HSA

Maryland High School Assessment

Maryland State Department of Education

Achievement Matters Most

BIOLOGY

Public Release 2005

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Sample A

Which of these instruments should a student use to measure the length of a housefly?

A microscope

B metric ruler

C funnel

D graduated cylinder

Sample B

Which of these systems <u>directly</u> provides support for the human body?

F skeletal

G excretory

H endocrine

J reproductive

STOP

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1 **Students will conduct a laboratory experiment using the following materials: a Bunsen burner, a beaker of water, glass tubing, four test tubes containing different chemicals, and rubber stoppers. Which of these steps is <u>most</u> critical for students to follow when using these materials in the lab?**

A wearing eye protection at all times

B writing the lab procedure in a notebook

C washing hands before starting the experiment

D placing a stopper on all test tubes before heating them

2 **Which of these are the repeating units that form a DNA molecule?**

F fatty acids

G nucleotides

H amino acids

J chromosomes

GO ON

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3 **The table below shows the number of species of different types of simple land plants.**

NUMBER OF SIMPLE PLANT SPECIES

Simple Plants	Number of Species
Bryophytes	20,000
Club mosses, spike mosses, and horsetails	1,000
Ferns	12,000
Total	**33,000**

According to the table, approximately what proportion of all simple plant species are bryophytes?

A $\frac{1}{3}$

B $\frac{1}{2}$

C $\frac{2}{3}$

D $\frac{3}{4}$

4 **A protein called p53 can keep cells from dividing. To prevent cell division, this protein <u>most likely</u> stops**

F osmosis

G mitosis

H respiration

J mutation

GO ON

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5
BCR

A student reads an advertisement from a fertilizer company. The advertisement claims their fertilizer increases the growth of tomato plants by 25 percent. The student decides to perform an experiment to test this claim. She performs the following procedure.

1. **Choose three similar-sized tomato plants.**
2. **Plant each tomato plant in a small pot.**
3. **Place all three small pots into one container and place on a window sill.**
4. **Add fertilizer mixed with water to Plants 1 and 2.**
5. **Add only water to Plant 3.**
6. **Record the heights of the three plants after four weeks.**

The student's results are shown in the table below.

THE EFFECT OF FERTILIZER ON TOMATO PLANTS

Plant	Height (centimeters)
1	23
2	20
3	20

Analyze the student's experiment to determine if it supports the claims made in the fertilizer company's advertisement. In your response, be sure to include

- **a description of the data needed to support the company's claim**
- **an explanation of the results of the student's experiment**
- **an evaluation of the student's experiment**
- **a description of any changes you would make to the experiment; explain your answer**

Write your answer in your Answer Book.

GO ON

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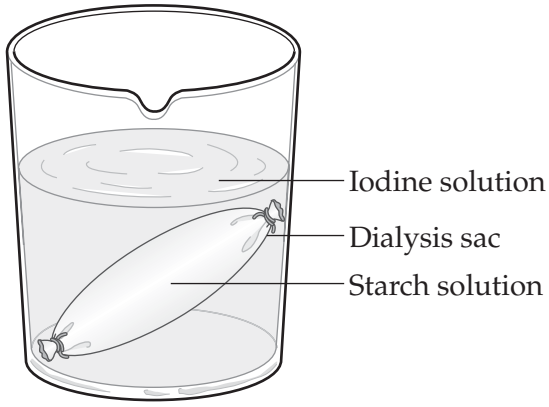
Directions

Use the information and the diagram below to answer Numbers 6 and 7.

Starch turns blue-black in the presence of iodine solution. A selectively permeable dialysis sac containing a starch solution is placed into a beaker of iodine solution.



6 **If the dialysis sac is permeable <u>only</u> to water and iodine, what will the solutions in the beaker and the sac look like after two hours?**

F The iodine solution in the beaker will turn blue-black; the starch solution will not change.

G The starch solution in the dialysis sac will turn blue-black; the iodine solution will not change.

H Neither solution will turn blue-black.

J Both solutions will turn blue-black.

7 **Which of these processes is demonstrated by the experiment shown in the diagram?**

A cellular respiration

B active transport

C endocytosis

D diffusion

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8 **A scientist is performing an investigation funded by a company. Which of these would be <u>least likely</u> to produce biased data?**

F making the results please the company paying for the research

G being open minded and honest throughout the research project

H using only the data that supports the hypothesis

J using personal opinions to decide the results of the research

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9 **The energy required for photosynthesis is provided by**

A proteins

B sunlight

C chlorophyll

D carbohydrates

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Directions

Use the technical passage below to answer Numbers 10 and 11.

SHORTAGE OF HONEYBEES

Honeybees are very important to agriculture. They produce honey and they pollinate many plants, making seed and fruit development possible. In recent years, severe weather and attacks by newly introduced insects have seriously affected both wild and domestic honeybee populations.

Two species of mites entered North America around 1980. These mites weaken and kill honeybees by consuming their bodily fluids, blocking their respiratory passages, and spreading germs. European and South American honeybees developed an immunity to the effects of these mites. However, North American honeybees did not develop this immunity. By 1995, infestation with mites reached epidemic levels. In addition, the harsh winter of 1995 to 1996 killed honeybee colonies in many states.

Scientists have observed a significant decline in both wild and domestic honeybee populations. This loss affects beekeepers and farmers. Fifteen percent of all agricultural crops require bee pollination. Farmers have had to look for other species to pollinate their crops.

Honeybees are not the only pollinators that have decreased in numbers. Many other insect and vertebrate pollinators throughout the world have been killed by the overuse of pesticides and habitat destruction. Many wild plants, including a number of endangered species, depend entirely on one animal species for pollination. The solutions to this "pollination crisis" are complex. It is clear that efforts to save threatened pollinators cannot be separate from efforts to preserve threatened plants and habitats.

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10 **According to the passage, which of these is <u>most</u> responsible for the decline of honeybee populations?**

F an increase in pollution

G the use of bees to harvest honey

H the introduction of foreign species

J the use of bees to pollinate crops

11 **South American honeybees are resistant to the mites. Scientists believe that the North American honeybees may also become resistant to the mites in another ten years.**

Which of these processes will cause the honeybee population to become resistant to the mites?

A natural selection

B chemosynthesis

C aerobic respiration

D succession

12 **A sperm cell of a moth has 112 chromosomes. How many chromosomes are in the moth's wing cells?**

F 66

G 112

H 224

J 448

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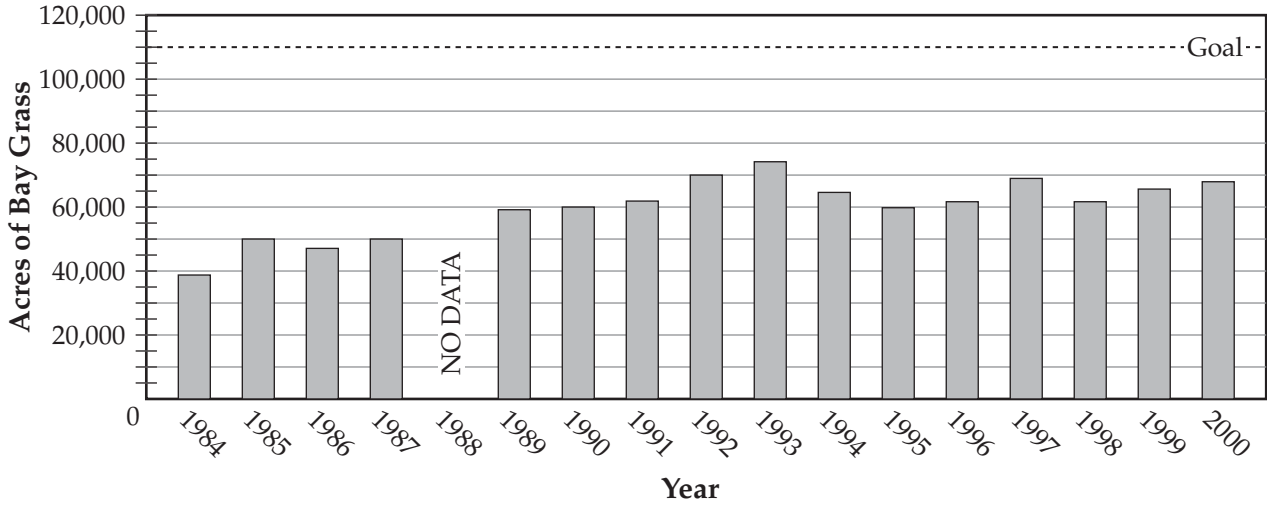
13
BCR

There are approximately 14 species of bay grasses in Chesapeake Bay. Bay grasses provide a habitat for birds, fish, and shellfish. Most bay grasses grow attached to the bottom substrate in shallow water.

Scientists estimate that the area covered by bay grasses once exceeded 600,000 acres. In 1978, scientists learned that bay grasses only covered 41,000 acres.

Scientists began working to improve environmental conditions in the bay. They replanted bay grasses in some areas. They set a goal of having 110,000 acres of bay grasses by the year 2000. The data collected from yearly surveys of bay grasses is shown in the graph below.

BAY GRASS COVERAGE IN CHESAPEAKE BAY
(1984–2000)



Evaluate the success of this project. In your response, be sure to

- **predict the most likely value for the missing data in 1988; explain your answer**
- **describe the trend in the area covered by bay grasses in Chesapeake Bay from 1984 to 2000; use specific information from the graph to support your answer**
- **suggest possible reasons for the changes in the graph between 1993 and 1995**
- **describe ways that individuals can help in the restoration of bay grasses**

Write your answer in your Answer Book.

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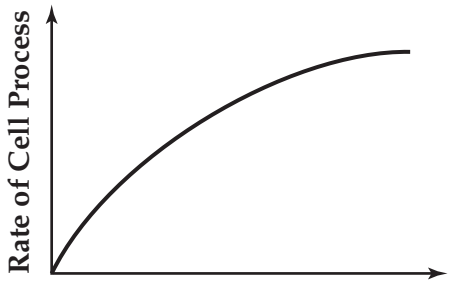
Directions

Use the information and the graph below to answer Numbers 14 and 15.

A group of students studied the effect of light intensity on the rate of a cell process in Elodea plants. The students exposed Elodea plants to different light intensities. A gas was produced by the cell process. The amount of this gas was measured. The rate of the cell process was determined by the amount of gas produced. A graph of the students' measurements is shown below.

THE EFFECT OF LIGHT INTENSITY ON A CELL PROCESS IN ELODEA PLANTS



14 **Which of these is the independent variable in this experiment?**

F rate of cell process

G volume of gas

H size of Elodea plant

J intensity of light

15 **Which of these parts of the Elodea plant cell produces the gas measured in the experiment?**

A mitochondrion

B chloroplast

C ribosome

D nucleus

GO ON

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16 **Which of these combinations results in the expression of a recessive trait?**

F two dominant alleles

G a dominant sex-linked allele and a Y chromosome

H two recessive alleles

J a dominant allele and a recessive allele

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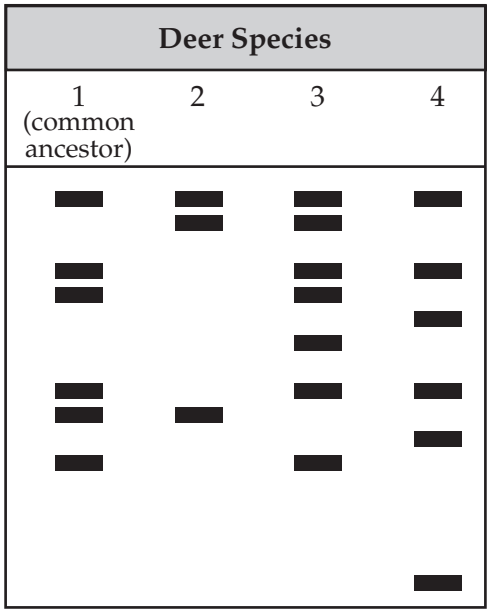
17
BCR

Scientists are studying how four species of deer are related. The scientists believe that Species 1 is the common ancestor. The four species have some traits in common. They also have traits that are unique to their species.

Scientists used the process of gel electrophoresis to study the relatedness of the four deer species. The results of their gel electrophoresis study are shown below.

ELECTROPHORESIS GEL OF DEER SPECIES



Describe how three species of deer evolved from the common ancestor. In your response, be sure to

- **identify which species is most closely related to the common ancestor; explain your answer using the results of their gel electrophoresis**
- **identify and describe the process that leads to the development of different species**
- **explain what factors affect this process in the deer species**

Write your answer in your Answer Book.

GO ON

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18 **Certain plant crops are genetically engineered to grow faster and resist disease. These genetically engineered plant crops cannot reproduce because they have a "terminator" gene that keeps their seeds from sprouting. However, once the genetically engineered plant crops are planted outside, they may cross-pollinate with unaltered plant crops.**

The use of terminator genes is <u>least likely</u> to result in

F increased costs for seeds

G decreased varieties of food

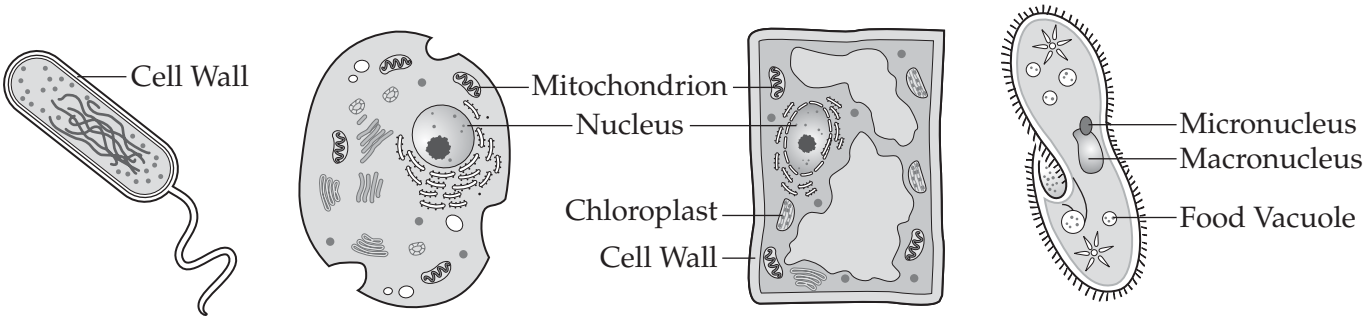
H terminator genes spreading to other crops

J scientists being harmed from working with the terminator genes

Directions

Use the information and the diagrams below to answer Numbers 19 and 20.

A student observed different types of cells under a microscope. Four of the cells he observed are shown below.



Cell 1 **Cell 2** **Cell 3** **Cell 4**

19 **Which of these structures in Cell 3 releases energy for use in cell processes?**

A nucleus

B cell wall

C chloroplast

D mitochondrion

20 **Cell 4 has many hair-like structures that it uses for movement. What are these structures called?**

F cilia

G flagella

H vacuoles

J pseudopodia

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21 **Which of these organ systems is responsible for the removal of metabolic wastes from the blood?**

A endocrine

B nervous

C respiratory

D excretory

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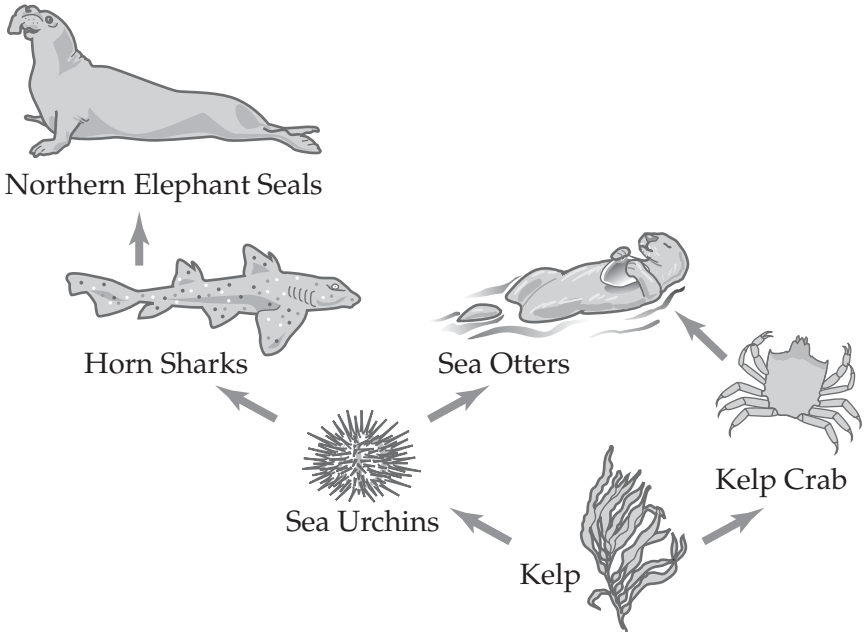
22
BCR

A population of sea urchins in a kelp forest ecosystem is being overfished. A team of students believe that a decline in the number of sea urchins will affect the organisms in the kelp forest ecosystem. The kelp forest food web below shows the relationships among the organisms in the kelp forest ecosystem.

KELP FOREST FOOD WEB



The students believe that the kelp crab population will decrease if the sea urchin population decreases. Use the kelp forest food web to support or refute the students' conclusion. In your response, be sure to

- **describe the roles of the kelp crab, sea otter, and sea urchin in the food web**
- **describe the relationships between the kelp crab, sea otter, and sea urchin**
- **explain how each organism in the food web would be affected by a change in the sea urchin population**

Write your answer in your Answer Book.

GO ON

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Directions

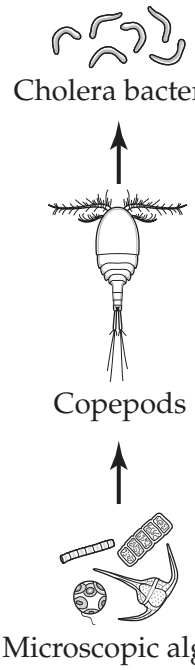
Use the information and the food chain below to answer Numbers 23 and 24.

Cholera bacteria live inside copepods, tiny marine organisms. This type of microscopic bacteria harms the copepods by feeding off their internal tissues.

Both of these organisms are found in oceans throughout the world. Unfavorable temperatures or salt levels may cause cholera bacteria to become inactive. When inactive, they do not feed or reproduce. When conditions become favorable, they become active once again.

A cholera population may depend on the population of copepods in the surrounding water. A simple food chain showing this relationship is shown below.

MARINE FOOD CHAIN



23 **Cholera bacteria perform binary fission to**

A reproduce asexually

B digest food rapidly

C regulate temperature

D increase body size

24 **Which of these describes the relationship between cholera bacteria and copepods?**

F mutualism

G parasite–host

H commensalism

J producer–consumer

GO ON

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25 **Scientists are developing a microscopic submarine to deliver medicine to sites within the body. A biomotor that uses bacteria would move the submarine. The scientists are experimenting with several species of bacteria to find which one works best in the biomotor.**

Which of these is the dependent variable in the scientists' experiment?

A the species of bacteria

B the movement of the submarine

C the size of the submarine

D the sites within the body

26 **A scientist cloned a goat. Which of these is a true statement about the cloned goat?**

F It has new genes and traits.

G It lacks the genes for reproduction.

H It has genes that are identical to the original goat.

J It looks the same as the original goat but has different genes.

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27 **Hemoglobin is an important protein in red blood cells. The DNA code for hemoglobin contains the following segment:**

TGC-GGA-CTC-CTC

Which of these is the messenger RNA code for this segment of DNA?

A ACG-CCT-GAA-GAA

B TCC-GGT-CTC-CTC

C ACG-CCU-GAG-GAG

D UGC-GGA-CUC-CUC

28 **Reproductive cells are produced during**

F mitosis

G meiosis

H fertilization

J budding

STOP

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No test material on this page

Session **2**

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Directions

Use the information below to answer Numbers 29 and 30.

A team of marine scientists is studying biotic and abiotic factors that affect the stability of a deep-sea ecosystem.

29 **The scientists discovered a species of fish that eats other fish and decaying matter. Which of these does <u>not</u> describe the newly discovered fish?**

A consumer

B predator

C scavenger

D producer

30 **The deep-sea ecosystem is a stable ecosystem. Which of these is a characteristic of <u>most</u> stable ecosystems?**

F They contain a wide variety of organisms.

G They contain very few organisms.

H Organic nutrients are in short supply.

J Sunlight is not used to make food.

31 **BCR** **How is carbon related to the flow of energy between the environment and organisms?**

- **Name the carbon compound that is exchanged between plants and their environment.**
- **Describe how plants use carbon from the atmosphere to create more complex molecules.**
- **Describe how animals that eat plants change these molecules and return carbon to the atmosphere.**

Write your answer in your Answer Book.

32 **Which of these will <u>most likely</u> result in variation within a species?**

F mutation

G succession

H diffusion

J competition

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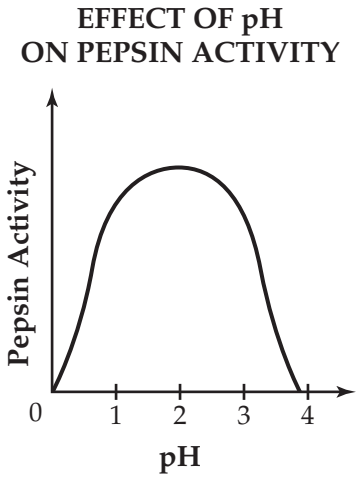
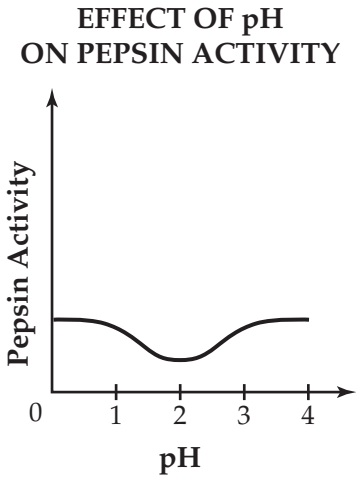
33 **Cells in the stomach produce pepsin, an enzyme, to help digest food. Pepsin works best at a pH of 2. Which of these graphs <u>most likely</u> shows what will happen to the activity of pepsin as the pH of the stomach is increased?**

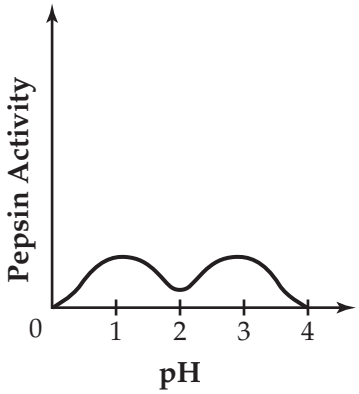
A



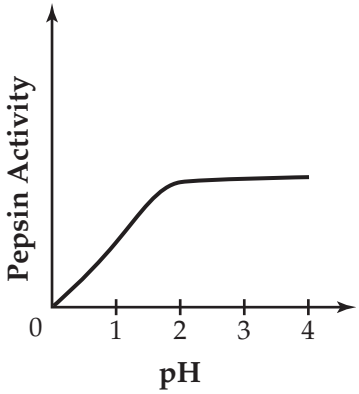
C



B



D



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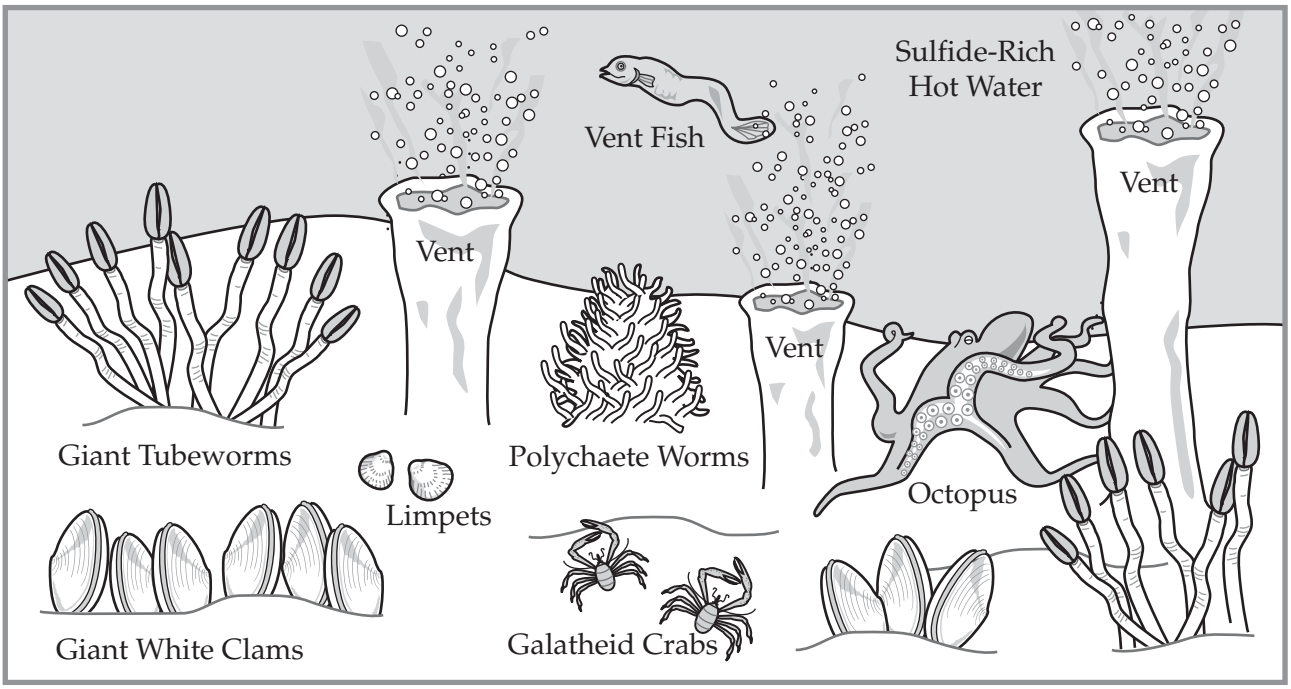
Directions

Use the information and the figure below to answer Numbers 34 through 36.

Scientists have recently discovered hydrothermal vent communities on the ocean floor. A diagram of a hydrothermal vent community is shown in the figure below.

HYDROTHERMAL VENT COMMUNITY



The organisms in this community live near heated vents. Inorganic compounds such as sulfides mix with extremely hot water when they are released from the vents. Bacteria use the sulfides to make food for themselves and other animals. Many of these bacteria live in the bodies of the giant tubeworms and the giant white clams that live in this community.

GO ON

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34 **Hydrothermal vent communities are often destroyed by lava erupting from the ocean floor. After the lava has cooled, different organisms begin to inhabit the area. Over a period of a few years, organisms inhabit the area in the following order:**

sulfur bacteria → crabs → giant tubeworms → clams and mussels

Which of these <u>best</u> identifies this sequence of events?

F evolution

G mutation

H succession

J translation

35 **The bacteria that live in the bodies of the giant tubeworms and the giant white clams are classified as**

A eukaryotes

B prokaryotes

C plants

D fungi

36 **Which of these is an abiotic factor that influences this ecosystem?**

F food

G bacteria

H water temperature

J giant tubeworms

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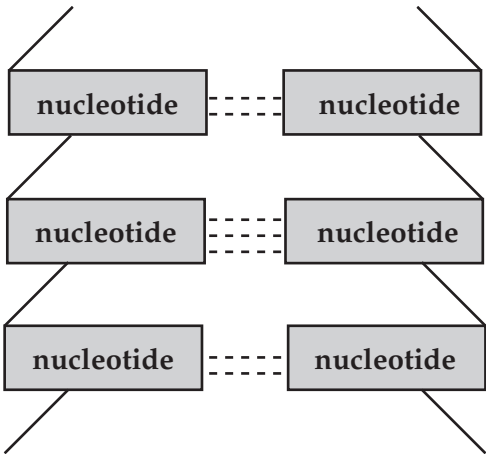
37 **Amylase is an enzyme that allows the human body to digest starch. Which of these diagrams <u>best</u> represents part of the structure of amylase?**

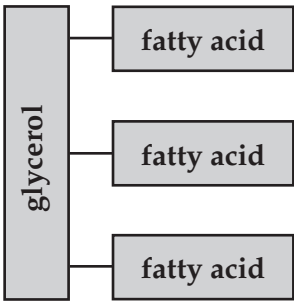
A

B



C

D



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38 **BCR**

Galactosemia is an inherited disorder in humans. A person with the disorder cannot digest the sugars in milk. The allele for normal digestion (G) is dominant; the allele for galactosemia (g) is recessive.

A female who is heterozygous for the galactosemia trait and a male who has galactosemia have a child.

Describe how this disorder could have been passed on in the family. In your response, be sure to

- **identify the genotype of the father**
- **complete a Punnett square to show the possible genotypes and phenotypes of the child**
- **describe the probability that the child will inherit galactosemia**
- **describe all the possible genotypes and phenotypes of the father's parents; explain your answer**

Write your answer in your Answer Book.

39 **Nitrogen compounds are a part of all organisms. What happens to the nitrogen in an organism after it dies?**

A It is destroyed by decomposition.

B It is recycled and used by other organisms.

C It remains trapped in the organism's tissues.

D It is all used up by the time the organism dies.

GO ON

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40 **The global water cycle consists of water circulating among the land, the atmosphere, the oceans, and organisms. Trees get <u>most</u> of their water directly from**

F lakes

G air

H streams

J soil

GO ON

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41 **Which of these is produced as a result of fertilization?**

A a zygote with twice the number of chromosomes as a gamete

B an egg with half the number of chromosomes as a zygote

C a gamete with twice the number of chromosomes as a zygote

D a zygote with half the number of chromosomes as a gamete

GO ON

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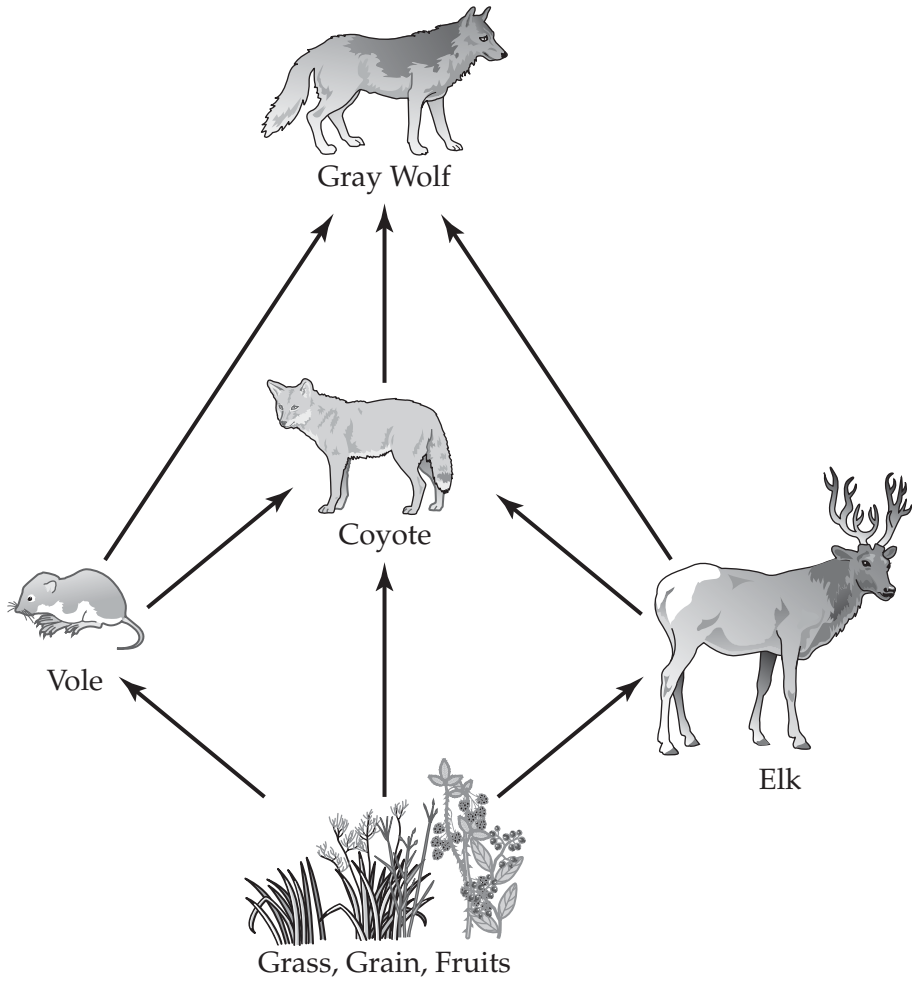
Directions

Use the information and the food web below to answer Numbers 42 and 43.

Part of the food web in Yellowstone National Park is shown below.

YELLOWSTONE NATIONAL PARK FOOD WEB



Gray wolves were reintroduced into Yellowstone National Park in 1995. Two years later, the population of coyotes had decreased by 50%. Coyotes were found in all habitats of the park before the gray wolves were reintroduced. Now, coyotes are most often found in the hills and mountains.

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42 **Coyotes and gray wolves have a high degree of relatedness. Which of these best describes why the two species are closely related?**

F They have similar behaviors.

G They have a common ancestor.

H They feed on the same types of food.

J They are found in the same habitat.

43 **Which of these describes the role of the vole in the Yellowstone ecosystem?**

A decomposer

B producer

C herbivore

D carnivore

44 **Scientists estimate that 200 non-native organisms have been introduced into Chesapeake Bay. Which of these statements is not true about non-native organisms?**

F They often form mutualistic relationships with native organisms.

G They can deplete the food sources of native organisms.

H They are often aggressive at acquiring and maintaining territory.

J They can prey on native organisms causing them to go extinct.

GO ON

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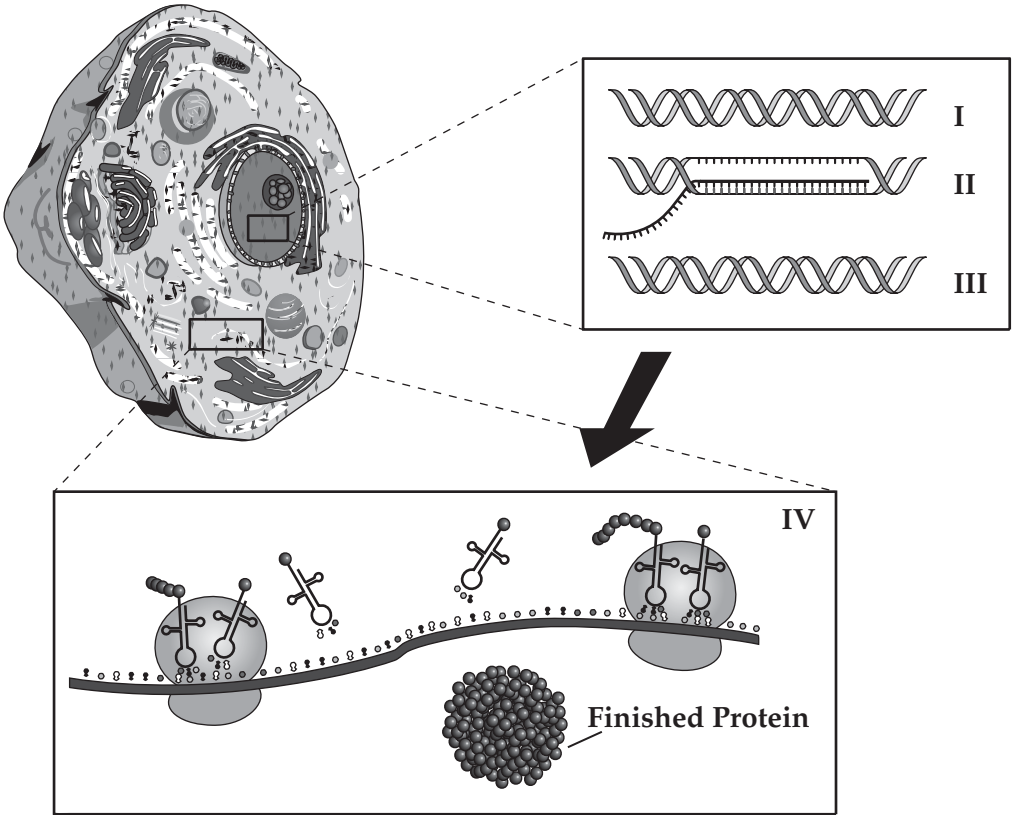
Directions

The diagram below shows the key steps for making proteins. Use the diagram to answer Numbers 45 through 47.



45 **According to the diagram, in which step is messenger RNA being constructed?**

A I

B II

C III

D IV

46 **Which step involves transfer RNA?**

F I

G II

H III

J IV

47 **Which step involves ribosomes?**

A I

B II

C III

D IV

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48
BCR

Mammals are exposed to a variety of outside temperatures. However, they are able to maintain a constant internal body temperature.

Describe ways that mammals warm and cool themselves in response to their environment.

Include in your response

- **an example of a mammal and its environment**
- **both body structures and activities they use**
- **specific examples of both warming and cooling**

Write your answer in your Answer Book.

49 **Which of these body systems transports glucose and other substances in the blood to the cells of the body?**

A digestive system

B endocrine system

C circulatory system

D reproductive system

GO ON

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50 **Reef-building coral are marine animals with single-celled algae living in their tissues. The coral provide protection for the algae and the algae provides food for the coral. Which of these statements <u>best</u> explains what would happen to the coral if the algae die?**

F The coral would grow well because it does not have a competitor.

G The coral would die because it needs the food produced by the algae.

H The coral would grow well because it does not have a parasite.

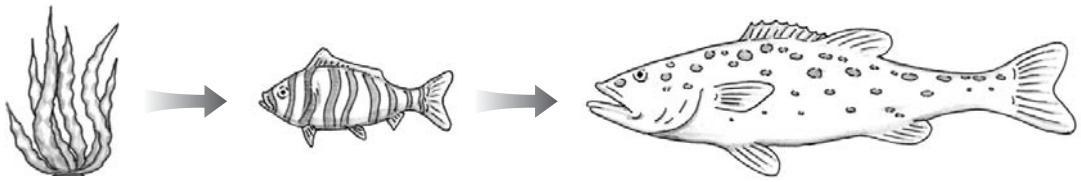
J The coral would die because it cannot produce food for the algae.

Directions

Use the information and food chain below to answer Numbers 51 and 52.

A summer camp was built near a lake in the mountains. The campers used the lake for swimming, fishing, and boating. The relationships between three organisms found in the lake are shown below.

LAKE FOOD CHAIN



Algae → Striped Fish → Spotted Fish

51 **Which of these fish cell structures would be <u>most directly</u> affected by a change in the oxygen level of the lake?**

A mitochondrion

B chloroplast

C golgi apparatus

D endoplasmic reticulum

52 **Striped fish are affected by biotic and abiotic factors in their environment. Which of these factors is biotic?**

F water temperature

G mineral nutrients

H freshwater algae

J inorganic sediments

GO ON

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53 **A researcher recently discovered a species of bacteria. DNA sequences were obtained from it and from several other species of bacteria. The DNA sequences came from the same part of the bacterial chromosome of each species.**

	DNA Sequence		
Unknown Species	ACT	GCA	GCC
Species I	ACA	GCG	CCG
Species II	ACT	GCT	GGC
Species III	ACA	GCC	GGG
Species IV	ACT	GCA	GCG

According to the data above, the unknown bacteria are <u>most closely</u> related to which species?

A Species I

B Species II

C Species III

D Species IV

STOP

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BIOLOGY

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