that indicate a state of dynamic equilibrium in a mosquito population?



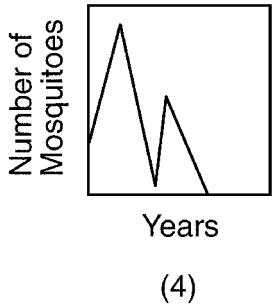
(1)



(3)

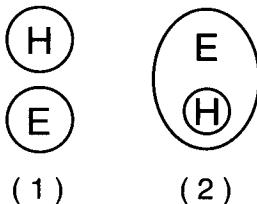


Years



(4)

16. Which diagram best illustrates the relationship between humans (H) and ecosystems (E)?



(1)

(2)

(3)

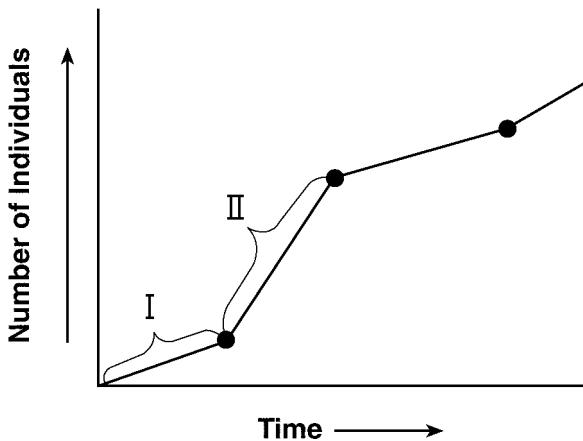
(4)

17. The reason that organisms can not produce populations of unlimited size is that

- (1) the resources of Earth are finite
 - (2) there is no carrying capacity on Earth
 - (3) species rarely compete with one another
 - (4) interactions between organisms are unchanging

18. The graph below shows the growth of a population of bacteria over a period of 80 hours.

Growth of a Population of Bacteria



Which statement best describes section II of the graph?

- (1) The population has reached the carrying capacity of the environment.
 - (2) The rate of reproduction is slower than in section I.
 - (3) The population is greater than the carrying capacity of the environment.
 - (4) The rate of reproduction exceeds the death rate.

19. Information concerning nests built in the same tree by two different bird species over a ten-year period is shown in the table below.

Distance of Nest Above Ground (m)	Total Number of Nests Built by Two Different Species	
	A	B
less than 1	5	0
1–5	10	0
6–10	5	0
over 10	0	20

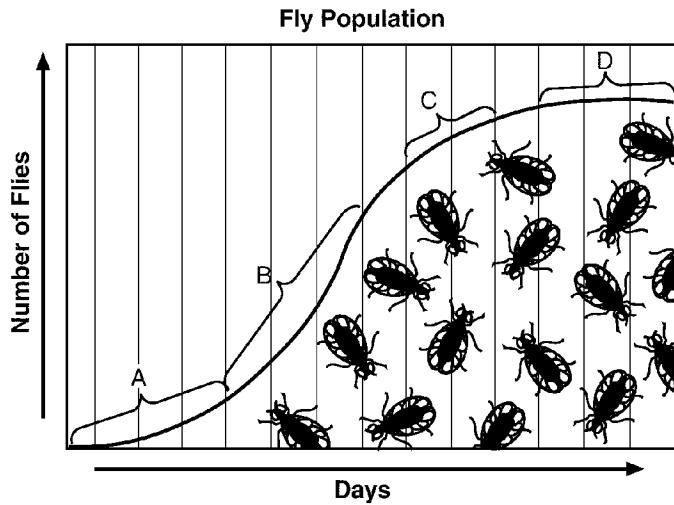
What inference best describes these two bird species?

- (1) They most likely do not compete for nesting sites because they occupy different niches.
 - (2) They do not compete for nesting sites because they have the same reproductive behavior.
 - (3) They compete for nesting sites because they build the same type of nest.
 - (4) They compete for nesting sites because they nest in the same tree at the same time.

20. After a rabbit population reaches the carrying capacity of its habitat, the population of rabbits will most likely

- (1) decrease, only
- (2) increase, only
- (3) alternately increase and decrease
- (4) remain unchanged

21. The graph below represents the growth of a population of flies in a jar.



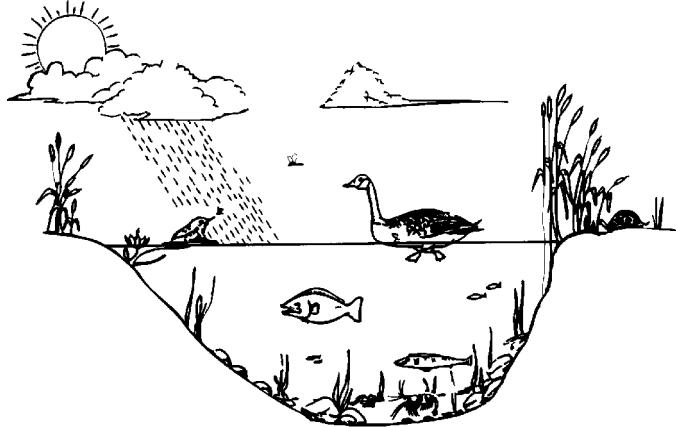
Which letter indicates the part of the graph that represents the carrying capacity of the environment in the jar?

- (1) A
- (2) B
- (3) C
- (4) D

22. Which statement describes a situation that leads to stability within an ecosystem?

- (1) Carbon dioxide and water are released only by abiotic sources in the ecosystem.
- (2) Interactions between biotic and abiotic components regulate carbon dioxide and water levels.
- (3) Animals provide the oxygen used by plants, and plants provide the nitrogen needed by animals.
- (4) Organisms provide all the necessary energy for the maintenance of this ecosystem.

Base your answers to questions 1 through 4 on the lake ecosystem represented below and on your knowledge of biology.



1. Identify one organism represented in the diagram that provides the vital link for the transfer of energy from the Sun to the other organisms in the ecosystem. [1]
-
-

2. Identify one predator/prey relationship that may occur in this ecosystem. [1]

Predator: _____ Prey: _____

3. State one piece of evidence from the diagram that indicates that light penetrates to the bottom of the lake. [1]
-
-

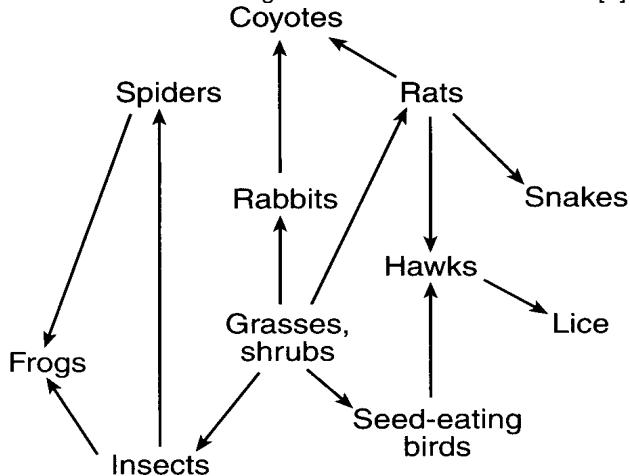
4. Identify the type of organism that is not visible in the diagram but must be present in this ecosystem to recycle the remains of dead organisms. [1]
-

5. Which information concerning a desert is provided by the quotation below?

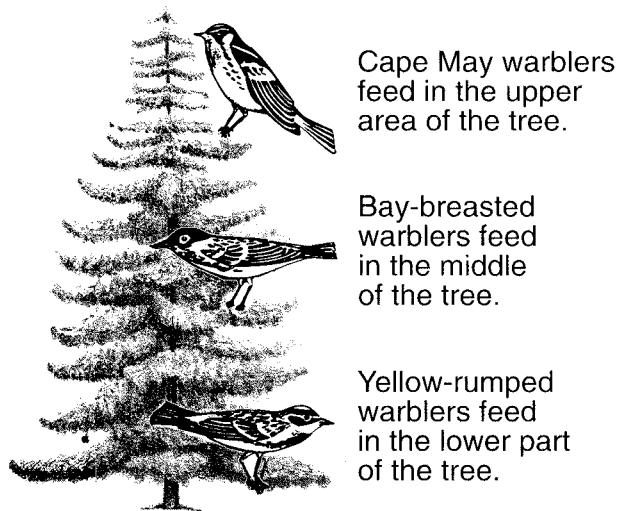
"The desert is arid, with less than 25 cm of rain per year. The plants are spaced far apart, or are grouped around water sources. Most of the animals are active at night."

- (1) daily temperature range and types of autotrophs
- (2) time of rainy season and type of food used by heterotrophs
- (3) identity of a limiting factor and behavior of heterotrophs
- (4) type of nutrition in animals and distribution of autotrophs

6. The diagram below represents a food web. The arrows only point away from "Grasses, shrubs" and not toward them. State one biological reason that this is so. [1]



7. The ecological niches of three bird species are shown in the diagram below.



What is the advantage of each bird species having a different niche?

- (1) As the birds feed higher in the tree, available energy increases.
- (2) More abiotic resources are available for each bird.
- (3) Predators are less likely to feed on birds in a variety of locations.
- (4) There is less competition for food.

8. Two closely related species of birds live in the same tree. Species A feeds on ants and termites, while species B feeds on caterpillars. The two species coexist successfully because

- (1) each occupies a different niche
- (2) they interbreed
- (3) they use different methods of reproduction
- (4) birds compete for food

Base your answers to questions 9 through 11 on the information and table below and on your knowledge of biology.

The variety of organisms known as plankton contributes to the unique nutritional relationships in an ocean ecosystem. Phytoplankton include algae and other floating organisms that perform photosynthesis. Plankton that cannot produce food are known as zooplankton. Some nutritional relationships involving these organisms and several others are shown in the table below.

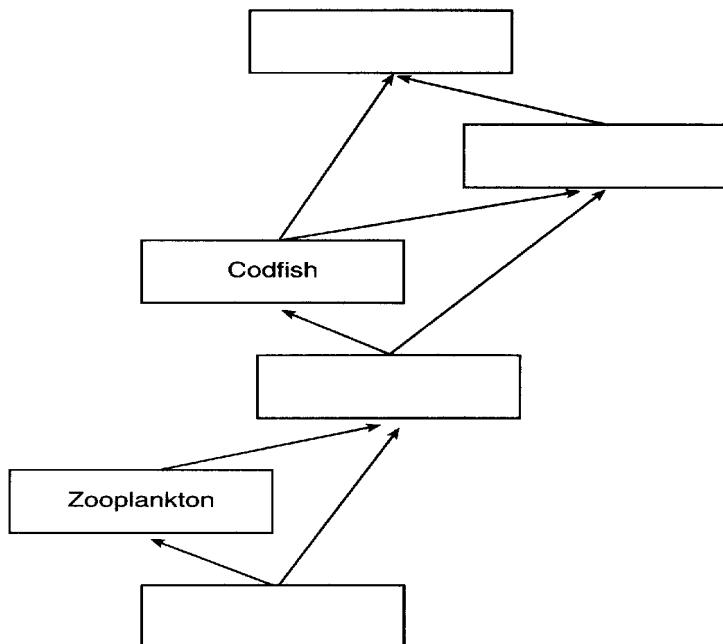
Nutritional Relationships in a North Atlantic Ocean Community

Animals in Community	Food Eaten by Animals in Community				
	Codfish	Phytoplankton	Small Fish	Squid	Zooplankton
codfish			X		
sharks	X			X	
small fish		X			X
squid	X		X		
zooplankton		X			

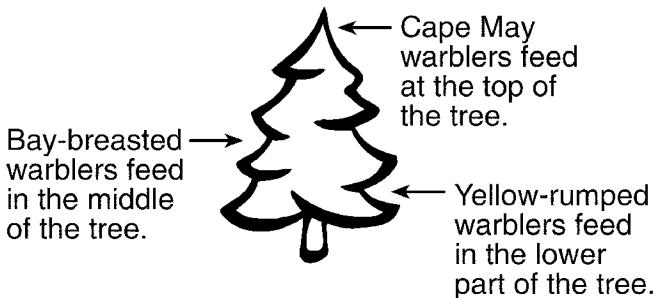
9. Humans are currently overfishing codfish in the North Atlantic. Explain why this could endanger both the shark population and the squid population in this community. [1]

10. According to the table, which organism can be classified as both an herbivore and a carnivore? [1]

11. Complete the food web below by placing the names of the organisms in the correct locations. [1]



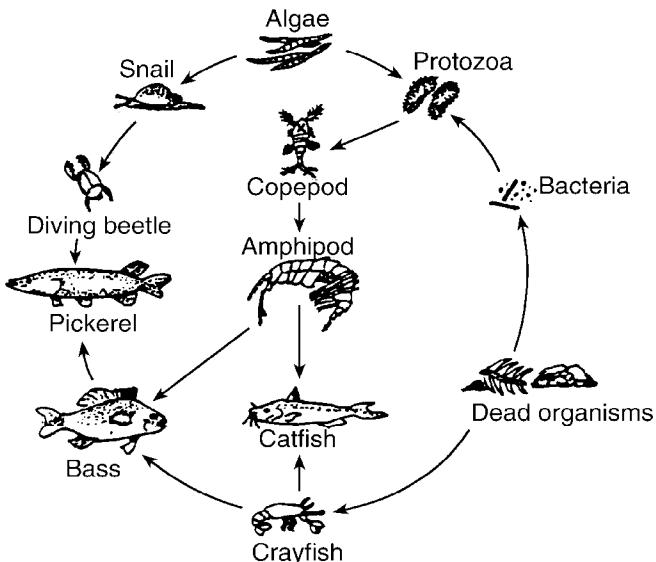
12. The feeding niches of three bird species are shown in the diagram below.



What is the advantage of these different feeding niches for the birds?

- (1) less competition for food
- (2) fewer abiotic resources for each bird species
- (3) fewer biotic resources for each bird species
- (4) less energy available as the birds feed higher in the tree

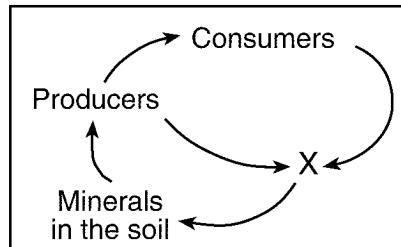
13. A food web is shown below.



Which organisms feed on both producers and decomposers?

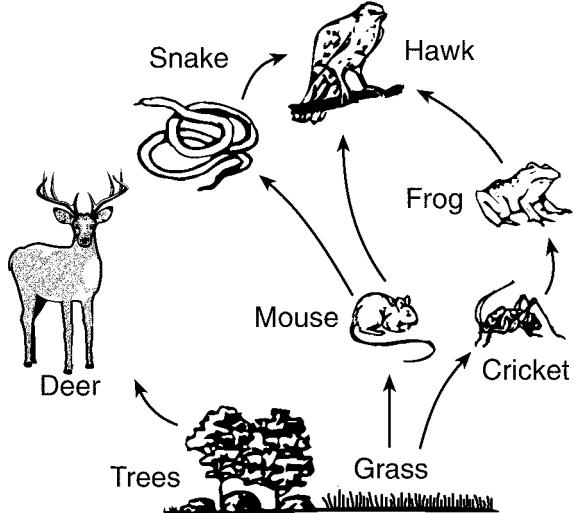
- (1) amphipods
- (2) catfish
- (3) crayfish
- (4) protozoa

14. In the diagram below, what does X most likely represent?



- (1) autotrophs
- (2) herbivores
- (3) decomposers
- (4) carnivores

15. Nutritional relationships between organisms are shown in the diagram below.



The mouse population would most likely decrease if there were

- (1) an increase in the frog and tree populations
- (2) a decrease in the snake and hawk populations
- (3) an increase in the number of decomposers in the area
- (4) a decrease in the amount of available sunlight

16. Even before a flower bud opens, certain plant chemicals have colored the flower in patterns particularly attractive to specific insects. At the same time, these chemicals protect the plant's reproductive structures by killing or inhibiting pathogens and insects that may feed on the plant. Which statement about the plant and the other organisms mentioned is correct?

- (1) Chemicals affect plants but not animals.
- (2) Organisms of every niche may be preyed on by herbivores.
- (3) Any chemical produced in a plant can protect against insects.
- (4) Organisms may interact with other organisms in both positive and negative ways.

Base your answer to question 17 on the information below and on your knowledge of biology.

Lichens are composed of two organisms, a fungus that cannot make its own food and algae that contain chlorophyll. Lichens may live on the bark of trees or even on bare rock. They secrete acids that tend to break up the rock they live on, helping to produce soil. As soil accumulates from the broken rock and dead lichens, other organisms, such as plants, may begin to grow.

17. What is the role of the algae component of a lichen in an ecosystem?

- (1) decomposer
- (2) parasite
- (3) herbivore
- (4) producer

Base your answer to question 18 on the information below and on your knowledge of biology.

Analysis of a sample taken from a pond showed variety in both number and type of organisms present. The data collected are shown in the table below.

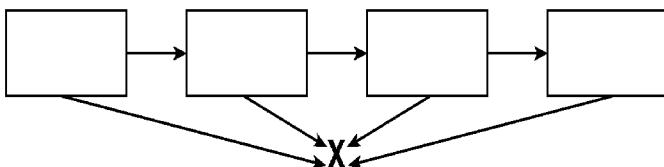
Data Table

Type of Organisms	Number Present
bass	two
frogs	forty
phytoplankton	thousands
insect larvae	hundreds

18. If the frogs feed on insect larvae, what is the role of the frogs in this pond ecosystem?

- (1) herbivore
- (2) parasite
- (3) consumer
- (4) host

19. The diagram below represents some energy transfers in an ecosystem.



Which type of organism is most likely represented by letter X?

- (1) decomposer
- (2) autotroph
- (3) producer
- (4) herbivore

20. The removal of nearly all the predators from an ecosystem would most likely result in

- (1) an increase in the number of carnivore species
- (2) a decrease in new predators migrating into the ecosystem
- (3) a decrease in the size of decomposers
- (4) an increase in the number of herbivores

Base your answer to question 21 on the passage below and on your knowledge of biology.

When Charles Darwin traveled to the Galapagos Islands, he observed 14 distinct varieties of finches on the islands. Darwin also observed that each finch variety ate a different type of food and lived in a slightly different habitat from the other finches. Darwin concluded that the finches all shared a common ancestor but had developed different beak structures.

21. The second sentence best describes

- (1) an ecosystem
- (2) a food web
- (3) a niche
- (4) a predator/prey relationship

Base your answers to questions 22 through 24 on the passage below which describes an ecosystem in New York State and on your knowledge of biology.

The Pine Bush ecosystem near Albany, New York, is one of the last known habitats of the nearly extinct Karner Blue butterfly. The butterfly's larvae feed on the wild green plant, lupine. The larvae are in turn consumed by predatory wasps. The four groups below represent other organisms living in this ecosystem.

Group A	Group B	Group C	Group D
algae	rabbits	hawks	soil bacteria
mosses	tent caterpillars	moles	molds
ferns	moths	hognosed snakes	mushrooms
pine trees		toads	
oak trees			

25. A scientist studied iguanas inhabiting a chain of small ocean islands. He discovered two species that live in different habitats and display different behaviors. His observations are listed in the table below.

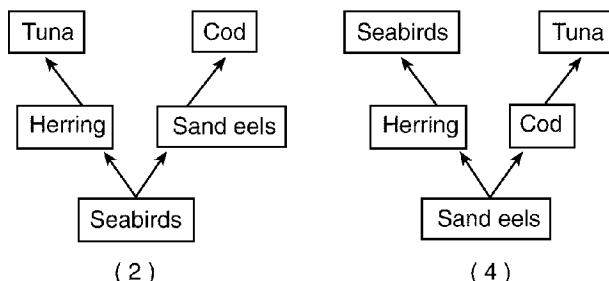
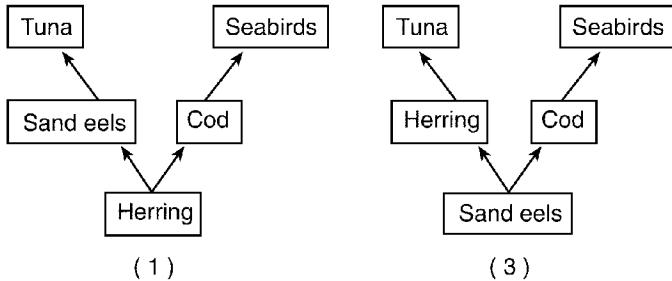
Observations of Two Species of Iguanas

Species A	Species B
spends most of its time in the ocean	spends most of its time on land
is rarely found more than 10 meters from shore	is found many meters inland from shore
eats algae	eats cactus and other land plants

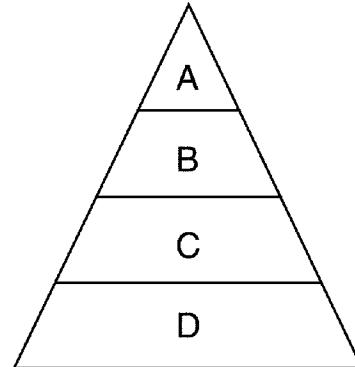
Which statement best describes these two species of iguanas?

- (1) Both species evolved through the process of ecological succession.
 - (2) Each species occupies a different niche.
 - (3) The two species can interbreed.
 - (4) Species A is a scavenger and species B is a carnivore.

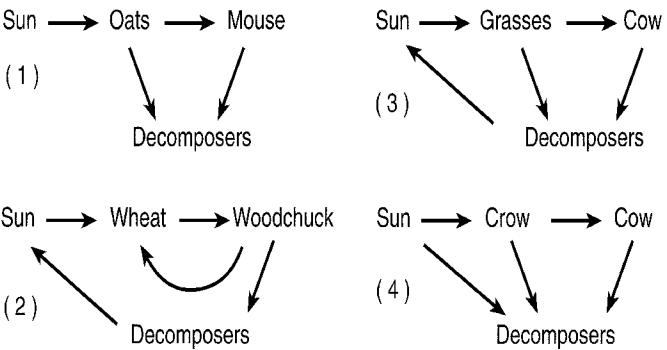
26. In an ecosystem, the herring population was reduced by fishermen. As a result, the tuna, which feed on the herring, disappeared. The sand eels, which are eaten by herring, increased in number. The fishermen then overharvested the sand eel population. Cod and seabirds then decreased. Which food web best represents the feeding relationships in this ecosystem?



27. Which level of the energy pyramid below would contain the plant species of this salt marsh?



28. Four students each drew an illustration to show the flow of energy in a field ecosystem. Which illustration is most accurate?



29. Many species of plants interact with harmless underground fungi. The fungi enable the plants to absorb certain essential minerals and the plants provide the fungi with carbohydrates and other nutrients. This describes an interaction between a

- (1) parasite and its host
- (2) predator and its prey
- (3) scavenger and a decomposer
- (4) producer and a consumer

30. Two food chains are represented below.

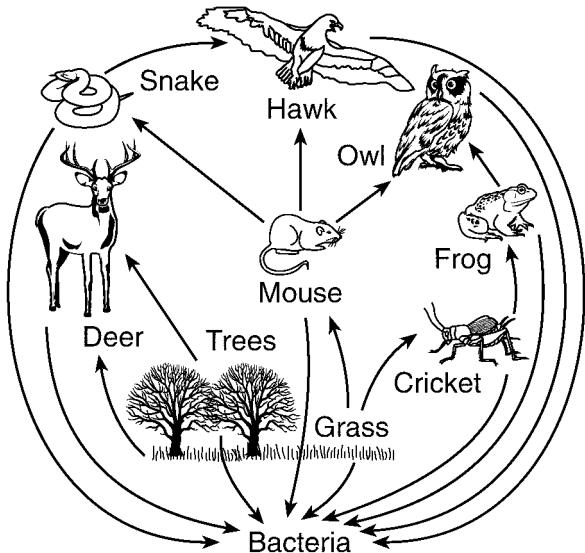
Food chain A: aquaticplant → insect → frog → hawk

Food chain B: grass → rabbit → hawk

Decomposers are important for supplying energy for

- (1) food chain A, only
- (2) food chain B, only
- (3) both food chain A and food chain B
- (4) neither food chain A nor food chain B

Base your answers to questions 31 through 33 on the diagram below and on your knowledge of biology.



31. What is an appropriate title for this diagram?

- (1) Energy Flow in a Community
- (2) Ecological Succession
- (3) Biological Evolution
- (4) A Food Chain

32. Which organism carries out autotrophic nutrition?

- (1) hawk
- (2) cricket
- (3) grass
- (4) deer

33. State what would most likely happen to the cricket population if all of the grasses were removed. [1]

ameba, and paramecium. The only information the student has is that the ameba and paramecium are both heterotrophs and the euglena can be either heterotrophic or autotrophic, depending on its environment.

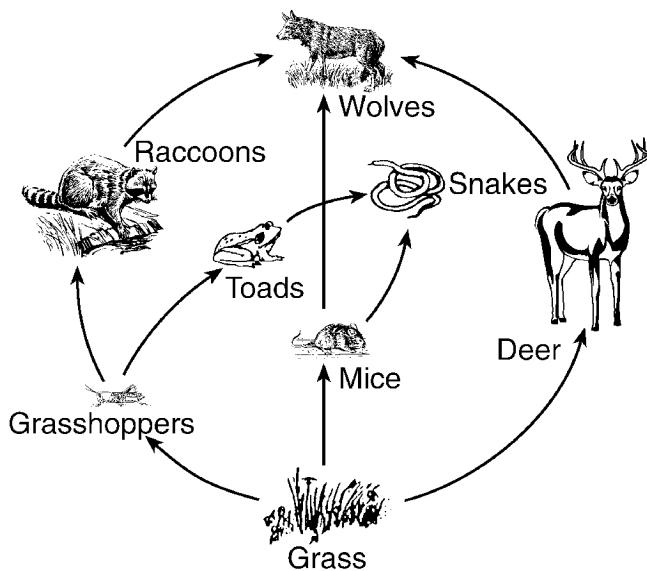
34. State one way the euglena's two methods of nutrition provide a survival advantage the other unicellular organisms do not have. [1]

35. Which procedure and resulting observation would help identify the jar that contains the euglena?

- (1) Expose only one side of each jar to light. After 24 hours, only in the jar containing euglena will most of organisms be seen on the darker side of the jar.
- (2) Expose all sides of each jar to light. After 48 hours, the jar with the highest dissolved carbon dioxide content will contain the euglena.
- (3) Over a period of one week, determine the method of reproduction used by each type of organism. If mitotic cell division is observed, the jar will contain euglena.
- (4) Prepare a wet-mount slide of specimens from each jar and observe each slide with a compound light microscope. Only the euglena will have chloroplasts.

36. The diagram below represents a food web.

A Meadow Environment



Two of the herbivores represented in this food web are

- (1) toads and snakes
- (2) deer and mice
- (3) wolves and raccoons
- (4) grasshoppers and toads

Base your answers to questions 34 and 35 on the information below and on your knowledge of biology.

A biology student was given three unlabeled jars of pond water from the same source, each containing a different type of mobile unicellular organism: euglena,

Base your answers to questions 1 through 4 on the information below and on your knowledge of biology.

A student uses a covered aquarium to study the interactions of biotic and abiotic factors in an ecosystem. The aquarium contains sand, various water plants, algae, small fish, snails, and decomposers. The water contains dissolved oxygen and carbon dioxide, as well as tiny amounts of minerals and salts.

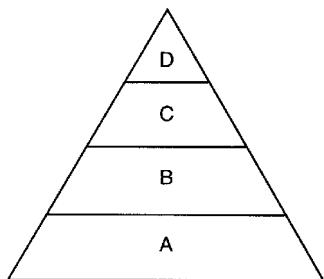
1. Explain how oxygen is cycled between organisms in this ecosystem. [2]

2. Describe one specific way the fish population changes the amount of one specific abiotic factor (other than oxygen) in this ecosystem. [1]

3. Identify one source of food for the decomposers in this ecosystem. [1]

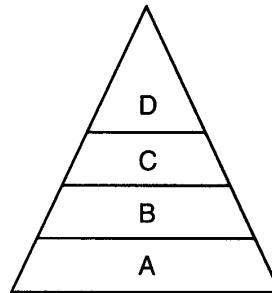
4. Describe one specific way the use of this food by the decomposers benefits the other organisms in the aquarium. [1]

5. Which statement about the pyramid of energy shown below is correct?



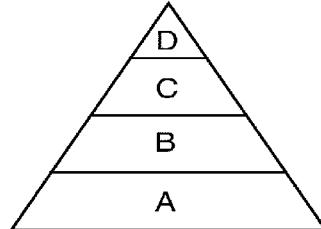
- (1) The amount of energy needed to sustain the pyramid enters at level D.
- (2) The total amount of energy decreases with each successive feeding level from D to A.
- (3) The amount of energy is identical in each level of the pyramid.
- (4) The total amount of energy at level D is less than the total amount of energy at level B.

6. Which process provides the initial energy to support all the levels in the energy pyramid shown below



- (1) circulation
- (2) photosynthesis
- (3) active transport
- (4) digestion

7. The diagram below represents an energy pyramid.



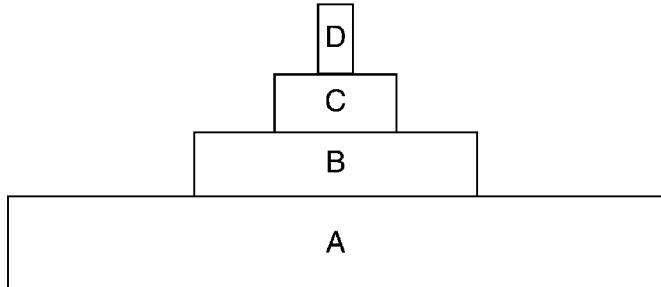
At each successive level from A to D, the amount of available energy

- (1) increases, only
- (2) decreases, only
- (3) increases, then decreases
- (4) remains the same

8. What would most likely happen if most of the bacteria and fungi were removed from an ecosystem?

- (1) Nutrients resulting from decomposition would be reduced.
- (2) Energy provided for autotrophic nutrition would be reduced.
- (3) The rate of mutations in plants would increase.
- (4) Soil fertility would increase.

9. An energy pyramid is represented below.



How much energy would be available to the organisms in level C?

- (1) all of the energy in level A, plus the energy in level B
- (2) all of the energy in level A, minus the energy in level B
- (3) a percentage of the energy contained in level B
- (4) a percentage of the energy synthesized in level B and level D

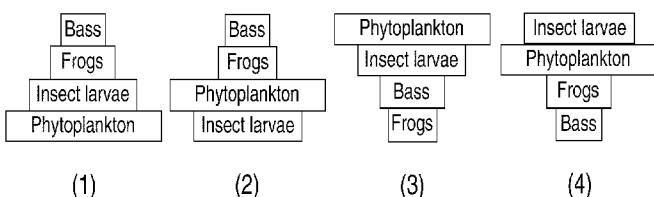
Base your answer to question 10 on the information below and on your knowledge of biology.

Analysis of a sample taken from a pond showed variety in both number and type of organisms present. The data collected are shown in the table below.

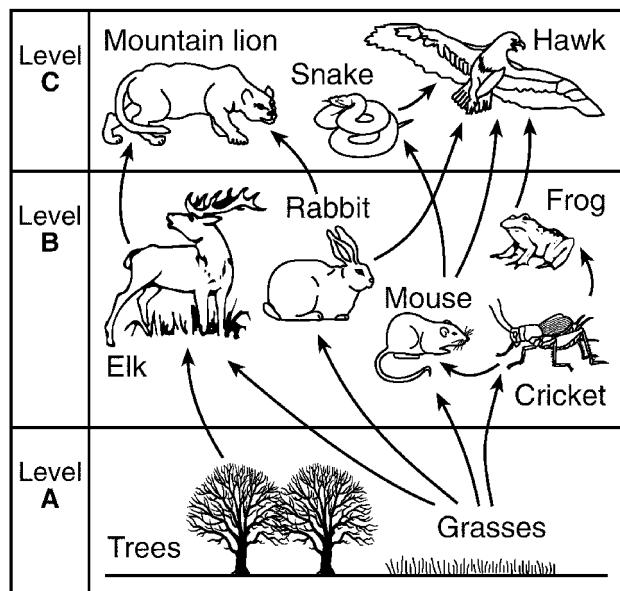
Data Table

Type of Organisms	Number Present
bass	two
frogs	forty
phytoplankton	thousands
insect larvae	hundreds

10. Which diagram best represents the organisms arranged as an energy pyramid?

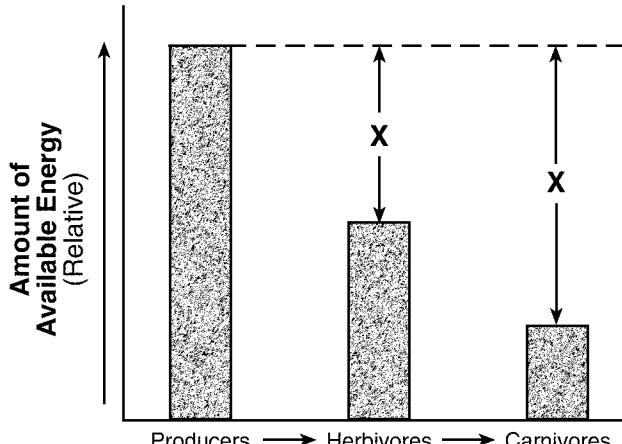


11. A food web is represented below. Which statement best describes energy in this food web?



- (1) The energy content of level B depends on the energy content of level C.
 - (2) The energy content of level A depends on energy provided from an abiotic source.
 - (3) The energy content of level C is greater than the energy content of level A.
 - (4) The energy content of level B is transferred to level A.

12. The graph below represents the amount of available energy at successive nutrition levels in a particular food web.

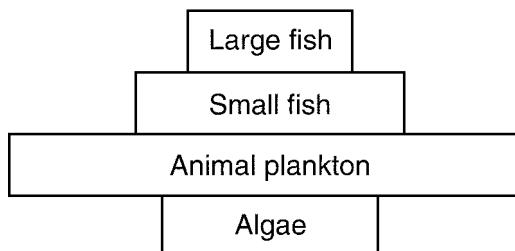


The Xs in the diagram represent the amount of energy that was most likely

- It was most likely

 - (1) changed into inorganic compounds
 - (2) retained indefinitely by the herbivores
 - (3) recycled back to the producers
 - (4) lost as heat to the environment

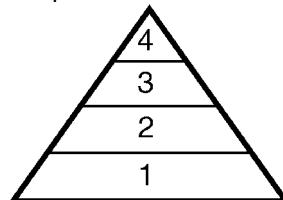
13. The diagram below represents an energy pyramid constructed from data collected from an aquatic ecosystem.



Which statement best describes this ecosystem?

- (1) The ecosystem is most likely unstable.
 - (2) Long-term stability of this ecosystem will continue.
 - (3) The herbivore populations will continue to increase in size for many years.
 - (4) The producer organisms outnumber the consumer organisms.

14. The diagram below represents a pyramid of energy that includes both producers and consumers.



The greatest amount of available energy is found at level

15. Which statement describes a role of fungi in an ecosystem?

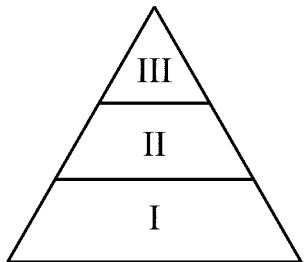
- (1) They transfer energy to decaying matter.
- (2) They release oxygen into the ecosystem.
- (3) They recycle chemicals from dead organisms.
- (4) They synthesize organic nutrients from inorganic substances.

16. Mice store only a small amount of the energy they obtain from plants they eat. State what might happen to some of the remaining energy they obtain from the plants.
[1]

17. Which condition would most likely upset the stability of an ecosystem?

- (1) a cycling of elements between organisms and the environment
- (2) energy constantly entering the environment
- (3) green plants incorporating sunlight into organic compounds
- (4) a greater mass of animals than plants

18. An energy pyramid containing autotrophs and other organisms from a food chain is represented below.



Carnivores would most likely be located in

- (1) level I, only
- (2) level I and level II
- (3) level III, only
- (4) level II and level III

1. Some data concerning bird species are shown in the chart below.

Number of Bird Species	Location
26	northern Alaska
153	southwest Texas
600	Costa Rica

Which statement is a valid inference based on information in the chart?

- (1) The different species in northern Alaska can interbreed.
- (2) There are conditions in Costa Rica that account for greater biodiversity there.
- (3) The different species in southwest Texas evolved from those in northern Alaska.
- (4) The greater number of species in Costa Rica is due to a greater number of predators there.

2. When habitats are destroyed, there are usually fewer niches for animals and plants. This action would most likely not lead to a change in the amount of

- (1) biodiversity
- (2) competition
- (3) interaction between species
- (4) solar radiation reaching the area

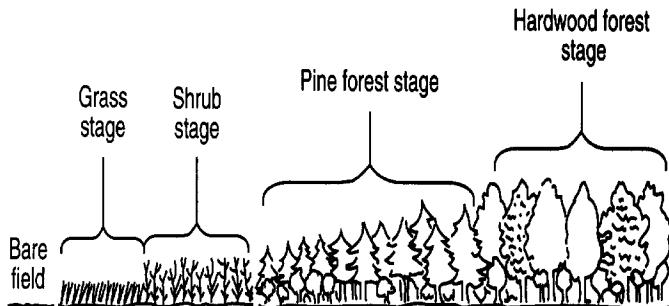
3. Ecosystems will have a greater chance of maintaining equilibrium over a long period of time if they have

- (1) organisms imported by humans from other environments
- (2) a sudden change in climate
- (3) a diversity of organisms
- (4) predators eliminated from the food chains

1. An established ecosystem may remain stable over hundreds of years because

- (1) species interdependence is absent
- (2) there is a lack of variety in the species
- (3) no competition exists between the species
- (4) there are natural checks on species

2. Which of the stages in the diagram below consists of plant species that modify the environment, eventually making it more suitable for another community?

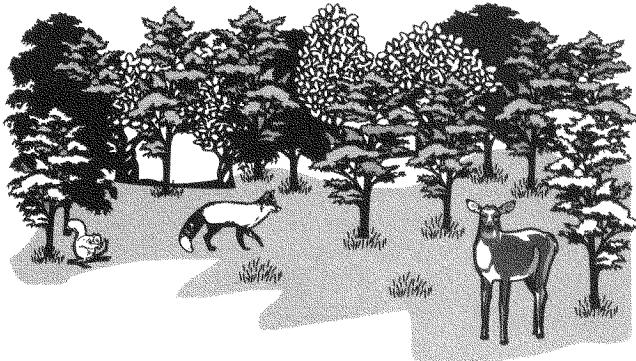


- (1) grass stage, only
- (2) grass, shrub, and pine forest stages
- (3) shrub, pine forest, and hardwood forest stages
- (4) hardwood forest stage, only

3. Lichens and mosses are the first organisms to grow in an area. Over time, grasses and shrubs will grow where these organisms have been. The grasses and shrubs are able to grow in the area because the lichens and mosses

- (1) synthesize food needed by producers in the area
- (2) are at the beginning of every food chain in a community
- (3) make the environment suitable for complex plants
- (4) provide the enzymes needed for plant growth

4. Which statement describes the ecosystem represented in the diagram below?



- (1) This ecosystem would be the first stage in ecological succession.
- (2) This ecosystem would most likely lack decomposers.
- (3) All of the organisms in this ecosystem are producers.
- (4) All of the organisms in this ecosystem depend on the activities of biological catalysts.

5. Which statement describes all stable ecosystems?

- (1) Herbivores provide energy for the autotrophs.
- (2) The populations of predators are dependent on the populations of their prey.
- (3) The number of autotrophs equals the number of heterotrophs.
- (4) Consumers synthesize ATP from light energy.

6. A fire burns an oak forest down to bare ground. Over the next 150 years, if the climate remains constant, this area will most likely

- (1) remain bare ground
- (2) return to an oak forest
- (3) become a rain forest
- (4) become a wetland

Base your answer to question 7 on the information below and on your knowledge of biology.

Lichens are composed of two organisms, a fungus that cannot make its own food and algae that contain chlorophyll. Lichens may live on the bark of trees or even on bare rock. They secrete acids that tend to break up the rock they live on, helping to produce soil. As soil accumulates from the broken rock and dead lichens, other organisms, such as plants, may begin to grow.

7. The ability of lichens to alter their environment, enabling other organisms to grow and take their places in that environment, is one step in the process of

- (1) biological evolution
- (2) ecological succession
- (3) maintenance of cellular communication
- (4) differentiation in complex organisms

8. Many years ago, a volcanic eruption killed many plants and animals on an island. Today the island looks much as it did before the eruption. Which statement is the best possible explanation for this?

- (1) Altered ecosystems regain stability through the evolution of new plant species.
- (2) Destroyed environments can recover as a result of the process of ecological succession.
- (3) Geographic barriers prevent the migration of animals to island habitats.
- (4) Destroyed ecosystems always return to their original state.

9. As succession proceeds from a shrub community to a forest community, the shrub community modifies its environment, eventually making it

- (1) more favorable for itself and less favorable for the forest community
- (2) more favorable for itself and more favorable for the forest community
- (3) less favorable for itself and more favorable for the forest community
- (4) less favorable for itself and less favorable for the forest community

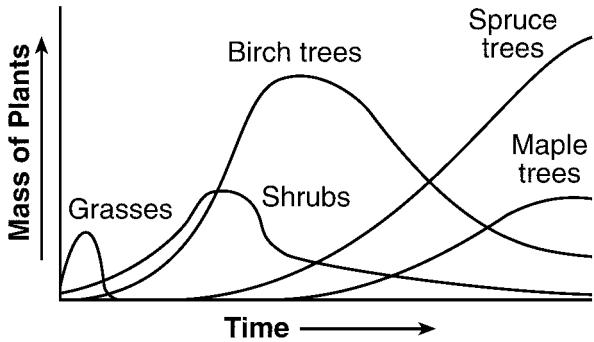
Base your answers to questions 10 and 11 on the information below and on your knowledge of biology.

A pond in the Adirondack Mountains of New York State was once a fishing spot visited by many people. It was several acres in size, and fishermen in boats were a common sight. Over time, the pond has become smaller in area and depth. Places where there was once open water are now covered by grasses and shrubs. Around the edges of the pond there are cattails and other wetland plants.

10. Identify the ecological process responsible for the changes to this pond. [1]

11. Predict what will most likely happen to this pond area over the next hundred years if this process continues. [1]

12. Which concept is represented in the graph below?



- (1) ecological succession in a community
- (2) cycling of carbon and nitrogen in a forest
- (3) energy flow in a food chain over time
- (4) negative human impact on the environment

- 1 Carbon dioxide containing carbon-14 is introduced into a balanced aquarium ecosystem. After several weeks, carbon-14 will most likely be present in
- (1) the plants, only
 - (2) the animals, only
 - (3) both the plants and animals
 - (4) neither the plants nor animals

Base your answers to questions 2 through 5 on the passage below and on your knowledge of biology.

Decline of the Salmon Population

Salmon are fish that hatch in a river and swim to the ocean where their body mass increases. When mature, they return to the river where they were hatched and swim up stream to reproduce and die. When there are large populations of salmon, the return of nutrients to the river ecosystem can be huge. It is estimated that during salmon runs in the Pacific Northwest in the 1800s, 500 million pounds of salmon returned to reproduce and die each year. Research estimates that in the Columbia River alone, salmon contributed hundreds of thousands of pounds of nitrogen and phosphorus compounds to the local ecosystem each year. Over the past 100 years, commercial ocean fishing has removed up to two-thirds of the salmon before they reach the river each year.

2. Identify the process that releases the nutrients from the bodies of the dead salmon, making the nutrients available for other organisms in the ecosystem. [1]
-

3. Identify one organism, other than the salmon, that would be present in or near the river that would most likely be part of a food web in the river ecosystem. [1]
-

4. Identify two nutrients that are returned to the ecosystem when the salmon die. [1]
-
-

5. State one impact, other than reducing the salmon population, that commercial ocean fishing has on the river ecosystem. [1]
-
-
-

6. In order to reduce consumption of nonrenewable resources, humans could

- (1) burn coal to heat houses instead of using oil
- (2) heat household water with solar radiation
- (3) increase industrialization
- (4) use a natural-gas grill to barbecue instead of using charcoal

7. One likely reason some experimental automobiles have been developed to use electricity rather than gasoline is that

- (1) gasoline is made from petroleum, a nonrenewable resource
- (2) Earth has an unlimited supply of fossil fuels
- (3) the use of electricity will eliminate the need for all antipollution laws
- (4) the use of electricity will increase the manufacture of antipollution devices for cars

8. Worms that had been invaded by bacteria were eaten by a species of bird. Many of these birds died as a result. The most likely explanation for this is that the

- (1) bacteria interfered with normal life functions of the birds
- (2) disease that killed the birds was inherited
- (3) gene alterations in the bacterial cells killed the birds
- (4) birds produced antigens in response to the bacteria

9. An individual has placed an editorial in the community newspaper stating that the local recycling program should be discontinued. Respond to this editorial by explaining the importance of the local recycling program for the environment. In your explanation be sure to:

- state one effect the increasing human population will have on the availability of natural resources [1]
 - state one reason why recycling is important [1]
 - identify two natural resources or products made from natural resources that can be recycled [2]
-
-
-
-
-
-
-
-
-

1. Humans are responsible for some of the negative changes that occur in nature because they
- have encouraged the development of wildlife refuges and parks
 - have passed laws to preserve the environment
 - are able to preserve scarce resources
 - are able to modify habitats more than any other species

2. The negative effect humans have on the stability of the environment is most directly linked to an increase in

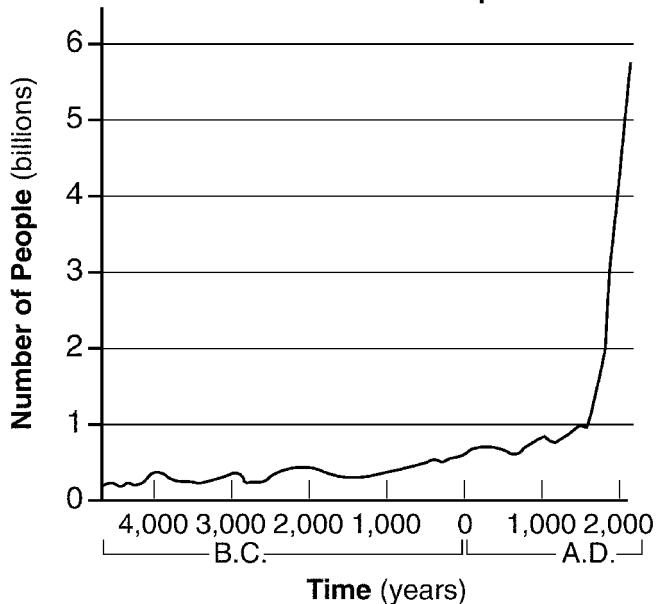
- recycling activities by humans
- supply of finite resources
- predation and disease
- human population size

3. Which long-term change could directly cause the other three?

- pollution of air and water
- increasing human population
- scarcity of suitable animal habitats
- depletion of resources

4. The graph below shows how the human population has grown over the last several thousand years.

Growth of the Human Population



Which statement is a valid inference that can be made if the human population continues to grow at a rate similar to the rate shown between 1000 A.D. and 2000 A.D.?

- Future ecosystems will be stressed and many animal habitats may be destroyed.
- Global warming will decrease as a result of a lower demand for fossil fuels.
- One hundred years after all resources are used up, the human population will level off.
- All environmental problems can be solved without a reduction in the growth rate of the human population.

5. Which human activity will most likely have a negative effect on global stability?

- decreasing water pollution levels
- increasing recycling programs
- decreasing habitat destruction
- increasing world population growth

1. Increased production of goods makes our lives more comfortable, but causes an increase in the demand for energy and other resources. One negative impact of this situation on ecosystems is an increase in

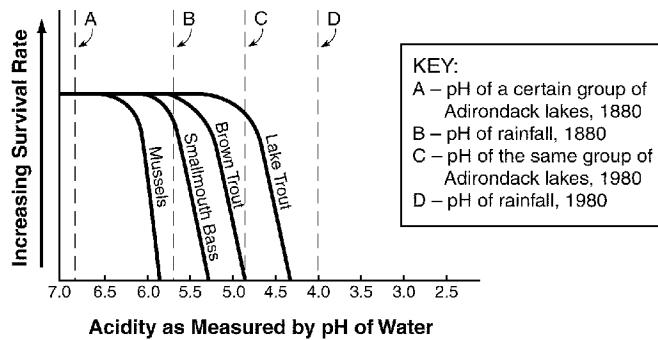
- (1) living space for wildlife
- (2) renewable resources
- (3) the diversity of plant species
- (4) pollution levels in the atmosphere

2. Water from nearby rivers or lakes is usually used to cool down the reactors in nuclear power plants. The release of this heated water back into the river or lake would most likely result in

- (1) an increase in the sewage content in the water
- (2) a change in the biodiversity in the water
- (3) a change in the number of mutations in plants growing near the water
- (4) a decrease in the amount of sunlight necessary for photosynthesis in the water

Base your answers to questions 3 and 4 on the information and graph below and on your knowledge of biology.

The Effect of pH on Survival Rates of Selected Species in Certain Adirondack Lakes



3. State how the pH of these Adirondack lakes changed between 1880 and 1980. [1]

6. When living organisms obtain water and food from their environment, they may also take in toxic pesticides. Low concentrations of some pesticides may not kill animals, but they may damage reproductive organs and cause sterility. The data table below shows concentrations of a pesticide in tissues of organisms at different levels of a food chain.

Concentration of Pesticide in Tissues	
Organisms	Pesticide Concentration (parts per million)
producers	0.01–0.03
herbivores	0.25–1.50
carnivores	4.10–313.80

What does this information suggest to a person who is concerned about health and is deciding on whether to have a plant-rich or an animal-rich diet? Support your answer using the information provided. [1]

7. Currently, Americans rely heavily on the burning of fossil fuels as sources of energy. As a result of increased demand for energy sources, there is a continuing effort to find alternatives to burning fossil fuels.

Discuss fossil fuels and alternative energy sources. In your answer be sure to:

- state one disadvantage of burning fossil fuels for energy [1]
- identify one energy source that is an alternative to using fossil fuels [1]
- state one advantage of using this alternative energy source [1]
- state one disadvantage of using this alternative energy source [1]

4. State the effect that the pH change in these Adirondack lakes had on lake trout, brown trout, smallmouth bass, and mussels. [1]

5. A change in the acidity of mountain lakes would most likely be a result of

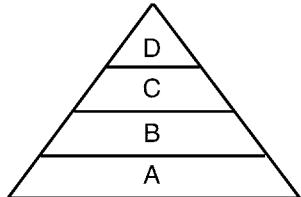
- (1) ecological succession of the area at the top of the mountain
- (2) the introduction of new species into the lakes
- (3) air pollution from smoke stacks miles away
- (4) planting grasses and shrubs around the lakes

8. Which situation is a result of human activities?
- (1) decay of leaves in a forest adds to soil fertility
 - (2) acid rain in an area kills fish in a lake
 - (3) ecological succession following volcanic activity reestablishes an ecosystem
 - (4) natural selection on an island changes gene frequencies

9. In many investigations, both in the laboratory and in natural environments, the pH of substances is measured. Explain why pH is important to living things. In your explanation be sure to:

- identify one example of a life process of an organism that could be affected by a pH change [1]
- state one environmental problem that is directly related to pH [1]
- identify one possible cause of this environmental problem [1]

10. The diagram below represents a food pyramid.



The concentration of the pesticide DDT in individual organisms at level D is higher than the concentration in individuals at level A because DDT is

- (1) synthesized by organisms at level D
- (2) excreted by organisms at level A as a toxic waste
- (3) produced by organisms at level C which are eaten by organisms at level D
- (4) passed through levels A, B, and C to organisms at level D

Base your answers to questions 11 and 12 on the information below and on your knowledge of biology.

You are the owner of a chemical company. Many people in your community have been complaining that rabbits are getting into their gardens and eating the flowering plants and vegetables they have planted. Your company is developing a new chemical product called Bunny Hop-Away that repels rabbits. This product would be sprayed on the plants to prevent the rabbits from eating them. Certain concerns need to be considered before you make the product available for public use.

11. State two environmental concerns that should be considered before the product is sold and used by the public. [2]

12. State one safety procedure that should be followed when the product is sprayed on plants. [1]

Base your answers to questions 1 and 2 on the information below and on your knowledge of biology.

Gaurs, which are large oxlike animals found in South Asia, have been hunted for sport for many generations. Most recently, as human populations have increased, the gaur's habitats of forests, bamboo jungles, and grasslands have dwindled. The gaur is now considered an endangered species.

Scientists have succeeded in preserving endangered species by cloning. Recently, a gaur was cloned and the resulting embryo was placed inside a domestic cow, which then gave birth to a baby gaur.

1. State one biological benefit of preserving endangered species. [1]
-
-

2. State one way, other than cloning, that gaurs might be saved from extinction. [1]
-
-

3. Some organizations are buying up sections of forest land. Once purchased, these sections of forest will never be cut down. The main reason for protecting these sections of forest is to

- (1) cause the extinction of undesirable animal species
- (2) prevent these trees from reproducing too fast
- (3) maintain the diversity of the living environment
- (4) provide more land for agricultural purposes

4. Oak trees in the northeastern United States have survived for hundreds of years, in spite of attacks by native insects. Recently, the gypsy moth, which has a caterpillar stage that eats leaves, was imported from Europe. The gypsy moth now has become quite common in New England ecosystems. As a result, many oak trees are being damaged more seriously than ever before.

State one biological reason that this imported insect is a more serious problem for the trees than other insects that have been present in the area for hundreds of years. [1]

Base your answers to questions 5 through 7 on the passage below and on your knowledge of biology.

Research indicates that many plants prevent the growth of other plants in their habitat by releasing natural herbicides (chemicals that kill plants). These substances are known as allelochemicals and include substances such as quinine, caffeine, and digitalis. Experiments have confirmed that chemicals in the bark and roots of black walnut trees are toxic, and when released into the soil they limit the growth of crop plants such as tomatoes, potatoes, and apples. Allelochemicals can alter growth and enzyme action, injure the outer cover of a seed so the seed dies, or stimulate seed growth at inappropriate times of the year. Studies on allelochemical effects help explain the observation that almost nothing grows under a black walnut tree even though light and moisture levels are adequate for growth.

5. The release of allelochemicals into the soil under a black walnut tree will result in

- (1) a decrease in biodiversity and a competitive advantage for the tree
- (2) an increase in biodiversity and a competitive advantage for the tree
- (3) a decrease in biodiversity and a competitive disadvantage for the tree
- (4) an increase in biodiversity and a competitive disadvantage for the tree

6. Explain why stimulation of seed growth by allelochemicals at inappropriate times of the year is considered a *disadvantage*. [1]
-
-

7. State one possible use of allelochemicals in agriculture. [1]
-
-

8. The rapid destruction of tropical rain forests may be harmful because

- (1) removing trees will prevent scientists from studying ecological succession
- (2) genetic material that may be useful for future medical discoveries will be lost
- (3) energy cycling in the environment will stop
- (4) the removal of trees will limit the construction of factories that will pollute the environment

Base your answer to question 9 on the information below and on your knowledge of biology.

The dodo bird inhabited the island of Mauritius in the Indian Ocean, where it lived undisturbed for years. It lost its ability to fly and it lived and nested on the ground where it ate fruits that had fallen from trees. There were no mammals living on the island.

In 1505, the first humans set foot on Mauritius. The island quickly became a stopover for ships engaged in the spice trade. The dodo was a welcome source of fresh meat for the sailors and large numbers of dodos were killed for food. In time, pigs, monkeys, and rats brought to the island ate the dodo eggs in the ground nests.

9. Which statement describes what most likely happened to the dodo bird within 100 years of the arrival of humans on Mauritius?

- (1) Dodo birds developed the ability to fly in order to escape predation and their population increased.
 - (2) The dodo bird population increased after the birds learned to build their nests in trees.
 - (3) Human exploitation and introduced species significantly reduced dodo bird populations.
 - (4) The dodo bird population became smaller because they preyed upon the introduced species.

10. Certain insects are kept under control by sterilizing the males with x rays so that sperm production stops. Explain how this technique reduces the survival of this insect species. [1]

11. Cutting down a rain forest and planting agricultural crops, such as coffee plants, would most likely result in

- (1) a decrease in biodiversity
 - (2) an increase in the amount of energy recycled
 - (3) a decrease in erosion
 - (4) an increase in the amount of photosynthesis

12. Humans have altered ecosystems in many ways. The most positive impact on an ecosystem would result from

- (1) planting a single economically valuable crop in a 25-acre area
- (2) seeding an area with valuable plants that are from another ecosystem
- (3) planting many different plants that are native to the area in a vacant lot
- (4) filling in a swamp and planting grass and trees for a community park

13. A forest is cut down and is replaced by a cornfield. A negative consequence of this practice is

- (1) an increase in the carbon dioxide released into the atmosphere
 - (2) an increase in the size of predators
 - (3) a decrease in biodiversity
 - (4) a decrease in the amount of soil that is washed away during rainstorms

14. Mosquitoes are eaten by many birds and bats. In the New York City area, mosquitoes have been found to transmit West Nile Virus to some people who have been bitten by a mosquito carrying this virus. As a result, New York City health officials have sprayed pesticides into the air in order to kill as many mosquitoes as possible.

Discuss the use of pesticides to control the mosquito population. In your answer be sure to:

- state one advantage of killing all of the mosquitoes [1]
 - state one disadvantage of killing all of the mosquitoes [1]
 - state one danger to humans of spraying pesticides into the air [1]

15. Which human activity would have the most positive effect on the environment of an area?

- (1) using fire to eliminate most plants in the area
- (2) clearing the area to eliminate weed species
- (3) protecting native flowers and grasses in the area
- (4) introducing a foreign plant species to the area

16. Growers of fruit trees have always had problems with insects. Insects can cause visible damage to fruits, making them less appealing to consumers. As a result of this damage, much of the fruit cannot be sold. Insecticides have been useful for controlling these insects, but, in recent years, some insecticides have been much less effective. In some cases, insecticides do nothing to stop the insect attacks.

Provide a biological explanation for this loss of effectiveness of the insecticides. In your answer, be sure to:

- identify the original event that resulted in the evolution of insecticide resistance in some insects [1]
- explain why the percentage of resistant insects in the population has increased [1]
- describe one alternative form of insect control, other than using a different insecticide, that fruit growers could use to protect their crops from insect attack [1]

17. Deforestation is viewed as a problem in the world today. Describe a cause and an effect of deforestation and a way to lessen this effect. In your answer, be sure to:

- state one reason deforestation is occurring [1]
- state one environmental problem that results from widespread deforestation [1]
- state one way to lessen the effects of deforestation, other than planting trees [1]

18. Bacteria that are removed from the human intestine are genetically engineered to feed on organic pollutants in the environment and convert them into harmless inorganic compounds. Which row in the table below best represents the most likely negative and positive effects of this technology on the ecosystem?

Row	Negative Effect	Positive Effect
(1)	Inorganic compounds interfere with cycles in the environment.	Human bacteria are added to the environment.
(2)	Engineered bacteria may out-compete native bacteria.	The organic pollutants are removed.
(3)	Only some of the pollutants are removed.	Bacteria will make more organic pollutants.
(4)	The bacteria will cause diseases in humans.	The inorganic compounds are buried in the soil.

19. Which human activity would have the least negative impact on the quality of the environment?

- (1) adding animal wastes to rivers
- (2) cutting down tropical rain forests for plywood
- (3) using species-specific sex attractants to trap and kill insect pests
- (4) releasing chemicals into the groundwater

Base your answer to question 20 on the information below and on your knowledge of biology.

Cargo ships traveling to the Great Lakes from the Caspian Sea in Eurasia often carry water in tanks known as ballast tanks. This water helps the ships to be more stable while crossing the ocean. Upon arrival in the Great Lakes, this water is pumped out of the ships. Often this water contains species that are not native to the Great Lakes environment. The zebra mussel is one species that was introduced into the Great Lakes in this way.

Although large numbers of zebra mussels often clog water intake pipes of power plants and other industries, the mussels have a benefit. Each mussel filters about a quart of water per day, absorbing cancer-causing PCB's from lake water in the process.

The goby, a bottom-feeding fish from Europe, was introduced into the Great Lakes in a similar way a few years later. The gobies have become a dominant species in the Great Lakes, eating small zebra mussels and the eggs and young of other fish. Gobies are eaten by large sport fish. These sport fish have been tested and PCB's have been found in their tissues. Recommendations have been made that people limit the number of sport fish they eat.

20. Explain how the introduction of foreign species can often cause environmental problems.

In your answer be sure to:

- state how the zebra mussels and gobies were introduced into the United States [1]
 - state one way either the zebra mussels or gobies have become a problem in their new environment [1]
 - describe how both zebra mussels and gobies contribute to increasing the concentration of PCB's in sport fish [2]
-
-
-
-
-
-
-
-

21. State one specific way the removal of trees from an area has had a negative impact on the environment. [1]

22. In 1859, a small colony of 24 rabbits was brought to Australia. By 1928 it was estimated that there were 500 million rabbits in a 1-million square mile section of Australia. Which statement describes a condition that probably contributed to the increase in the rabbit population?

- (1) The rabbits were affected by many limiting factors.
- (2) The rabbits reproduced by asexual reproduction.
- (3) The rabbits were unable to adapt to the environment.
- (4) The rabbits had no natural predators in

Base your answers to questions 23 through 25 on the information below and on your knowledge of biology.

A population of gray squirrels lived in the trees surrounding four houses in a city. The houses and trees were removed, and a tall office building was constructed in their place. Some of the squirrels were able to survive by relocating to the trees in a park nearby.

23. State one specific way the relocated squirrels would most likely interact with a gray squirrel population that has lived in the park for many years. [1]

24. State one specific way the relocated squirrels will change an abiotic factor in the park ecosystem. [1]

25. State one specific natural factor in the park ecosystem that will limit the growth of the squirrel population and support your answer. [1]

26. One irreversible effect of both deforestation and water pollution on the environment is the

- (1) extinction of species
- (2) thinning of the ozone shield
- (3) depletion of atmospheric carbon dioxide levels
- (4) increase in renewable resources

27. When brown tree snakes were accidentally introduced onto the island of Guam, they had no natural predators. These snakes sought out and ate many of the eggs of insect-eating birds. What probably occurred following the introduction of the brown tree snakes?

- (1) The bird population increased.
- (2) The insect population increased.
- (3) The bird population began to seek a new food source.
- (4) The insect population began to seek a new food source.

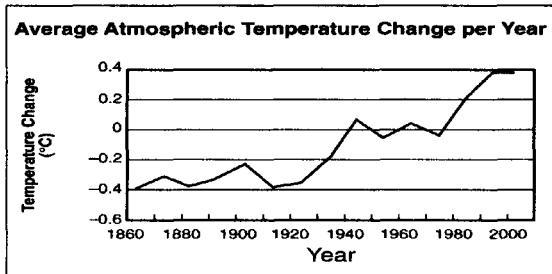
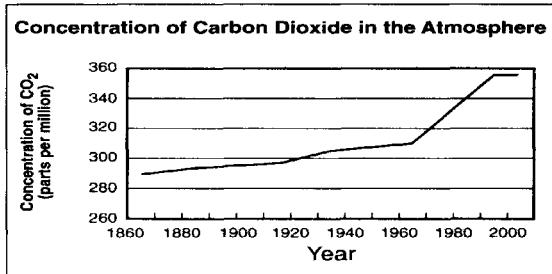
Base your answers to questions 28 and 29 on the passage below and on your knowledge of biology.

Human activities have had a major impact on biodiversity. Scientists cannot solve this problem alone. Concerned individuals need to be involved in restoring and maintaining biodiversity.

28. Explain how a loss of biodiversity today can affect the survival of humans in the future. [1]

29. State one specific action that you as a student can take in your community to help maintain or increase biodiversity. [1]

1. For over 100 years scientists have monitored the carbon dioxide concentrations in the atmosphere in relation to changes in the atmospheric temperature. The graphs below show the data collected for these two factors.



Discuss the overall relationship between carbon dioxide concentration and changes in atmospheric temperature and the effect of these factors on ecosystems. Your answer must include:

- a statement identifying the overall relationship between the concentration of carbon dioxide and changes in atmospheric temperature [1]
 - one way in which humans have contributed to the increase in atmospheric carbon dioxide [1]
 - one specific negative effect the continued rise in temperature would be likely to have on an ecosystem [1]
 - one example of how humans are trying to reduce the problem of global warming [1]

Base your answers to questions 2 through 4 on the passage below and on your knowledge of biology.

Great Effects on the Great Lakes due to Global Warming

Trees such as the jack pine, yellow birch, red pine, and white pine may no longer be able to grow in the Great Lakes region because summers are becoming warmer. However, other trees such as black walnut and black cherry may grow in the area, given enough time. The change in weather would favor these new tree species.

The Great Lakes region is the only place in the world where the endangered Kirtland's Warbler breeds. This bird species nests in young jack pine trees (5 to 23 years old). The vegetation must have specific characteristics or the birds will not nest. A specific area of Michigan is one of the few preferred areas. If the jack pines can no longer grow in this area, the consequences for the Kirtland's Warbler could be devastating.

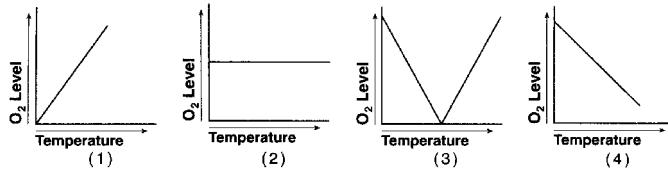
Recent research findings also suggest that algae production in Lake Ontario and several other Great Lakes will be affected as warmer weather leads to warmer lake water. An increase in water temperature reduces the ability of water to hold dissolved oxygen. These changes have implications for the entire Great Lakes food web. Changes in deep-water oxygen levels and other habitat changes may prevent the more sensitive cold-water fish from occupying their preferred niches in a warmer climate.

All other factors being equal, climatic changes may not have a negative effect on every species in the Great Lakes region. This is because the length of the growing season would be increased. Some temperature-sensitive fish could move to cooler, deeper water when the surface water temperatures become too high. The total impact of global warming is difficult to predict.

2. Explain how the habitat of the Kirtland's Warbler may be changed as a result of global warming. [1]

3. Identify one producer found in the water of Lake Ontario. [11]

4. Which graph best shows the relationship between changes in temperature in the Great Lakes waters and the amount of dissolved oxygen those waters can hold?



Base your answers to questions 5 and 6 on the information below and on your knowledge of biology.

The ice fields off Canada's Hudson Bay are melting an average of three weeks earlier than 25 years ago. The polar bears are therefore unable to feed on the seals on these ice fields during the last three weeks in spring. Polar bears have lost an average of 10% of their weight and have 10% fewer cubs when compared to a similar population studied just 20 years ago. Scientists have associated the early melting of the ice fields with the fact that the average world temperature is about 0.6°C higher than it was a century ago and this trend is expected to continue.

5. What ecological problem most likely caused the earlier melting of the ice fields in the Hudson Bay area of Canada? [1]

6. State one specific long-term action that humans could take that might slow down or reduce the melting of the ice fields. [1]

7. Continued depletion of the ozone layer will most likely result in

- (1) an increase in skin cancer among humans
 - (2) a decrease in atmospheric pollutants
 - (3) an increase in marine ecosystem stability
 - (4) a decrease in climatic changes

Base your answers to questions 1 and 2 on the information below and on your knowledge of biology.

Our national parks are areas of spectacular beauty. Current laws usually prohibit activities such as hunting, fishing, logging, mining, and drilling for oil and natural gas in these areas. Congress is being asked to change these laws to permit such activities.

1. Choose one of the activities listed above. State one way that activity could harm the ecosystem. [1]

Activity: _____

Harm: _____

2. State one way allowing the activity you chose could benefit society. [1]
-
-
-

Base your answers to questions 3 and 4 on the statement below and on your knowledge of biology.

The use of nuclear fuel can have positive and negative effects on an ecosystem.

3. State one positive effect on an ecosystem of using nuclear fuel to generate electricity. [1]
-
-
-

4. State one negative effect on an ecosystem of using nuclear fuel to generate electricity. [1]
-
-
-

5. Which action illustrates an increased understanding and concern by humans for ecological interrelationships?

- (1) importing organisms in order to stabilize existing ecosystems
- (2) eliminating pollution standards for industries that promote technology
- (3) removing natural resources at a rate equal to the needs of the population
- (4) implementing laws to regulate the number of animals hunted and killed each year

Base your answers to questions 6 through 8 on the information below and on your knowledge of biology.

It has been discovered that plants utilize chemical signals for communication. Some of these chemicals are released from leaves, fruits, and flowers and play various roles in plant development, survival, and gene expression. For example, bean plant leaves infested with spider mites release chemicals that result in an increase in the resistance to spider mites in uninfested leaves on the same plant and the expression of self-defense genes in uninfested bean plants nearby.

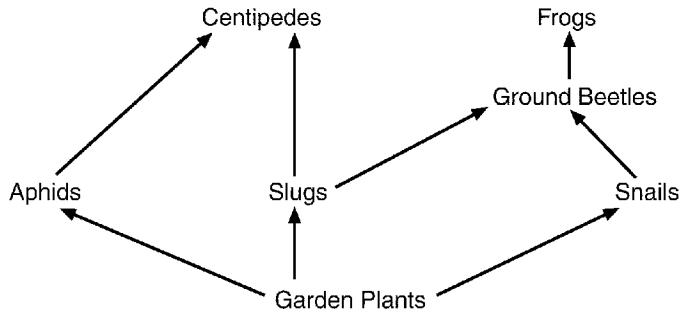
Plants can also communicate with insects. For example, corn, cotton, and tobacco under attack by caterpillars release chemical signals that simultaneously attract parasitic wasps to destroy the caterpillars and discourage moths from laying their eggs on the plants.

6. Identify the specialized structures in the cell membrane that are involved in communication. [1]
-

7. Explain why chemicals released from one plant species may not cause a response in a different plant species. [1]
-
-
-

8. State two advantages of relying on chemicals released by plants rather than using man-made chemicals for insect control. [2]
-
-
-

Base your answers to questions 9 through 11 on the information below and on your knowledge of biology



Gardeners sometimes use slug traps to capture and kill slugs. These traps were tested in a garden with a large slug population. Organisms found in the trap after one week are shown in the table below.

Organisms in Trap

Organism	Number in Trap
slugs	8
snails	1
aphids	13
centipedes	1
ground beetles	98

11. In a process known as biological control, natural predators that prey on plant or animal pests are used to control the populations of the pests. Identify one organism shown in this food web that could be used as a biological control to replace the slug traps. [1]

1. Researchers performing a well-designed experiment should base their conclusions on

- (1) the hypothesis of the experiment
- (2) data from repeated trials of the experiment
- (3) a small sample size to insure a reliable outcome of the experiment
- (4) results predicted before performing the experiment

2. Which statement best describes a scientific theory?

- (1) It is a collection of data designed to provide support for a prediction.
- (2) It is an educated guess that can be tested by experimentation.
- (3) It is a scientific fact that no longer requires any evidence to support it.
- (4) It is a general statement that is supported by many scientific observations.

3. A student was comparing preserved specimens of three plant species, X, Y, and Z, in a classroom. Which statement is an example of an observation the student could have made and not an inference?

- (1) The leaves produced by plant X are 4 cm across and 8 cm in length.
- (2) Plant Y has large purple flowers that open at night.
- (3) Plant X produces many seeds that are highly attractive to finches.
- (4) The flowers of plant Z are poisonous to household pets.

4. Which statement most accurately describes scientific inquiry?

- (1) It ignores information from other sources.
- (2) It does not allow scientists to judge the reliability of their sources.
- (3) It should never involve ethical decisions about the application of scientific knowledge.
- (4) It may lead to explanations that combine data with what people already know about their surroundings.

5. In 1910, Thomas Morgan discovered a certain pattern of inheritance in fruit flies known as sex linkage. This discovery extended the ideas of inheritance that Gregor Mendel had discovered while working with garden peas in 1865. Which principle of scientific inquiry does this illustrate?

- (1) A control group must be part of a valid experiment.
- (2) Scientific explanations can be modified as new evidence is found.
- (3) The same experiment must be repeated many times to validate the results.
- (4) Values can be used to make ethical decisions about scientific discovery.

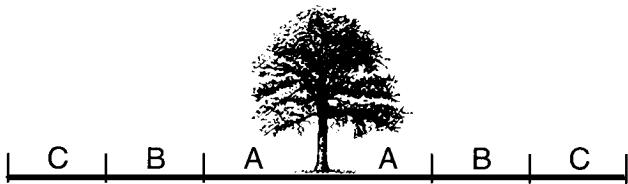
Name: _____ Topic 8B

Base your answers to questions 1 through 2 on the passage below and on your knowledge of biology.

Research indicates that many plants prevent the growth of other plants in their habitat by releasing natural herbicides (chemicals that kill plants). These substances are known as allelochemicals and include substances such as quinine, caffeine, and digitalis. Experiments have confirmed that chemicals in the bark and roots of black walnut trees are toxic, and when released into the soil they limit the growth of crop plants such as tomatoes, potatoes, and apples. Allelochemicals can alter growth and enzyme action, injure the outer cover of a seed so the seed dies, or stimulate seed growth at inappropriate times of the year. Studies on allelochemical effects help explain the observation that almost nothing grows under a black walnut tree even though light and moisture levels are adequate for growth.

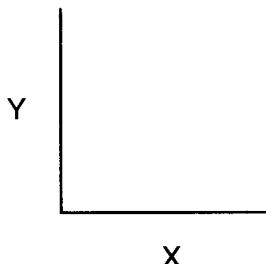
1. Which phrase best predicts the relative numbers of different plant species in regions A, B, and C in the diagram shown below?

Black walnut tree



- (1) greater in C than B
 - (2) greater in A than C
 - (3) greater in A than B
 - (4) greater in B than C

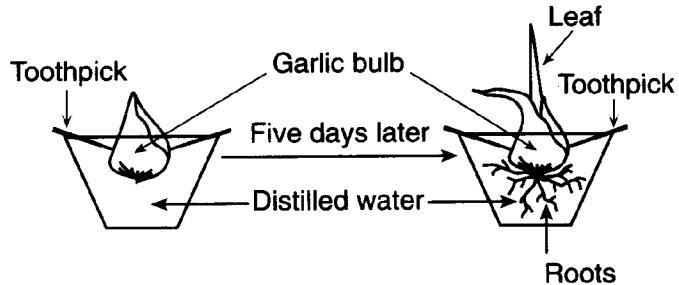
2. A set of axes is shown below.



When using this set of axes to show the effect of black walnut allelochemicals on the number of plants, which labels would be appropriate for axis X and axis Y?

- (1) X — Number of Plants
Y — Distance from Walnut Tree Trunk (meters)
 - (2) X — Distance from Walnut Tree Trunk (meters)
Y — Number of Plants
 - (3) X — Number of Plants
Y—Time (days)
 - (4) X — Time (days)
Y — Number of Plants

3. The diagram below illustrates the result of growing a garlic bulb in a cup of distilled water over five days.



Design an experiment consisting of a control and three different experimental groups to test the prediction, "Garlic grows better as the salt concentration of the solution in which it is grown increases." In your answer, be sure to:

- describe the control to be used in the experiment [1]
 - describe the difference between the three experimental groups [1]
 - state one type of measurement that should be made to determine if the prediction is accurate [1]
 - describe one example of experimental results that would support the prediction [1]

4. The drugs usually used to treat high blood pressure do not affect blood vessels in the lungs. Bosentan is a new drug being studied as a treatment for high blood pressure in the lungs. In an experiment, patients treated with bosentan showed an improvement in the distance they could walk without fatigue within 12 weeks. Design an experiment to test the effectiveness of bosentan as a drug to treat high blood pressure in the lungs. In your answer be sure to:

- state the hypothesis your experiment will test [1]
 - state how the control group will be treated differently from the experimental group [1]
 - state two factors that must be kept the same in both the experimental and control groups [1]
 - state the type of data that should be collected to determine if the hypothesis is supported [1]
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6. A scientist wants to determine the best conditions for hatching brine shrimp eggs. In a laboratory, brine shrimp hatch at room temperature in glass containers of salt water. The concentration of salt in the water is known to affect how many brine shrimp eggs will hatch.

Design an experiment to determine which of three saltwater concentrations (2%, 4%, or 6%) is best for hatching brine shrimp eggs. In your experimental design, be sure to:

- state how many containers to use in the experiment, and describe what would be added to each container in addition to the eggs [1]
 - state two factors that must be kept constant in all the containers [1]
 - state what data must be collected during this experiment [1]
 - state one way to organize the data so that they will be easy to analyze [1]
 - describe a result that would indicate the best salt solution for hatching brine shrimp eggs [1]
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5. A student hypothesizes that the pulse rate of a person and background music that is playing are related. The student designs an experiment to test this hypothesis. What would be an appropriate control for this experiment? [1]

7. The concentration of salt in water affects the hatching of brine shrimp eggs. Brine shrimp eggs will develop and hatch at room temperature in glass containers of salt solution.

Describe a controlled experiment using three experimental groups that could be used to determine the best concentration of salt solution in which to hatch brine shrimp eggs. Your answer must include at least:

- a description of how the control group and each of the three experimental groups will be different [1]
- two conditions that must be kept constant in the control group and the experimental groups [2]
- data that should be collected [1]
- one example of experimental results that would indicate the best concentration of salt solution in which to hatch brine shrimp eggs [1]

- state one result of the experiment that would support the hypothesis [1]

9. A student squeezed a clothespin as many times as possible in a 30-second time period. The student repeated this procedure nine more times in quick succession. The data obtained are in the chart below.

Trial	Number of Squeezes in 30 Seconds
1	32
2	29
3	28
4	27
5	26
6	25
7	23
8	21
9	19
10	17

State one hypothesis that this data would support concerning the relationship between number of trials and number of squeezes in 30 seconds. [1]

8. A certain plant has white flower petals and it usually grows in soil that is slightly basic. Sometimes the plant produces flowers with red petals. A company that sells the plant wants to know if soil pH affects the color of the petals in this plant. Design a controlled experiment to determine if soil pH affects petal color. In your experimental design be sure to:

- state the hypothesis to be tested in the experiment [1]
- state one way the control group will be treated differently from the experimental group [1]
- identify two factors that must be kept the same in both the control group and the experimental group [1]
- identify the dependent variable in the experiment [1]

10. An experiment was carried out to determine how competition for living space affects plant height. Different numbers of plants were grown in three pots, A, B, and C. All three pots were the same size. The data collected are shown in the table below.

	Average Daily Plant Height (mm)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Pot A—5 plants	2	4	6	8	10	14	16
Pot B—10 plants	2	4	6	8	10	12	12
Pot C—20 plants	2	2	2	6	6	8	8

Analyze the experiment that produced the data shown in the table. In your answer be sure to:

- state a hypothesis for the experiment [1]
- identify one factor, other than pot size, that should have been kept the same in each experimental group [1]
- identify the dependent variable [1]
- state whether the data supports or fails to support your hypothesis and justify your answer [1]

11. Which statement best describes a controlled experiment?

- (1) It eliminates the need for dependent variables.
- (2) It shows the effect of a dependent variable on an independent variable.
- (3) It avoids the use of variables.
- (4) It tests the effect of a single independent variable.

Base your answers to questions 12 through 14 on the information below and on your knowledge of biology.

Arsenic and Old Glucocorticoids

cancer and other diseases. In January of 2001, the EPA (Environmental Protection Agency) lowered the acceptable levels of arsenic in drinking water from 50 ppb (parts per billion) to 10 ppb.

Researchers are now trying to determine how arsenic affects the body. Recent experiments suggest that arsenic may block the activity of hormones. One group of hormones affected by arsenic is glucocorticoids, which are responsible for activating many genes that appear to suppress cancer.

Rat tumor cells were used to determine the effect of arsenic on glucocorticoids. One group of cells was treated with a solution of synthetic glucocorticoid and arsenic, another with a solution of synthetic glucocorticoid and water, and a third group with a solution containing only water. Researchers then measured the activity of one of the genes that is usually activated by glucocorticoids. The genes in the cells treated with the hormone and arsenic mixture and those treated with just water did not become activated. The genes in the cells treated with the hormone and water mixture were activated. Researchers concluded that arsenic blocked the normal activity of the hormone. They are now extending their studies to determine if arsenic acts in a similar manner in other types of cells and in entire organisms.

12. Research suggests that a buildup of arsenic in the cells of humans may be harmful because

- (1) synthetic arsenic can be formed by the breakdown of glucocorticoids in the body
- (2) arsenic prevents the action of genes that are important in reactions that suppress cancer
- (3) arsenic prevents the reaction in which water and hormones bond and attach to cancer cells
- (4) glucocorticoids can build up in tissues and cause an increase in the absorption of arsenic

13. State one reason this study should be extended to other cells or to other complex organisms. [1]

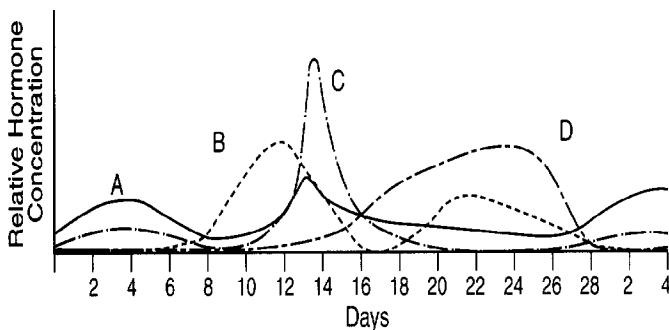
14. Identify one specific hormone in the body, other than glucocorticoid. Explain how disruption of the activity of the hormone you identified might upset a feedback mechanism in the body. [2]

15. Students were asked to determine if they could squeeze a clothespin more times in a minute after resting than after exercising. An experiment that accurately tests this question should include all of the following except

- (1) a hypothesis on which to base the design of the experiment
- (2) a large number of students
- (3) two sets of clothespins, one that is easy to open and one that is more difficult to open
- (4) a control group and an experimental group with equal numbers of students of approximately the same age

16. A student hypothesized that the pulse rate in humans would increase 1 hour after eating a meal. Pulse rates were obtained from nine classmates 1 hour after eating lunch. The data in beats per minute were recorded as: 60, 64, 56, 68, 72, 76, 72, 80, and 68. State one error in this experiment. [1]

1. The graph below shows the different concentrations of female reproductive hormones A, B, C, and D over a 28-day cycle.



Although the data used to make this graph was originally entered in a data table, most scientists prefer to see the information in the form of a graph because

- (1) the information in a graph is more accurate than the information in a data table
- (2) it is easier to see relationships between variables in a graph than in a data table
- (3) it is possible to put more information in a graph than in a data table
- (4) only graphs can be used to predict future trends

Base your answer to question 2 on the information below and on your knowledge of biology.

A student squeezes and releases a clothespin as often as possible for 2 minutes and then takes his pulse for 20 seconds. After a 2-minute rest, he repeats the procedure. This pattern is repeated one more time. The student's 20-second pulse counts were 23, 26, and 21.

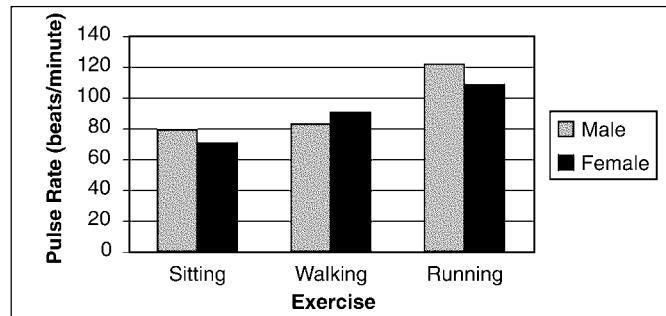
2. Complete the "Pulse/Min" column in the data table below for all three trials as well as the average pulse rate per minute. [1]

Pulse Rate After Activity

Trial	20-Second Pulse Counts	Pulse/Min
1	23	
2	26	
3	21	
Average		

Base your answer to question 3 on the information below and on your knowledge of biology.

In an investigation, 28 students in a class determined their pulse rates after performing each of three different activities. Each activity was performed three times during equal time intervals. The average results are shown in the graph below.



3. Before constructing the graph it would have been most helpful to organize the results of the investigation in

- (1) a research plan
- (2) an equation
- (3) a data table
- (4) a generalization

Base your answers to questions 1 through 4 on the information and data table below and on your knowledge of biology.

A number of bean seeds planted at the same time produced plants that were later divided into two groups, A and B. Each plant in group A was treated with the same concentration of gibberellic acid (a plant hormone). The plants in group B were not treated with gibberellic acid. All other growth conditions were kept constant. The height of each plant was measured on 5 consecutive days, and the average height of each group was recorded in the data table below.

Data Table

	Average Plant Height (cm)				
	Day 1	Day 2	Day 3	Day 4	Day 5
Group A	5	7	10	13	15
Group B	5	6	6.5	7	7.5

Directions (1–3): Using the information in the data table, construct a line graph on the grid in the next column, following the directions below.

1. Mark an appropriate scale on the axis labeled "Average Plant Height (cm)." [1]
2. Plot the data for the average height of the plants in group A. Surround each point with a small circle and connect the points. [1]



3. Plot the data for the average height of the plants in group B. Surround each point with a small triangle and connect the points. [1]



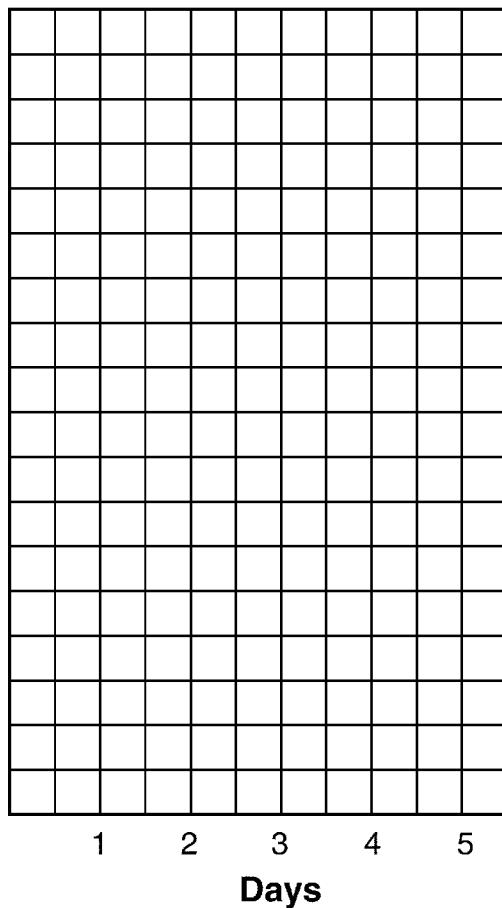
4. State a valid conclusion that can be drawn concerning the effect of gibberellic acid on bean plant growth. [1]
-
-
-
-

Key

- | | |
|---|---------|
| ● | Group A |
| △ | Group B |

Plant Height

Average Plant Height (cm)



Base your answers to questions 5 through 9 on the information and data table below and on your knowledge of biology.

The effect of temperature on the action of pepsin, a protein-digesting enzyme present in stomach fluid, was tested. In this investigation, 20 milliliters of stomach fluid and 10 grams of protein were placed in each of five test tubes. The tubes were then kept at different temperatures. After 24 hours, the contents of each tube were tested to determine the amount of protein that had been digested. The results are shown in the table below.

Protein Digestion at Different Temperatures

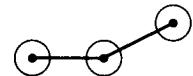
Tube #	Temperature (°C)	Amount of Protein Digested (grams)
1	5	0.5
2	10	1.0
3	20	4.0
4	37	9.5
5	85	0.0

5. The dependent variable in this investigation is the
(1) size of the test tube
(2) time of digestion
(3) amount of stomach fluid
(4) amount of protein digested

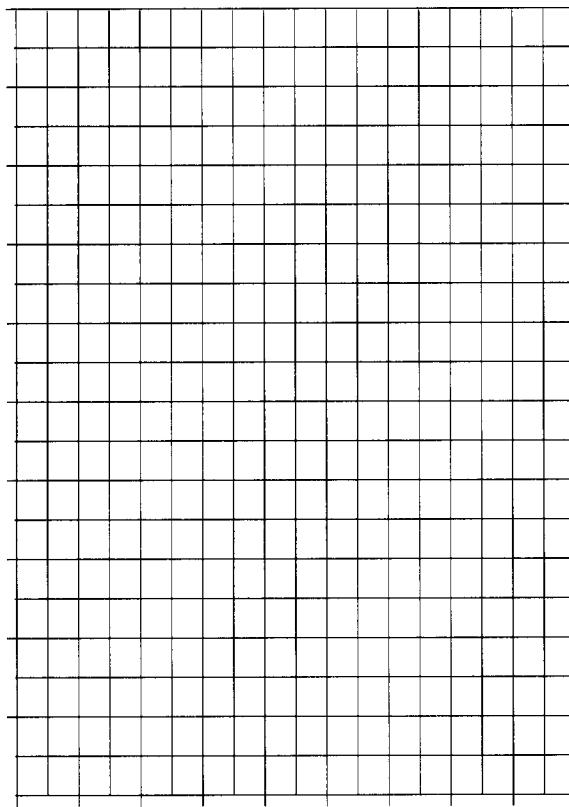
Directions (6—7) : Using the information in the data table, construct a line graph on the grid on page 15, following the directions below.

6. Mark an appropriate scale on each axis. [1]
7. Plot the data on the grid. Surround each point with a small circle and connect the points. [1]

Example:



Protein Digestion at Different Temperatures



8. If a sixth test tube identical to the other tubes was kept at a temperature of 30°C for 24 hours, the amount of protein digested would most likely be

- (1) less than 1.0 gram
(2) between 1.0 and 4.0 grams
(3) between 4.0 and 9.0 grams
(4) more than 9.0 grams

9. This investigation was repeated using 10 grams of starch instead of protein in each test tube. The contents of each tube were tested to determine the amount of starch that had been digested. The test results showed that no starch digestion occurred. Explain why no starch was digested. [1]

Base your answers to questions 10 through 14 on the passage and data table below and on your knowledge of biology.

The amount of oxygen gas dissolved in water is important to the organisms that live in a river. The amount of dissolved oxygen varies with changes in both physical factors and biological processes. The temperature of the water is one physical factor affecting dissolved oxygen levels as shown in the data table below. The amount of dissolved oxygen is expressed in parts per million (ppm).

Dissolved Oxygen Levels at Various Temperatures

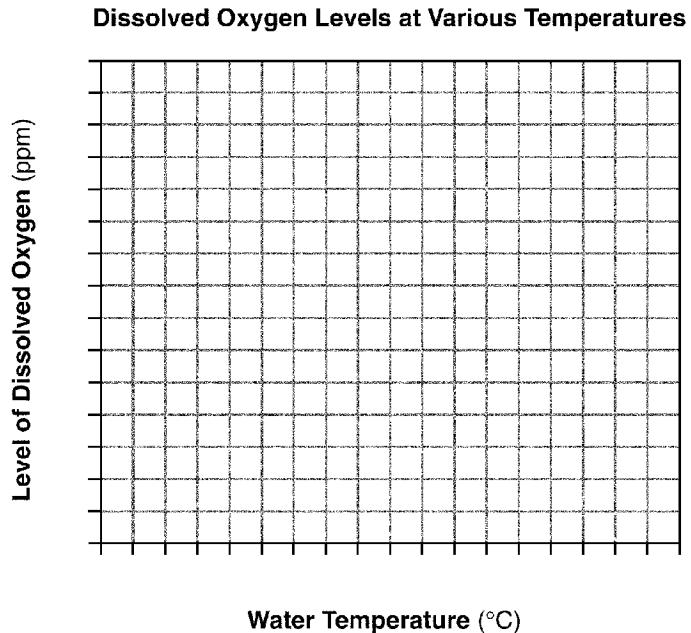
Water Temperature (°C)	Level of Dissolved Oxygen (ppm)
1	14
10	11
15	10
20	9
25	8
30	7

Directions (10–11): Using the information given, construct a line graph on the grid on page 13, following the directions below.

10. Mark an appropriate scale on each labeled axis. [1]

11. Plot the data for dissolved oxygen on the grid. Surround each point with a small circle and connect the points. [1]

Example:



12. If the trend continues as shown in the data, what would the dissolved oxygen level most likely be if the temperature of the water was 35°C? [1]

_____ ppm

13. State the relationship between the level of dissolved oxygen and water temperature. [1]

14. Identify one physical or biological process taking place within the river, other than temperature change, that would affect the level of dissolved oxygen and state whether this process would increase or decrease the level of dissolved oxygen. [1]

Base your answers to questions 15 through 19 on the information and data table below and on your knowledge of biology.

Biologists investigated the effect of the presence of aluminum ions on root tips of a variety of wheat. They removed 2-mm sections of the tips of roots. Half of the root tips were placed in a nutrient solution with aluminum ions, while the other half were placed in an identical nutrient solution without aluminum ions. The length of the root tips, in millimeters, was measured every hour for seven hours. The results are shown in the data table below.

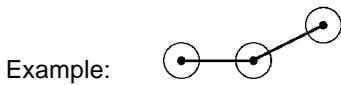
Data Table

Time (hr)	Length of Root Tips in Solution With Aluminum Ions (mm)	Length of Root Tips in Solution Without Aluminum Ions (mm)
0	2.0	2.0
1	2.1	2.2
2	2.2	2.4
3	2.4	2.8
4	2.6	2.9
5	2.7	3.2
6	2.8	3.7
7	2.8	3.9

Directions (15–17): Using the information in the data table, construct a line graph on the grid on the next page, following the directions below.

15. Mark an appropriate scale on each labeled axis. [1]

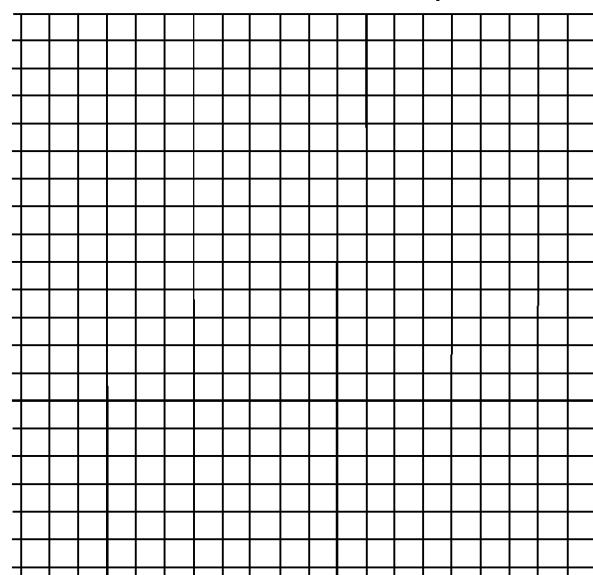
16. Plot the data for root tips in the solution with aluminum ions on the grid. Surround each point with a small circle and connect the points. [1]



17. Plot the data for root tips in the solution without aluminum ions on the grid. Surround each point with a small triangle and connect the points. [1]



Growth of Wheat Root Tips



Time (hr)

○ = Root tips in solution with aluminum ions

△ = Root tips in solution without aluminum ions

18. The aluminum ions most likely affected

- (1) photosynthetic rate
- (2) the union of gametes
- (3) mitotic cell division
- (4) starch absorption from the soil

19. Describe the effect of aluminum ions on the growth of the root tips of wheat. [1]

Base your answers to questions 20 through 23 on the information and data table below and on your knowledge of biology.

Tooth decay occurs when bacteria living in the mouth produce an acid that dissolves tooth enamel (the outer, protective covering of a tooth).

The Effect of Sugar Intake on Tooth Decay

World Regions	Average Sugar Intake per Person (kg/year)	Average Number of Teeth with Decay per Person
Americas	40	3.0
Africa	18	1.7
Southeast Asia	14	1.6
Europe	36	2.6

Directions (20–22) : Using the information in the data table, construct a bar graph on the grid on page 17, following the directions below.

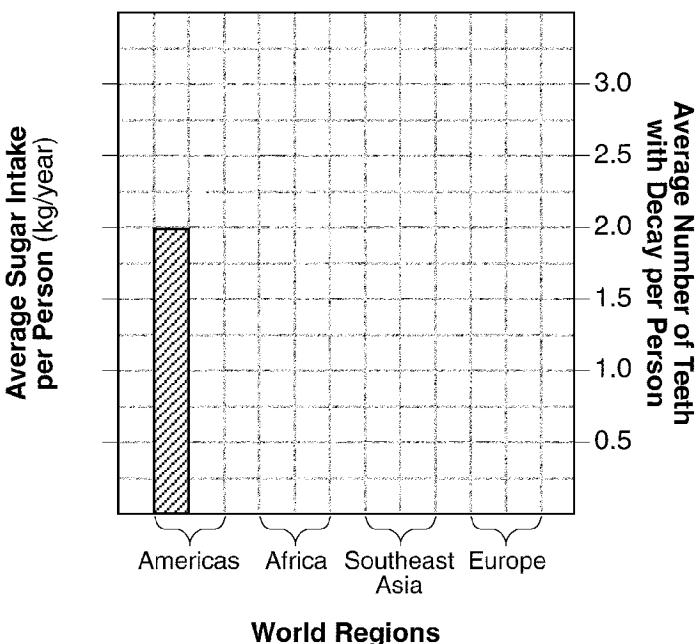
20. Mark an appropriate scale on the axis labeled "Average Sugar Intake per Person." [1]
21. Construct vertical bars in the bracketed area for each world region to represent the "Average Sugar Intake per Person." Place the bars on the left side of each bracketed region and shade the bars as shown below. (The bar for Americas has been done for you.) [1]



22. Construct vertical bars in the bracketed area for each world region to represent the "Average Number of Teeth with Decay per Person." Place the bars on the right side of each bracketed region and shade in each bar as shown below. [1]



Effect of Sugar Intake on Tooth Decay

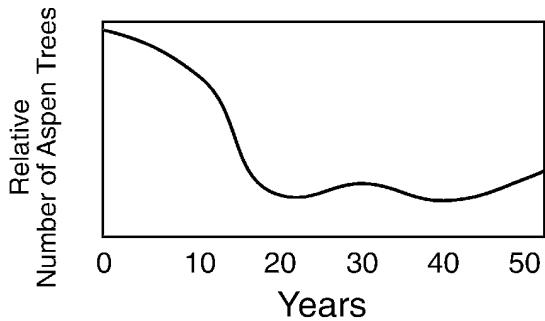
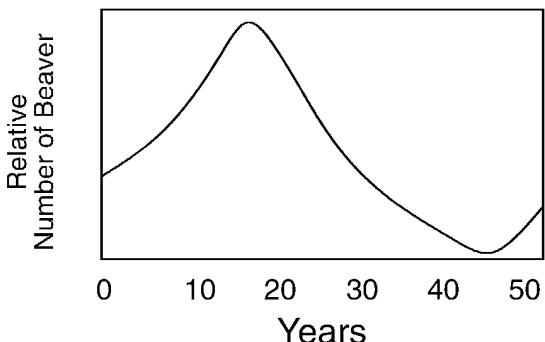


Key	
	Average Sugar Intake per Person
	Average Number of Teeth with Decay per Person

23. Which statement is a valid conclusion regarding tooth decay?

- As sugar intake increases, the acidity in the mouth decreases, reducing tooth decay.
- As sugar intake increases, tooth decay increases in Europe and the Americas, but not in Africa and Southeast Asia.
- The greater the sugar intake, the greater the average number of decayed teeth.
- The greater the sugar intake, the faster a tooth decays.

Base your answers to questions 1 through 3 on the graphs below, which show changes in the number of aspen trees and the beaver population in an area over a 50-year period.



1. State the relationship that exists between the number of aspen trees and the beaver populations in this region during the first 15 years. [1]
-
-
-

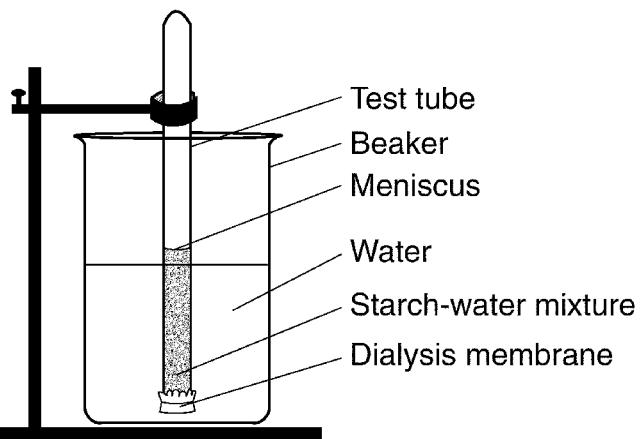
2. State one possible reason for the relationship between the aspen tree and the beaver populations. [1]
-
-
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-

3. Predict how the number of aspen trees would change if a parasite that targets the beaver population were introduced into the area during year 5. Explain your answer. [1]
-
-
-

4. A science researcher is reviewing another scientist's experiment and conclusion. The reviewer would most likely consider the experiment invalid if

- (1) the sample size produced a great deal of data
- (2) other individuals are able to duplicate the results
- (3) it contains conclusions not explained by the evidence given
- (4) the hypothesis was not supported by the data obtained

5. A laboratory setup for a demonstration is represented in the diagram below.



Describe how an indicator can be used to determine if starch diffuses through the membrane into the beaker. In your answer, be sure to include:

- the procedure used [1]
 - how to interpret the results [1]
-
-
-
-

Base your answer to question 6 on the information below and on your knowledge of biology.

A student squeezes and releases a clothespin as often as possible for 2 minutes and then takes his pulse for 20 seconds. After a 2-minute rest, he repeats the procedure. This pattern is repeated one more time. The student's 20-second pulse counts were 23, 26, and 21.

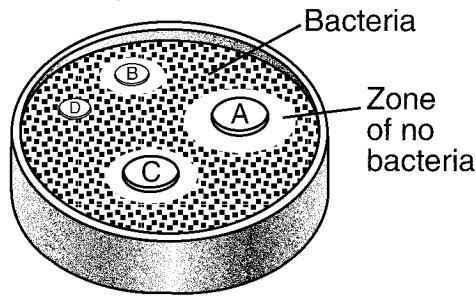
6. What additional data should the student have collected in order to determine the effect of squeezing a clothespin on his pulse rate? [1]
-
-

7. A student performed an experiment to determine if treating 500 tomato plants with an auxin (a plant growth hormone) will make them grow faster. The results are shown in the table below.

Days	Average Stem Height (cm)
1	10
5	13
10	19
15	26
20	32
25	40

Explain why the student can not draw a valid conclusion from these results. [1]

8. An experiment was carried out to determine which mouthwash was most effective against bacteria commonly found in the mouth. Four paper discs were each dipped into a different brand of mouthwash. The discs were then placed onto the surface of a culture plate that contained food, moisture, and bacteria commonly found in the mouth. The diagram below shows the growth of bacteria on the plate after 24 hours.

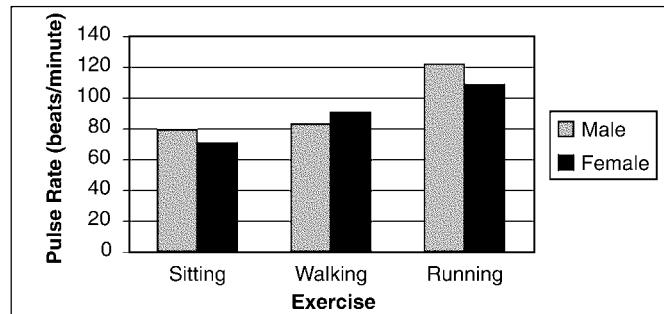


Which change in procedure would have improved the experiment?

- (1) using a smaller plate with less food and moisture
- (2) using bacteria from many habitats other than the mouth
- (3) using the same size paper discs for each mouthwash
- (4) using the same type of mouthwash on each disc

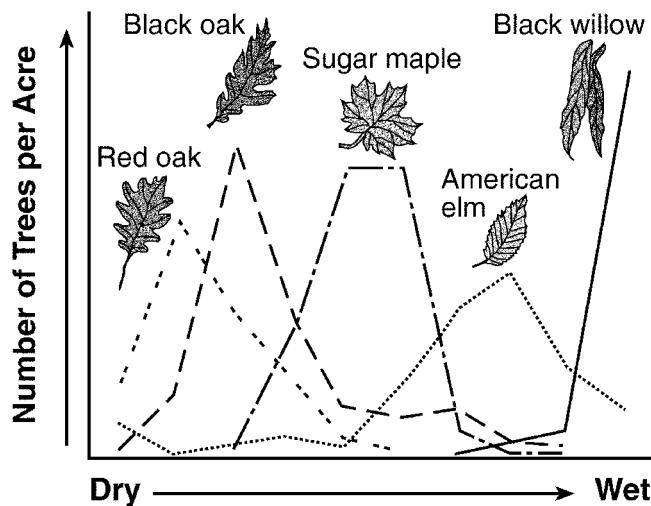
Base your answer to question 9 on the information below and on your knowledge of biology.

In an investigation, 28 students in a class determined their pulse rates after performing each of three different activities. Each activity was performed three times during equal time intervals. The average results are shown in the graph below.



9. Some students concluded that males always have a higher pulse rate than females. Does the graph support this conclusion? Justify your answer. [1]

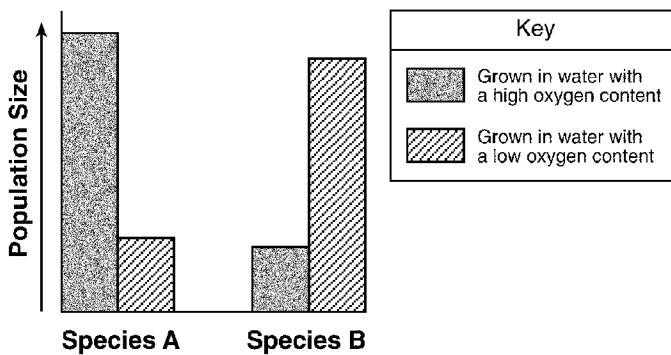
10. The graph below shows the effect of moisture on the number of trees per acre of five tree species.



Which observation best represents information shown in the graph?

- (1) All five species grow in the same habitat.
- (2) The American elm grows in the widest range of moisture conditions.
- (3) Red oaks can grow in wetter conditions than black willows.
- (4) Sugar maples can grow anywhere black oaks can grow.

11. A graph of the population growth of two different species is shown below.



Which conclusion can be drawn from information in the graph?

- (1) Oxygen concentration affects population sizes of different species in the same manner.
- (2) Species A requires a high oxygen concentration for maximum population growth.
- (3) Species B requires a high oxygen concentration to stimulate population growth.
- (4) Low oxygen concentration does not limit the population size of either species observed.

Base your answers to questions 12 and 13 on the data table below and on your knowledge of biology. The table contains information about glucose production in a species of plant that lives in the water of a salt marsh.

Temperature (°C)	Glucose Production (mg/hr)
10	5
20	10
30	15
40	5

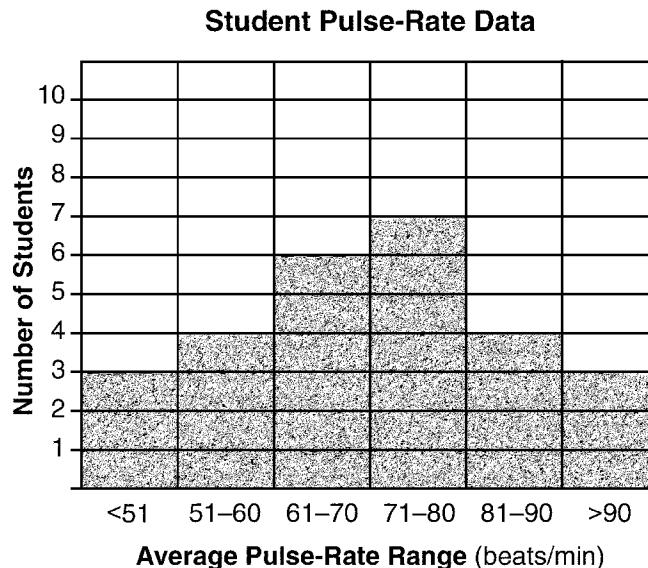
12. Which terms describe temperature in this investigation?

- (1) abiotic factor and independent variable
- (2) abiotic factor and dependent variable
- (3) biotic factor and independent variable
- (4) biotic factor and dependent variable

13. What evidence from the data table shows that a saltmarsh plant is sensitive to its environment? [1]

Base your answers to questions 14 through 16 on the information and graph below and on your knowledge of biology.

Pulse-rate data were collected from some students during their lunch time for the lab activity, Making Connections. The data are represented in the histogram below.



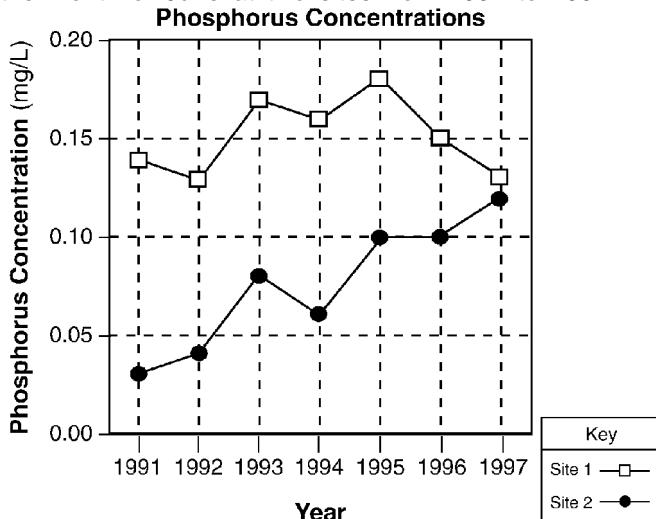
14. The histogram includes data from a total of how many students?

- | | |
|-------|--------|
| (1) 6 | (3) 10 |
| (2) 7 | (4) 27 |

15. Describe one way in which a pulse rate below 45 would disrupt homeostasis in an individual whose average resting pulse rate falls in the range of 71–80. [1]

16. State one way the data would most likely be different if the pulse rates were collected immediately after exercising instead of during lunch. [1]

17. Compounds containing phosphorus that are dumped into the environment can upset ecosystems because phosphorus acts as a fertilizer. The graph below shows measurements of phosphorus concentrations taken during the month of June at two sites from 1991 to 1997.



Which statement represents a valid inference based on information in the graph?

- (1) There was no decrease in the amount of compounds containing phosphorus dumped at site 2 during the period from 1991 to 1997.
- (2) Pollution controls may have been put into operation at site 1 in 1995.
- (3) There was most likely no vegetation present near site 2 from 1993 to 1994.
- (4) There was a greater variation in phosphorous concentration at site 1 than there was at site 2

18. Information concerning the diet of crocodiles of different sizes is contained in the table below.

Percentage of Crocodiles of Different Lengths and Their Food Sources

Food Source	Group A 0.3–0.5 Meter	Group B 2.5–3.9 Meters	Group C 4.5–5.0 Meters
mammals	0	18	65
reptiles	0	17	48
fish	0	62	38
birds	0	17	0
snails	0	25	0
shellfish	0	5	0
spiders	20	0	0
frogs	35	0	0
insects	100	2	0

Which statement is not a valid conclusion based on the data?

- (1) Overharvesting of fish could have a negative impact on group C.
- (2) The smaller the crocodile is, the larger the prey.
- (3) Group B has no preference between reptiles and birds.
- (4) Spraying insecticides would have the most direct impact on group A.

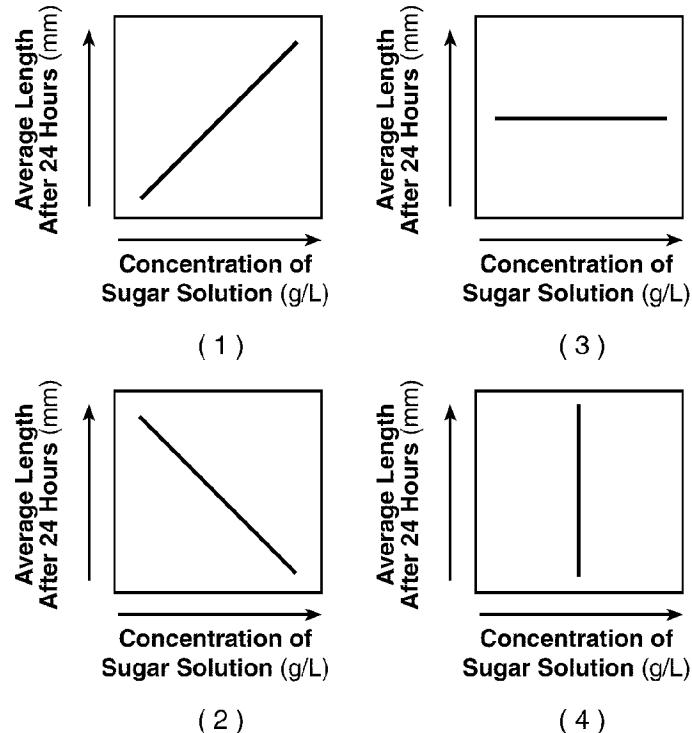
Base your answer to question 19 on the information below and on your knowledge of biology.

Students cut 20 rod-shaped pieces of potato of the same diameter and length. Five pieces of potato were placed into each of four beakers containing different concentrations of sugar solutions. Each potato piece was measured again after 24 hours. The table below shows the results of their experiment.

Change in Length

Concentration of Sugar Solution (grams per liter)	Original Length of Potato Pieces (mm)	Average Length After 24 Hours (mm)
0	50.0	52.0
5	50.0	44.0
8	50.0	43.5
10	50.0	42.5

19. Which graph best represents the information in the data table?



Base your answers to questions 20 and 21 on the information and data table below and on your knowledge of biology.

Two students collected data on their pulse rates while performing different activities. Their average results are shown in the data table below.

Data Table

Activity	Average Pulse Rate (beats/min)
sitting quietly	70
walking	98
running	120

20. State the relationship between activity and pulse rate. [1]
-
-
-

21. State one way that this investigation could be improved. [1]
-
-
-

Base your answers to question 22 on the information and data table below and on your knowledge of biology.

A student studied the location of single-celled photosynthetic organisms in a lake for a period of several weeks. The depth at which these organisms were found at different times of the day varied greatly. Some of the data collected are shown in the table below.

Data Table

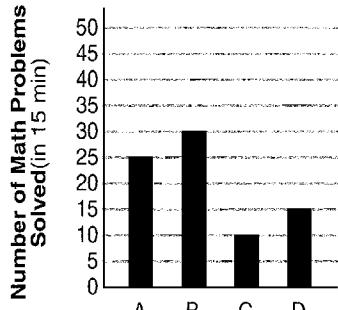
Light Conditions at Different Times of the Day	Average Depth of Photosynthetic Organisms (cm)
full light	150
moderate light	15
no light	10

22. A valid inference based on these data is that
- most photosynthetic organisms live below a depth of 150 centimeters
 - oxygen production increases as photosynthetic organisms move deeper in the lake
 - photosynthetic organisms respond to changing light levels
 - photosynthetic organisms move up and down to increase their rate of carbon dioxide production

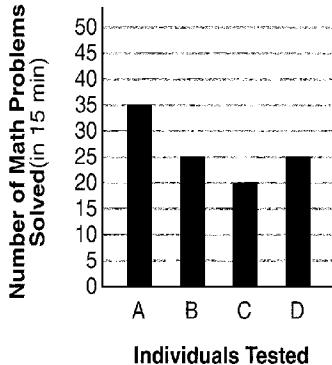
Base your answers to questions 23 and 24 on the information below and on your knowledge of biology.

A student read a magazine article that claimed people who exercise for 30 minutes are able to solve more math problems than if they had not exercised. The student convinced four of his friends to test this claim. First, he gave them 15 minutes to do 50 math problems. The number each person solved is shown in the trial 1 graph. Next, all four of the students exercised for 30 minutes. At the end of the 30 minutes, they were given another 50 math problems of equal difficulty for the same amount of time. The number of math problems each student solved is shown in the trial 2 graph.

Trial 1:
Before Exercise



Trial 2:
After Exercise



23. Explain why exercise could influence the ability of a student to solve math problems. [1]
-
-
-

24. State whether or not exercising for 30 minutes improved the ability of students to solve math problems. Support your answer using data from the graphs. [1]
-
-
-

25. The data in the table below were collected during a reaction-time experiment conducted in five biology classes. Average reaction times for each class were determined first at room temperature and then after cooling each student's hand in cold water for two minutes. Average Reaction Times to Grab a Falling Ruler

Average Reaction Times to Grab a Falling Ruler

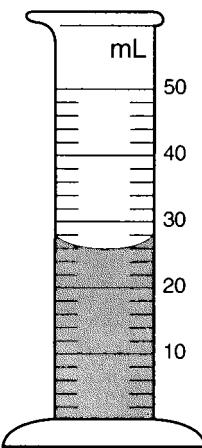
Class	At Room Temperature (seconds)	After Cooling (seconds)
1	.42	.48
2	.36	.41
3	.35	.47
4	.43	.58
5	.44	.47
Averages	.40	.48

Which statement is best supported by the data?

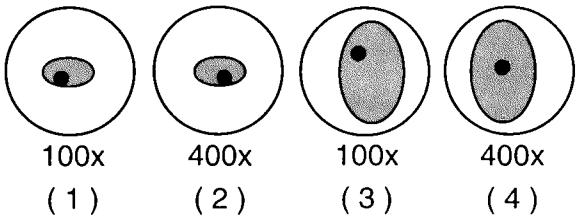
- (1) Cooling the hand increases the reaction time.
- (2) Cooling the hand does not affect the reaction time.
- (3) Cooling the hand affects only some subjects.
- (4) Two minutes of cooling is not enough to affect reaction time.

1. What is the volume of the liquid in the graduated cylinder shown below?

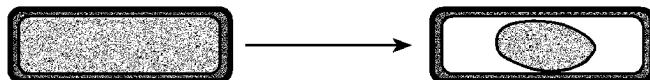
- (1) 23 mL
 - (2) 26 mL
 - (3) 27 mL
 - (4) 28 mL



2. The diagrams below show four different one-celled organisms (shaded) in the field of view of the same microscope using different magnifications. Which illustration shows the largest one-celled organism?



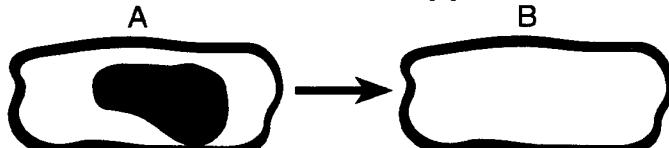
3. A red onion cell has undergone a change, as represented in the diagram below.



This change is most likely due to the cell being placed in
(1) distilled water (3) salt water
(2) light (4) darkness

4. A student prepared a wet-mount slide of some red onion cells and then added some salt water to the slide. The student observed the slide using a compound light microscope. Diagram A is typical of what the student observed after adding salt water.

Complete diagram B to show how the contents of the red onion cells should appear if the cell were then rinsed with distilled water for several minutes. [1]

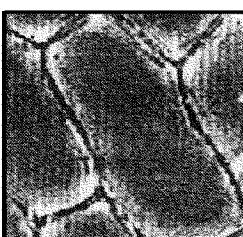


Red onion cell in salt water

Red onion cell
after rinsing with
distilled water

Base your answers to questions 5 through 7 on the information and diagram below.

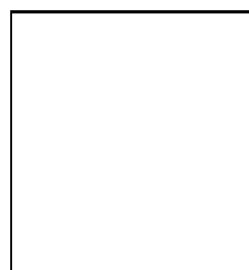
A student prepared a wet-mount slide of red onion skin and observed it under high power of a compound light microscope (view A). After adding a substance to the slide and waiting one minute, the student observed that there were changes in the cells (view B).

View A	View B
	

5. Identify one substance that could have been added to the cells on the slide in view A that would make them resemble the cells observed in view B. [1]

6. Identify the specific substance that diffused to cause the change in appearance from view A to view B. [1]

7. In the box below, sketch how view B would appear when viewed under lower power of the same compound light microscope. [1]



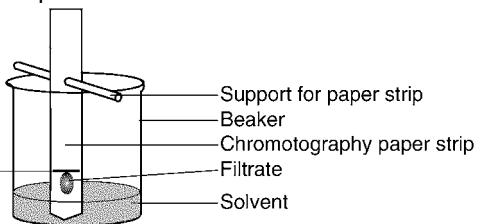
8. An indicator for a protein is added to a solution that contains protein and to a solution that does not contain protein. State one way, other than the presence or absence of protein, that the two solutions may differ after the indicator has been added to both. [1]

Base your answers to questions 9 through 11 on the information below and on your knowledge of biology.

Paper chromatography can be used to investigate evolutionary relationships.

Leaves from a plant were ground and mixed with a solvent. The mixture of ground leaves and solvent was then filtered. Using a toothpick, twenty drops of the filtrate (material that passed through the filter) were placed at one spot on a strip of chromatography paper.

This procedure was repeated using leaves from three other species of plants. A separate strip of chromatography paper was prepared for each plant species. Each of the four strips of chromatography paper was placed in a different beaker containing the same solvent for the same amount of time. One of the laboratory setups is shown below.



9. State one reason for using a new toothpick for the filtrate from each plant. [1]

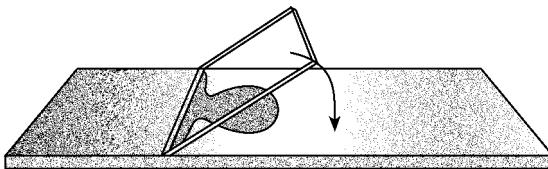
10. State one way the four strips would most likely be different from each other after being removed from the beakers. [1]

11. State how a comparison of these resulting strips could indicate evolutionary relationships. [1]

12. While viewing a specimen under high power of a compound light microscope, a student noticed that the specimen was out of focus. Which part of the microscope should the student turn to obtain a clearer image under high power?

- (1) eyepiece (3) fine adjustment
(2) coarse adjustment (4) nosepiece

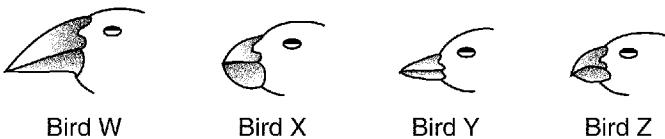
13. The diagram below shows how a coverslip should be lowered onto some single-celled organisms during the preparation of a wet mount.



Why is this a preferred procedure?

- (1) The coverslip will prevent the slide from breaking.
 - (2) The organisms will be more evenly distributed.
 - (3) The possibility of breaking the coverslip is reduced.
 - (4) The possibility of trapping air bubbles is reduced.

14. The dichotomous key shown below can be used to identify birds W, X, Y, and Z.



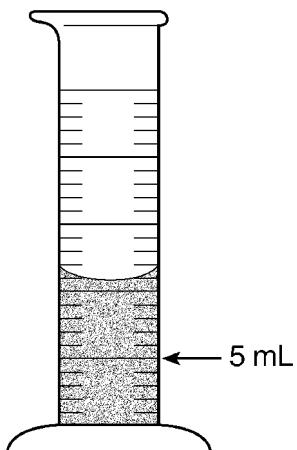
Dichotomous Key to Representative Birds

1. a. The beak is relatively long and slender.....*Certhidea*
 b. The beak is relatively stout and heavy.....go to 2
 2. a. The bottom surface of the lower beak is flat and straight*Geospiza*
 b. The bottom surface of the lower beak is curved.....go to 3
 3. a. The lower edge of the upper beak has a distinct bend*Camarhynchus*
 b. The lower edge of the upper beak is mostly flat*Platyspiza*

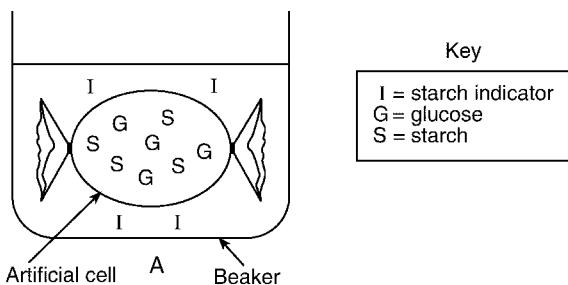
Bird X is most likely

- 15 How much water should be removed from the graduated cylinder shown below to leave 5 milliliters of water in the cylinder? 

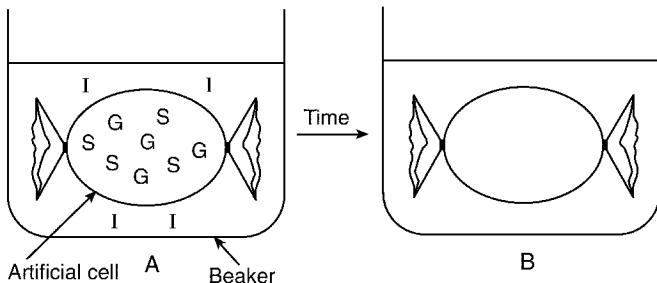
- (1) 6 mL
 - (2) 7 mL
 - (3) 11 mL
 - (4) 12 mL



Base your answers to questions 16 and 17 on the information and diagram below and on your knowledge of biology. The diagram illustrates an investigation carried out in a laboratory activity on diffusion. The beaker and the artificial cell also contain water.



16. Predict what would happen over time by showing the location of molecules I, G, and S in diagram B below. [3]

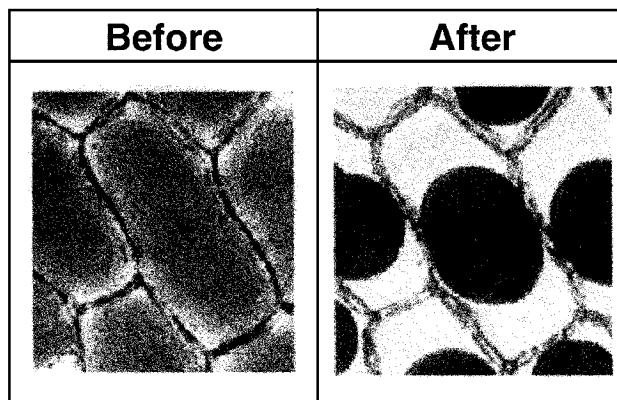


17. State what is observed when there is a positive test for starch using the starch indicator. [1]
-
-
-

18. A student prepared a slide of pollen grains from a flower. First the pollen was viewed through the low-power objective lens and then, without moving the slide, viewed through the high-power objective lens of a compound light microscope. Which statement best describes the relative number and appearance of the pollen grains observed using these two objectives?

- (1) low power: 25 small pollen grains high power: 100 large pollen grains
- (2) low power: 100 small pollen grains high power: 25 large pollen grains
- (3) low power: 25 large pollen grains high power: 100 small pollen grains
- (4) low power: 100 large pollen grains high power: 25 small pollen grains

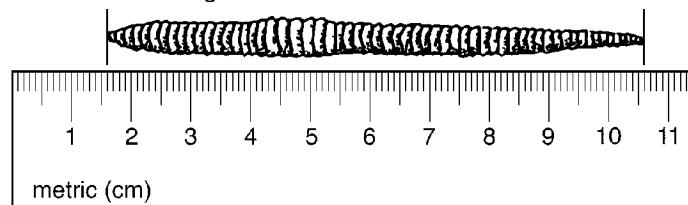
Base your answers to questions 19 and 20 on the information and diagram below and on your knowledge of biology. The diagram represents some cells on a microscope slide before and after a substance was added to the slide.



19. Identify a substance that was most likely added to the slide to cause the change observed. [1]
-

20. Describe a procedure that could be used to add this substance to the cells on the slide without removing the coverslip. [1]
-
-
-

21. What is the approximate length of the earthworm shown in the diagram below?



- (1) 9 mm
- (2) 90 mm
- (3) 10.6 cm
- (4) 106 cm

Base your answers to question 22 on the information and data table below and on your knowledge of biology.

A student studied the location of single-celled photosynthetic organisms in a lake for a period of several weeks. The depth at which these organisms were found at different times of the day varied greatly. Some of the data collected are shown in the table below.

Data Table

Light Conditions at Different Times of the Day	Average Depth of Photosynthetic Organisms (cm)
full light	150
moderate light	15
no light	10

22. Which materials would the student most likely have used in this investigation?

- (1) microscope, pipette, and slides with cover-slips
- (2) graduated cylinder, triple-beam balance, and chromatography paper
- (3) thermometer, electric balance, and biological stains
- (4) computer, pH paper, and gel electrophoresis apparatus

Price: \$5.95

Name: _____

Teacher: _____

The Living Environment Regents is
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