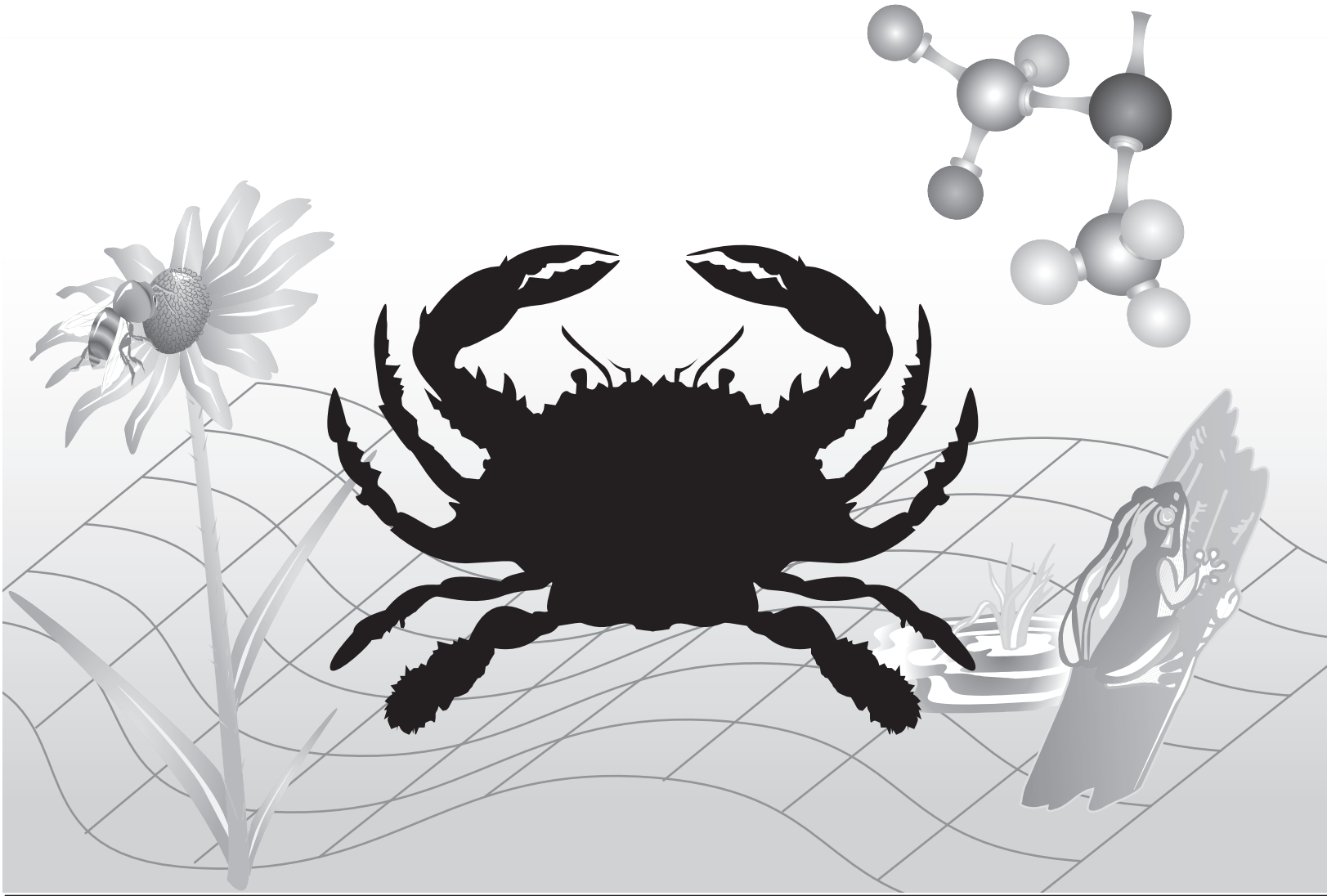
HSA

Maryland High School Assessment

Maryland State Department of Education

Achievement Matters Most



BIOLOGY

Public Release 2006

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 directly provides support for the human body?

F skeletal

G excretory

H endocrine

J reproductive

STOP

1 **An ecosystem contains organisms interacting with each other and their physical environment. Which of these is the best indicator of a healthy ecosystem?**

A There are few decomposers.

B There are many different species.

C There are few herbivores.

D There is a large population of only one species.

2 **Cheryl wants to perform an investigation that requires using hazardous chemicals. The following steps of the investigation are not in the correct order.**

1. **Perform the investigation.**
2. **Design the investigation.**
3. **Put on gloves, goggles, and an apron.**
4. **Dispose of waste materials.**

Which of these is the correct sequence of steps to safely complete the investigation?

F 1-3-4-2

G 3-2-1-4

H 4-1-3-2

J 2-3-1-4

3 **In humans, the allele for long eyelashes is dominant (L) and the allele for short eyelashes is recessive (l). A female who is heterozygous for long eyelashes and a male with short eyelashes have a child.**

What is the probability that their offspring will have short eyelashes?

A 0%

B 25%

C 50%

D 75%

4 **Which of the following is correctly matched with its function?**

F rRNA – contains codes to make new ribosomes

G DNA – carries the amino acids to the ribosomes

H tRNA – combines with proteins to make up ribosomes

J mRNA – carries genetic codes from nucleus to the ribosomes

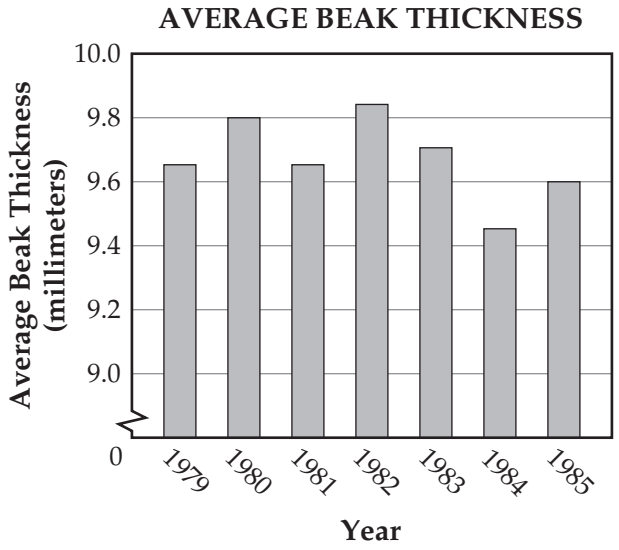
GO ON

5
BCR

A species of birds lives on an island. The thickness of the birds' beaks varies within the population. The birds feed mainly on seeds from plants. Birds with thinner beaks can eat only small seeds. Only birds with thicker beaks can crush and eat large seeds.

There are many small seeds during years with more rain. During dry years, there are very few small seeds and many large seeds. The large seeds are harder to crush than small seeds.

The graph below shows the average beak thickness in the bird population from 1979 to 1985: 1980 and 1982 were dry years; 1984 was a wet year; 1979, 1981, 1983, and 1985 received normal rainfall.



- **Explain why the average beak thickness changed between wet and dry years.**
- **Explain how beak thickness would have changed during the next ten years, 1986 to 1996, if these years were wet years.**
- **Name the process that led to this change.**

Write your answer in your Answer Book.

GO ON

Directions

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

A group of students separated 16 bean plants into four equal groups. They exposed each group to a different number of hours of light. The table below shows the amount of light each group of bean plants received. All other conditions were kept the same.

AMOUNT OF LIGHT RECEIVED BY BEAN PLANTS

Plant Group	Exposure to Light (in hours)
1	No light (kept in dark container)
2	5
3	10
4	15

The students measured the total leaf surface area of each plant once a day for two weeks.

6 **Which of these processes were the students most likely studying?**

F diffusion

G photosynthesis

H chemosynthesis

J mutation

7 **Which plant group will most likely have the greatest total leaf surface area after two weeks?**

A Group 1

B Group 2

C Group 3

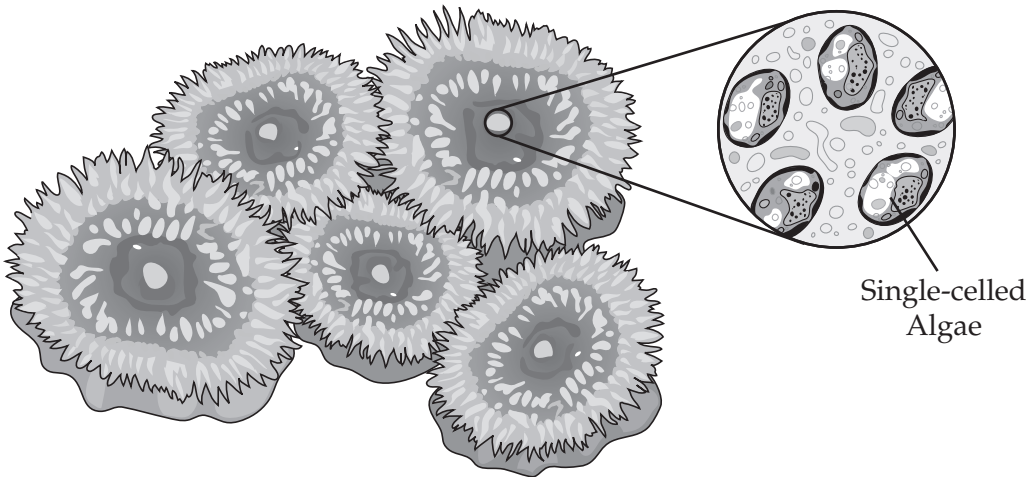
D Group 4

GO ON

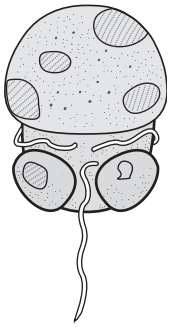
Directions

Use the information and the figure below to answer Numbers 8 and 9.

During a trip to the beach, Allen finds a colony of sea anemones on a rock. These sea anemones are green and get their color from tiny single-celled algae that live in their tissues. The algae produce food for the anemones while the anemones provide a place for the algae to live.



8 **A drawing of a mobile form of the single-celled green algae is shown below.**



Which of these structures help this algae move?

F flagella

G cilia

H pseudopodia

J vacuoles

GO ON

9 **Which parts of the single-celled algae are responsible for capturing energy?**

A nuclei

B chloroplasts

C mitochondria

D cytoplasm

GO ON

10 **The chart below is the nutrition facts found on a bag of pretzels.**

PRETZEL NUTRITION FACTS

Nutrition Facts	
Serving Size 25 Pretzels (30g)	
Servings Per Bag 10	
Amount Per Serving	
Calories 120	
	% Daily Value*
Fat 1 g	**1**%
Sodium 120 mg	**5**%
Potassium 50 mg	**1**%
Total Carbohydrate 23 g	**8**%
Dietary fiber 7 g	**30**%
Soluble fiber 5 g	
Insoluble fiber 2 g	
Sugars 11 g	
Other carbohydrates 5 g	
Protein 3 g	**6**%
*based on a 2000 Calorie diet	

Which of the following equations could be used to determine the number of pretzels in a 100-Calorie serving?

F $\frac{x}{100} = \frac{30}{120}$

G $\frac{30}{100} = \frac{120}{x}$

H $\frac{x}{100} = \frac{25}{120}$

J $\frac{25}{100} = \frac{120}{x}$

GO ON

11 **Scientists have found many similarities in the proteins of turtles and sharks. These similarities suggest that turtles and sharks**

A have stopped evolving

B have a common ancestor

C have all the same DNA sequences

D have the same number of chromosomes

GO ON

Directions

Use the technical passage below to answer Numbers 12 and 13.

THE GOOD, THE BAD, THE ZEBRA MUSSEL

Dreissena polymorpha, the zebra mussel, is a species of mussel that is native to East European waterways. Before their discovery in the Great Lakes region in 1988, zebra mussels were unknown in North America. They were probably brought in by ships traveling to the Great Lakes. By 1998, zebra mussels had spread to the lakes and streams of 12 states.

Zebra mussels have an impact on an ecosystem soon after they colonize a waterway. Their larvae spread rapidly, settling on almost any available surface. They quickly establish large colonies. Zebra mussels compete with native freshwater mussel populations so effectively that the native mussel populations quickly decline or totally disappear.

In a study of Lake Erie, researchers noted that just two years after the first zebra mussels colonized the lake, the water in the lake was six times clearer. Because mussels feed on plankton, the basis of the lake's food chain, they had reduced the plankton population by 80%.

The greater clarity of the water allowed light to reach greater depths. This resulted in increased growth of aquatic plants. Pollution inhibited the growth of some of these plants in the past, but when pollution decreased in Lake Erie and the water became clearer, the plants flourished, providing cover and nurseries for some types of fish.

Zebra mussels filter large amounts of water through their bodies. Researchers estimate that zebra mussels filter a large percentage of the water in Lake Erie every week. As they filter the water, they remove toxic chemicals and pollutants like PCBs. PCBs accumulate in the fatty tissues of organisms. Because of their ability to filter water and their high body-fat content, zebra mussels build up more than ten times the amount of PCBs and other toxic contaminants from the water than the native mussels. Some birds and fish absorb these contaminants when they feed on the zebra mussels. The contaminants are then passed up the food chain.

Scientists have studied the short-term effects of zebra mussel invasions on the ecology of North American waters. However, scientists will need to conduct additional studies to determine the long-term effects of these invasions.

GO ON

12 **Researchers believe that zebra mussels are ten times more effective in removing toxic contaminants like PCBs than are native mussels. Which of these experiments would test this hypothesis?**

F Place 20 zebra mussels in a tank with PCBs and 20 zebra mussels in another tank without PCBs. Test PCB levels of each tank after one week.

G Place 20 zebra mussels in a tank with PCBs and 20 native mussels in another tank without PCBs. Test PCB levels of each tank after one week.

H Place 20 zebra mussels in a tank with PCBs and 20 native mussels in another tank with PCBs. Test PCB levels of each tank after one week.

J Place 20 native mussels in a tank with PCBs and 20 native mussels in a tank without PCBs. Test PCB levels of each tank after one week.

13 **A scientist was testing the hypothesis that zebra mussels cause a decrease in the population of bluegill, a type of fish. The mussels feed on copepods, a type of plankton that is also eaten by bluegill and other fish. In an experiment, he counted the number of bluegill and the number of copepods in an aquarium containing one kiloliter of water. He then added zebra mussels. After two weeks, and again after four weeks, he counted the copepods, bluegill, and zebra mussels. Which set of experimental data supports his hypothesis that the number of bluegill decline because zebra mussels eat copepods?**

A

	Number of Organisms		
Weeks	Zebra Mussels	Copepods	Bluegill
0	50	2,000	7
2	300	120,000	24
4	1,900	210,000	33

C

	Number of Organisms		
Weeks	Zebra Mussels	Copepods	Bluegill
0	50	210,000	33
2	300	120,000	24
4	1,900	2,000	7

B

	Number of Organisms		
Weeks	Zebra Mussels	Copepods	Bluegill
0	50	2,000	33
2	300	120,000	24
4	1,900	210,000	7

D

	Number of Organisms		
Weeks	Zebra Mussels	Copepods	Bluegill
0	50	210,000	24
2	300	120,000	7
4	1,900	2,000	33

GO ON

14 **Scientists can insert and remove nucleotides from a DNA strand. Which of these identifies this process?**

F base pairing

G gene splicing

H DNA synthesis

J DNA transcription

15 **BCR** **The table below lists enzymes that function in different locations in the human body, and the normal pH and temperature ranges of these locations.**

ENZYMES IN THE HUMAN BODY

Location of enzyme	Enzyme	pH ranges of location	Temperature (°C) ranges of location
Mouth	Salivary amylase	6.0 - 7.0	36.7 - 37.0
Stomach	Pepsin	2.0 - 3.0	37.3 - 37.6
Small intestine	pancreatic amylase, trypsin, lipase	7.5 - 9.0	37.3 - 37.6

Use your understanding of the structure and function of enzymes to

- **predict how the activity of pepsin will change after it moves from the stomach to the small intestine**
- **explain your prediction using data from the table**
- **describe how changes in pH and temperature affect enzyme activity**
- **predict how a fever of 40°C would affect enzyme activity**

Write your answer in your Answer Book.

GO ON

16 **Most carbohydrates in the human body are**

F used as building blocks for proteins

G used as catalysts for reactions in cells

H consumed as a source of energy

J not easily absorbed into the bloodstream

GO ON

Directions

Use the information below to answer Numbers 17 and 18.

In a species of fly, the allele for red eyes (R) is dominant to the allele for brown eyes (r). Red eye color in the flies is not sex-linked. Students crossed male and female flies that had red eyes and recorded the eye color of their offspring. Their data are shown below.

FLY OFFSPRING

Eye Color	Number of Offspring
Red	77
Brown	27

17 **What are the most likely genotypes of the parent flies?**

A RR and *rr*

B Rr and Rr

C *rr* and *rr*

D RR and Rr

18 **Using the data in the table, what is the approximate ratio of red eyed offspring to brown eyed offspring?**

F 1:1

G 2:1

H 3:1

J 4:1

19 **Deep sea bacteria live at ocean depths too great for light to reach. These bacteria make their own food. Which of these is the source of energy for the bacteria?**

A nucleic acids

B binary fission

C inorganic compounds

D DNA replication

GO ON

Directions

Use the information below to answer Numbers 20 and 21.

Most organisms need oxygen for their cells to function normally. In mammals, two organ systems work together to move oxygen throughout the body.

20 **Which of these organelles use oxygen to release energy?**

F nuclei

G ribosomes

H chloroplasts

J mitochondria

21 **The respiratory system brings oxygen into the body from the environment. Which of these body systems is directly involved in the delivery of oxygen to the major organs of the human body?**

A the nervous system

B the digestive system

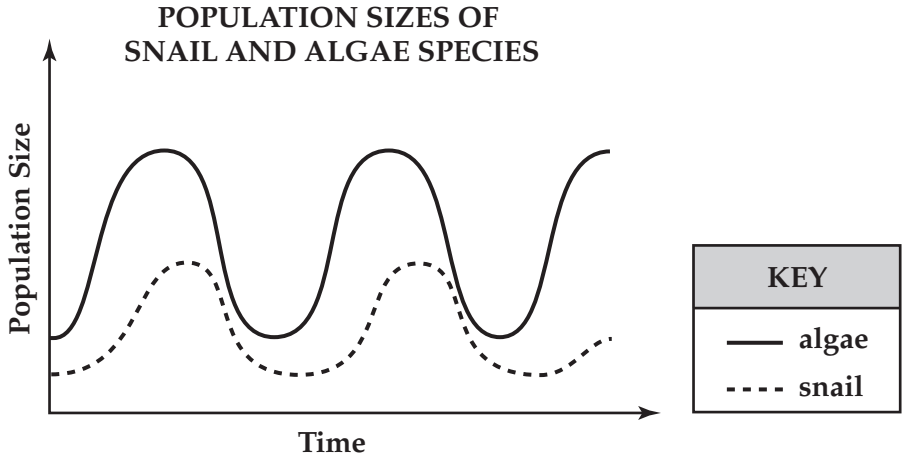
C the endocrine system

D the circulatory system

GO ON

22
BCR

Biologists conducted a study on the population sizes of a species of snail and a species of algae found in a lake ecosystem. The results of their study are shown in the graph below.



Based on the data in the graph, explain the most likely relationship between the two species. In your response, be sure to

- **identify the ecological role of the snails and the algae**
- **identify the trophic level each species occupies**
- **explain the ecological factors that may affect the population size of the two species**
- **explain how both populations would be affected if a landfill for garbage were built on the land surrounding the lake**

Write your answer in your Answer Book.

23 **Which of these is an example of homeostasis in a multicellular organism?**

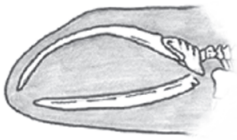
A inheriting a trait

B growing larger and stronger

C building a nest

D regulating body temperature

24 **Students used the three organisms shown below to study evolutionary relationships.**

	Bat	Bee	Whale
Head			
Limb	 wing	 wing	 flipper

Which of these structures are the best evidence of an evolutionary relationship?

F bat wing and bee wing

G bat lower jaw and whale lower jaw

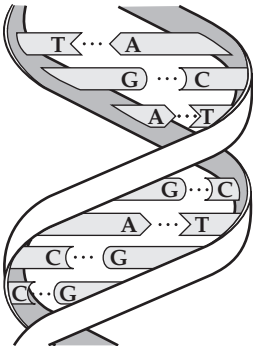
H whale flipper and bee wing

J bat wing and whale flipper

GO ON

25 **Which of these represents the structure of messenger RNA?**

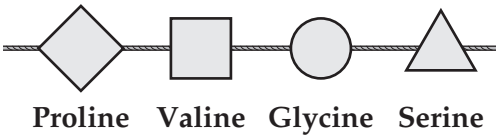
A



B

C

D



26 **Which of these substances moves across cell membranes by osmosis?**

F salt

G sugar

H water

J protein

STOP

No test material on this page

Session **2**

27 **Which of these statements best explains how genes and proteins are related?**

A Genes are segments of DNA that code for proteins.

B Proteins are segments of DNA that code for genes.

C Genes are the building blocks of proteins.

D Proteins are the building blocks of genes.

Directions

Use the information below to answer Numbers 28 and 29.

Corals are marine animals that often live in tropical seas. Many types of corals have unicellular algae living in their tissues. The algae provide up to 98 percent of the corals' food. The corals provide protection and inorganic nutrients for the algae.

28 **Algae leave the coral when the water is too warm. What kind of factor is temperature on this relationship?**

F biotic

G abiotic

H parasitic

J commensalistic

29 **Some coral cells undergo meiosis. Which of these would not occur during meiosis?**

A formation of a zygote

B chromosomes crossing-over

C production of gametes

D reduction in number of chromosomes

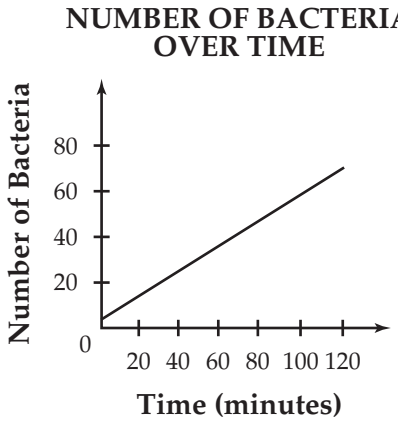
30 **The following table provides data on the population growth of bacteria over time.**

BACTERIAL GROWTH

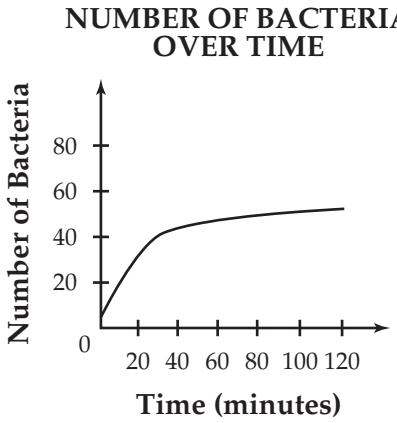
Time (minutes)	Number of Bacteria
0	1
20	2
40	4
60	8
80	16
100	32
120	64

Which graph best represents the population growth of bacteria over time?

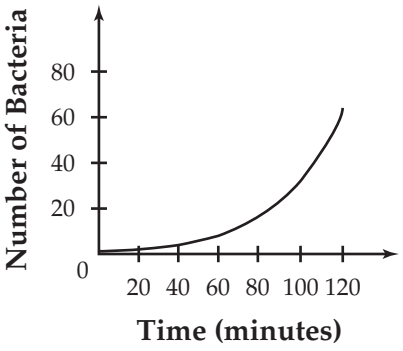
F



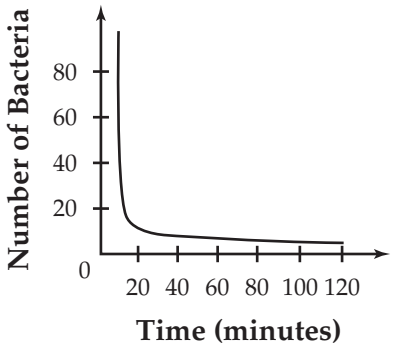
H



G



J



31 **BCR**

How do living systems control the movement of materials into and out of cells?

In your response, be sure to

- **identify the cell structures and body systems involved**
- **describe the functions of the cell structures and body systems involved**
- **identify and describe the processes responsible for the movement of materials into and out of cells**

Write your answer in your Answer Book.

32

Researchers are studying slider turtles. Slider turtles hatch on the beach. The researchers discovered that larger baby turtles were more likely to survive than smaller baby turtles. They hypothesized that the larger turtles could move more quickly toward the water than the smaller turtles, reducing their exposure to predators.

The survival advantage for the larger baby turtles is a result of

F natural selection

G gene splicing

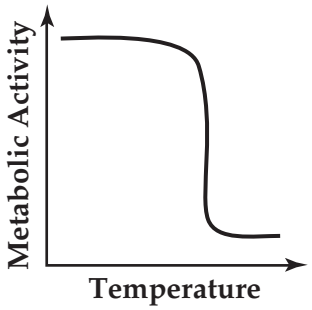
H mutualism

J commensalism

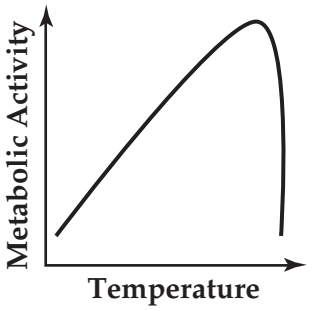
GO ON

33 **In crickets, the rate of chirping is related to the temperature of the air. The rate of chirping can be used to describe their metabolic activity. Which of these graphs most likely shows how temperature affects metabolic activity in crickets?**

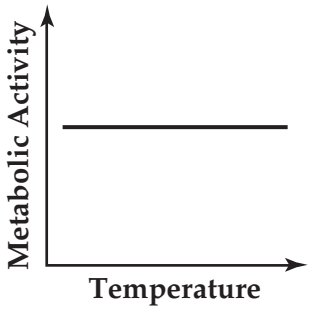
A



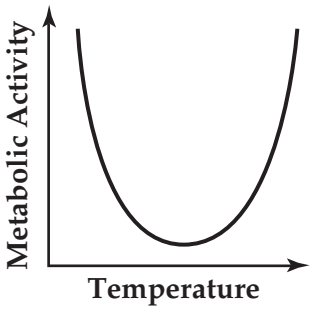
C



B



D



34 **In the laboratory, scientists remove the gene for insulin from human chromosomes. They insert the gene into the DNA of bacteria. This causes the bacteria to produce human insulin. The insulin is used to treat diabetes in humans. Which of these describes this process?**

F meiosis

G fertilization

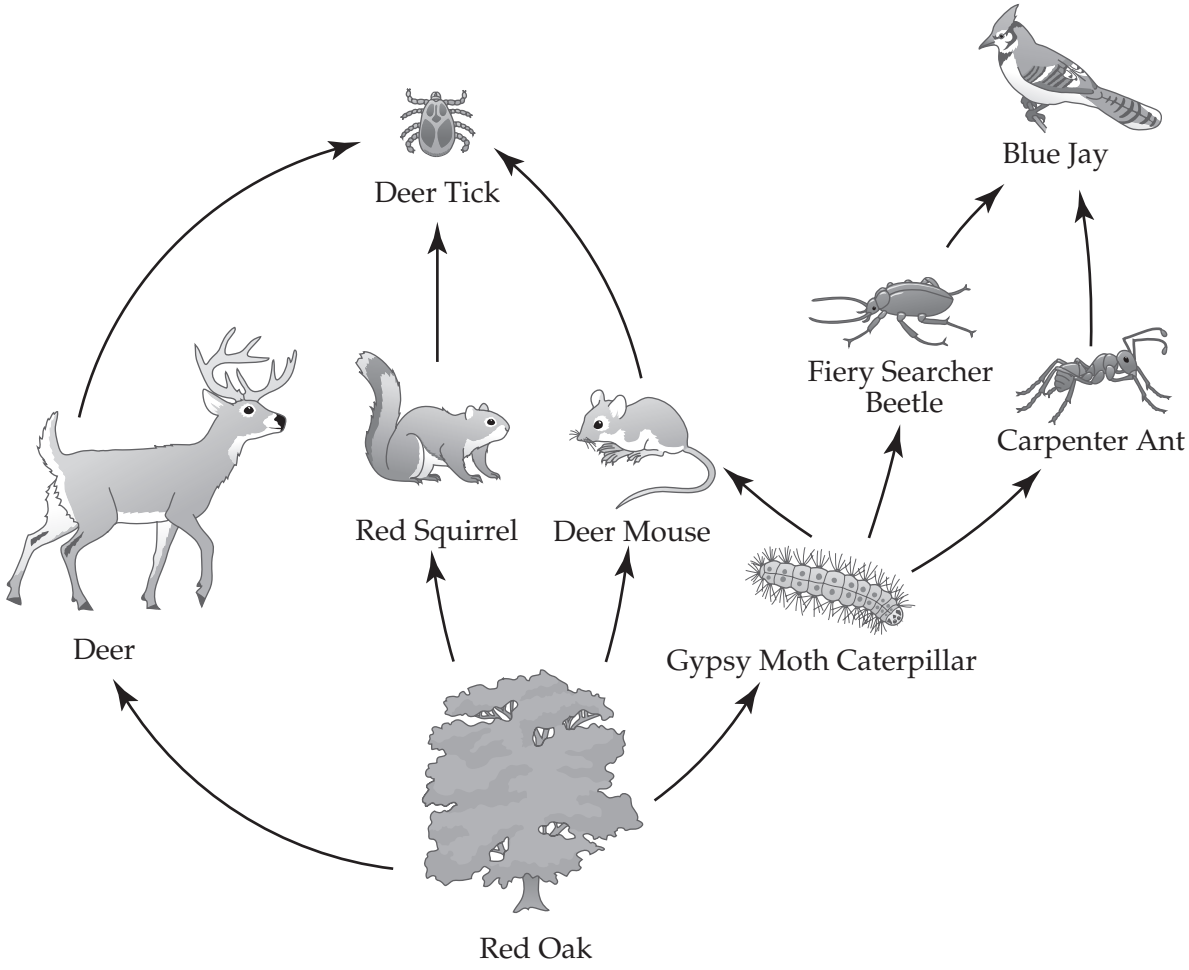
H gene splicing

J DNA fingerprinting

Directions

Use the forest food web below to answer Numbers 35 through 37.

FOREST FOOD WEB



35 **The deer tick feeds on the blood of the red squirrel, deer, and deer mouse. Which of these best describes the role of the deer tick in the forest food web?**

A parasite

B producer

C carnivore

D omnivore

36 **When gypsy moth caterpillars hatch, which of these populations benefits first?**

F red oak

G deer tick

H blue jay

J carpenter ant

37 **Which of these describes the role of the red oak in the forest food web?**

A omnivore

B parasite

C herbivore

D producer

GO ON

38
BCR

The length of a dog's tail is an inherited trait. The allele for short tails is dominant (T) over the allele for long tails (t). A dog breeder mates two short-tailed dogs (parents). One parent is homozygous and the other is heterozygous for this trait. A litter of twelve puppies, all with short tails, is produced (first generation). The breeder mates one of the first generation dogs with a short-tailed dog from another litter. A litter of ten puppies is produced (second generation). The breeder is surprised when one of the second generation puppies has a long tail.

Describe the genetic make-up of the parents and puppies that produced this inheritance pattern. In your response, be sure to

- **identify the genotype of the parents**
- **use a Punnett square to show the possible genotypes of the first generation puppies**
- **use a Punnett square to show the possible genotypes of the second generation puppies**
- **identify the genotypic and phenotypic ratios of the first and second generation puppies**
- **explain how a long-tailed dog can suddenly appear when all the other dog's were short-tailed**

Write your answer in your Answer Book.

GO ON

39 **A scientist removed the cell membranes from bacteria cells in a culture. She analyzed the cell membranes for specific molecules. Which of these was probably the most common type of molecule present in the bacteria cell membranes?**

A lipid

B amino acid

C nucleic acid

D carbohydrate

40 **Rain forests are often cleared to provide land for farming. Which of these outcomes is the most immediate effect of this practice on the global environment?**

F an increase in acid rain

G depletion of the ozone layer

H the decreased production of food

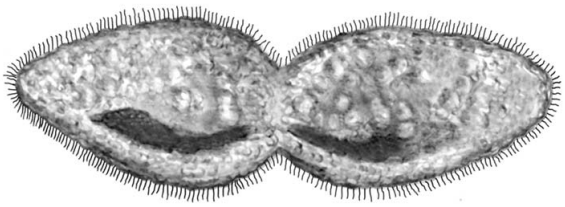
J an increase in atmospheric carbon dioxide levels

GO ON

Directions

Use the information and the diagram below to answer Numbers 41 and 42.

A student observes a unicellular organism under a microscope. After a while, the organism begins to split into two cells, as shown in the diagram.



41 **Which of these best describes the process shown in the diagram?**

A binary fission

B meiosis

C osmosis

D sexual reproduction

42 **Which of these structures does the organism shown above use to move itself?**

F cilia

G nuclei

H flagella

J ribosomes

43 **A strand of DNA has a nucleotide base sequence of TAC-CGG-AGT. Which of the following is the complementary mRNA nucleotide sequence produced from the strand of DNA?**

A UAC-CGG-AGU

B ACU-GAA-CGA

C AGU-UCC-UAC

D AUG-GCC-UCA

Directions

Use the information and the figure below to answer Numbers 44 through 46.

Black skimmers are water birds that live along coastal beaches, bays, estuaries, and marshes. They fly just above the surface of the water using their lower jaw to catch small fish, shrimp, and other small crustaceans.

These birds nest in simple, unlined depressions in the sand. Scientists have observed a decline in the number of nests. Some causes of this decline include a lack of suitable nesting sites, beach erosion, and human disturbances.

When people approach their nests, the birds become aggressive and chase away intruders. Other animals, like crows, will take advantage of the unprotected nests and feed on the eggs.

44 **Which of these best describes the effects of human disturbance on the black skimmer's eggs?**

F a biotic factor

G an allele

H a niche

J an abiotic factor

45 **Which of these terms best describes the relationship between the crows and the black skimmers?**

A mutualism

B commensalism

C parasite–host

D predator–prey

46 **A continued decrease in black skimmer populations will most likely lead to**

F a decrease in scavenger populations

G an increase in producer populations

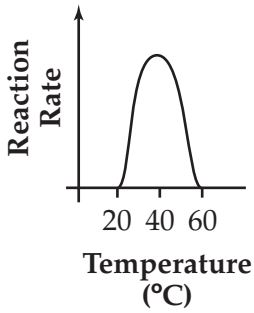
H a decrease in decomposer populations

J an increase in prey animal populations

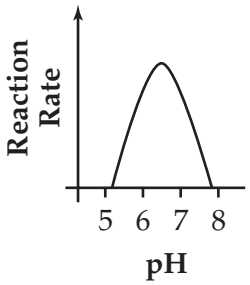
GO ON

47 **The graphs below show the effects of temperature and pH on the reaction rate of an enzyme.**

EFFECT OF TEMPERATURE ON ENZYME REACTION RATE



EFFECT OF pH ON ENZYME REACTION RATE



Food will stay fresh longer when enzyme activity is slowed. Which of the following conditions would most likely slow enzyme activity?

A reducing pH from 8 to 7 by adding a weak acid

B increasing pH from 5 to 6 by adding a weak base

C reducing temperature from 30°C to 20°C by refrigeration

D increasing temperature from 30°C to 40°C by heating

48 **Sea stars are genetically different from each other and from their parents. These genetic differences are the result of**

F mitosis

G cloning

H sexual reproduction

J asexual reproduction

49
BCR

Students studied a species of fish. They wanted to find out if these fish grow faster in warmer water. The students designed an experiment to determine how different water temperatures affect the growth of the fish.

They placed one fish in a tank at 26°C and another fish in a tank at 22°C. The fish were fed the same amount of food during the experiment. The mass of each fish was recorded at the beginning and at the end of the experiment. The data the students collected are shown in the table below.

EFFECTS OF WATER TEMPERATURE ON THE GROWTH OF FISH

Temperature (°C)	Starting Mass (g)	Final Mass (g)	Percent Change
26	3.68	7.84	113%
22	6.80	9.09	34%

Analyze the procedure and the data from the experiment. In your response, be sure to

- **include the hypothesis that the students were most likely investigating**
- **explain whether their data supports this hypothesis**
- **describe how other variables would affect the outcome of the results**
- **explain how the experiment could be redesigned to gather more reliable data**

Write your answer in your Answer Book.

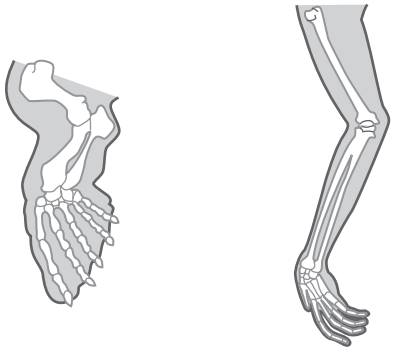
GO ON

Directions

Use the information and the figure below to answer Numbers 50 and 51.

The figure below shows the skeletal structure of a seal's flipper and a monkey's arm.

SKELETAL STRUCTURE OF SEAL FLIPPER AND MONKEY ARM



Seal **Monkey**

The skeletal structures of the flipper and the arm are similar, even though they have different functions. Seals use their flippers for swimming, while monkeys use their arms primarily for grasping and lifting.

50 **The seal's flipper and the monkey's arm differ in appearance. This difference is the result of**

F migration

G genetic engineering

H succession

J natural selection

51 **Which of these explains why the skeletal structures of the seal's flipper and the monkey's arm are similar?**

A Seals and monkeys have a common ancestor.

B Seals and monkeys have identical DNA sequences.

C All of the same genetic mutations occurred in seals and monkeys.

D All of the same vitamins are used for bone formation in seals and monkeys.

52 **In the fall, the leaves of many plants change color. Which of the following abiotic factors is primarily responsible for causing this change?**

F increased pH

G increased water

H decreased acidity

J decreased light

STOP

BIOLOGY

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