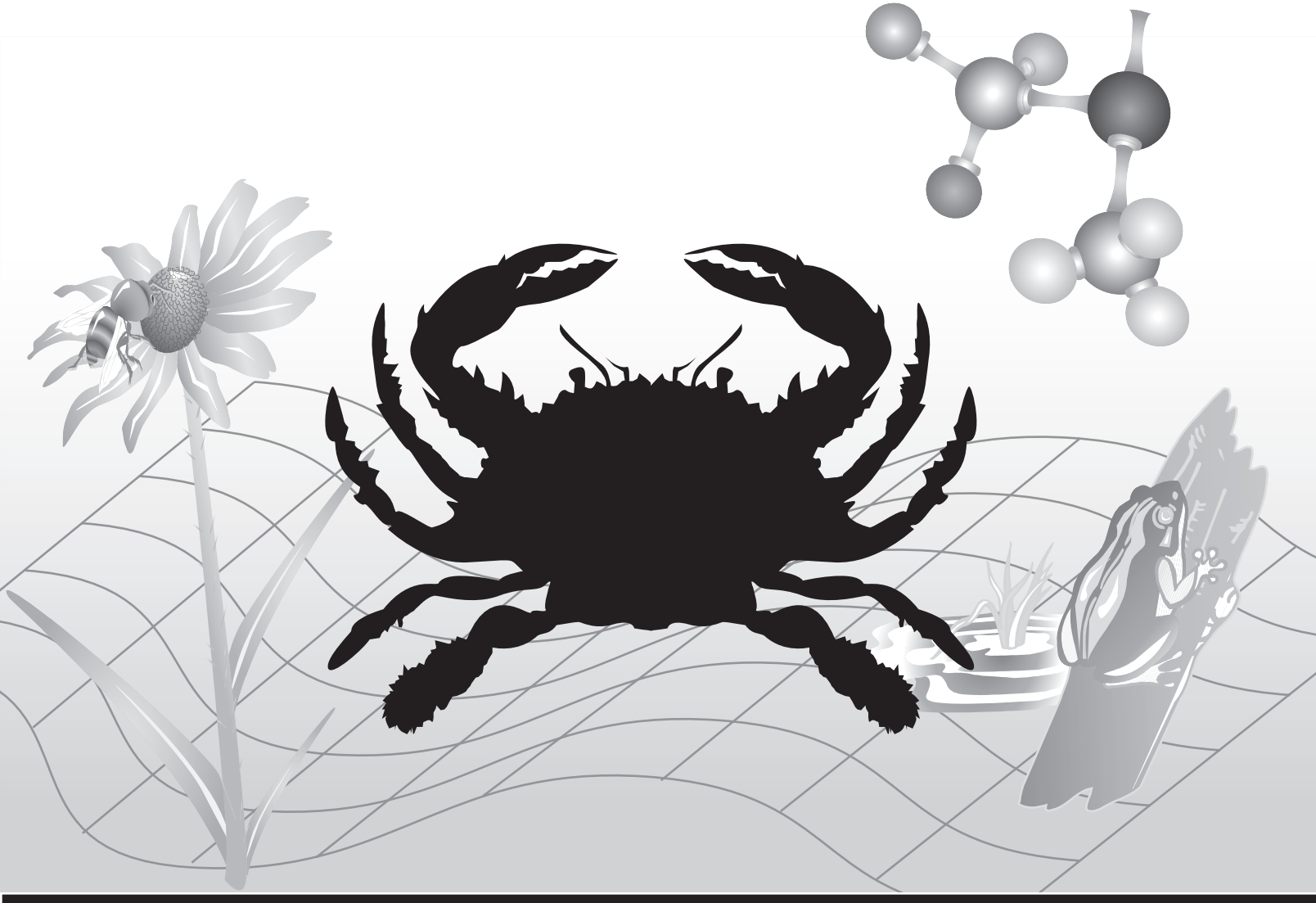
HSA

Maryland High School Assessment

Maryland State Department of Education

Achievement Matters Most



BIOLOGY

Public Release 2007

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 **Which of these should be done before beginning a laboratory investigation?**

A collect data

B review the procedure

C draw conclusions

D record data on tables

GO ON

2 **Sea grasses grow on the ocean floor in shallow areas. Runoff from the land into the ocean can cause the waters to become cloudy. Cloudy water affects the sea grasses' ability to make their own food because there is not enough**

F oxygen

G water

H light

J carbon

GO ON

Directions

Use the technical passage below to answer Numbers 3 through 5.

EXOTIC SPECIES VERSUS NATIVE SPECIES, WHO'S WINNING?

The introduction of non-native or "exotic" organisms is thought to be responsible for about half of the endangered or threatened species in the United States. This often happens by the "crowding out effect," in which an exotic plant or animal survives better than a native organism. Exotic species usually have no natural predators or parasites in their new environments. This enables them to take over entire areas where native species used to live. Biologists call this phenomenon eco-invasion. Chris Bright, an author on this subject, says that a non-native species will establish itself by adjusting to its new surroundings. "It tends to get better and better at exploiting an area's resources and at suppressing native species," says Bright.

The island of Guam is an example of an area that has been affected. The brown tree snake was accidentally introduced to the island about 60 years ago. Since then, nine of eleven native bird species have become extinct due to overpopulation by the brown tree snake.

Another example involves the Eurasian zebra mussel. Scientists believe this mussel was accidentally transported to the United States by ships in 1988. Colonies of the zebra mussels have since caused costly damage to waterpipes around the Great Lakes.

Airplane and boat traffic across the world has been blamed for the introduction of exotic organisms. Species are usually contained in certain areas because of natural borders such as mountains, oceans, and deserts. However, natural borders are no longer effective boundaries with the increase in worldwide travel.

3 **Which of these explains why the number of exotic organisms is increasing in ecosystems around the world?**

A The amount of global travel is increasing.

B Increasing temperatures favor non-native organisms.

C Native organisms are migrating to more remote locations.

D The number of prey organisms is increasing worldwide.

4 **Which of these is a false statement about exotic species?**

F They often out-compete native species.

G They often lead to the extinction of other species.

H They usually have predators in their new environments.

J They are transported to new areas by airplanes and boats.

5 **Eco-invasion of an area will most likely result in**

A an increase in habitat

B a decrease in biological diversity

C an increase in natural disasters

D a decrease in exotic organisms

GO ON

6 **Glucose is a building block of carbohydrates. Which of these best describes glucose?**

F nucleotide

G protein

H monosaccharide

J lipid

7 **The ears of foxes help to regulate body heat. The fennec fox lives in the North African desert and has large ears that release body heat. The Arctic fox lives in cold climates and has small ears that conserve body heat.**

Fennec Fox

Arctic Fox

Which of these processes led to the development of different ear sizes in foxes?

A selective breeding

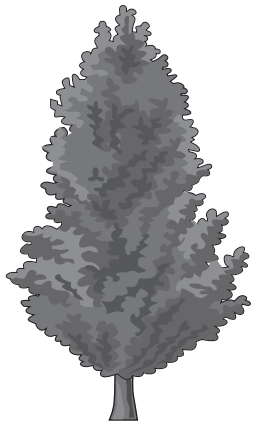
B succession

C natural selection

D mutualism

8
BCR

The pine tree and the blue jay, shown below, both have internal structures that help transport fluids containing dissolved materials within their tissues.



Pine Tree

Blue Jay

Compare and contrast the transport systems of the pine tree and the blue jay. In your response, be sure to

- **identify the type of transport system used by each organism**
- **describe the types of dissolved materials transported within each organism and exchanged with its environment**
- **explain why the pine tree and the blue jay need specialized transport systems**

Write your answer in your Answer Book.

GO ON

9 **The allele for attached earlobes (e) is recessive to the allele for unattached earlobes (E). A woman with the genotype (Ee) and a man with the genotype (ee) have a child.**

What is the probability that the child is heterozygous for attached earlobes?

A 0%

B 25%

C 50%

D 75%

10 **Which of these does not occur during meiosis?**

F production of identical gametes

G production of new gene combinations

H crossing-over of homologous chromosomes

J reduction of chromosome number by one-half

GO ON

11
BCR

Medical researchers are studying a new drug to treat anemia. Eligible patients are asked if they would like to participate in the study. If a patient does participate, there is a 50% chance that the patient will receive the actual anemia medication and a 50% chance that the patient will receive a placebo, or sugar pill. The placebo is not meant to have any effect on the patient's anemia. The study is double-blinded, meaning that neither the researchers nor the patients know which kind of pill is being taken—the actual medication or the placebo.

- **Explain why a placebo is being used in the study.**
- **Explain why it is important to conduct a double-blinded study.**
- **Describe both the possible benefits and risks of drug trials, such as the one in the example, to both the patient and society.**

Write your answer in your Answer Book.

12

Horses have 64 chromosomes in each body cell. If a horse cell undergoes meiosis, how many chromosomes should be in each gamete?

F 16

G 32

H 64

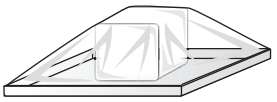
J 128

GO ON

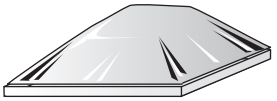
Directions

Use the information below to answer Numbers 13 and 14.

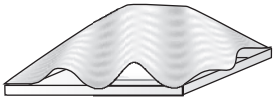
A student conducts an experiment at home to test the effect of different covers on the melting rate of ice. The student places identical ice cubes on separate trays of known mass. The student covers each tray as shown below.



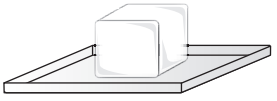
Plastic covered



Foil covered



Paper towel covered



Not covered

The trays are placed on the same table. After ten minutes, the student removes the covers, discards the excess water, and calculates the mass of each ice cube.

13 **Which of these is the dependent variable in the experiment?**

A shape of each ice cube

B mass of each ice cube

C temperature of the ice cubes

D material covering the ice cubes

14 **Which of these is the control in the experiment?**

F mass of the trays

G tray with no covering

H mass of the ice cubes

J tray with the plastic covering

GO ON

15 **A scientist believes that a factory has been dumping acid into a local river. To test this hypothesis, which property of water should the scientist monitor?**

A pH

B density

C polarity

D temperature

16 **A cellular process uses a strand of genetic material to produce a new strand. Parts of the strands are shown below.**

Original strand	**ATT CAG**
New strand	**UAA GUC**

This new strand will most likely be used for

F gene splicing

G DNA synthesis

H crossing-over

J protein synthesis

17 **Students conducted an experiment to test the effect of antibiotics on bacteria. They placed bacteria in a petri dish that contained agar treated with an antibiotic. Only one of the bacterial colonies survived.**

Which of these statements best explains why only one colony survived?

A The bacteria in the colonies competed for survival.

B There was only enough food in the dish for some of the bacteria to survive.

C There was not enough antibiotic in the dish to kill all the bacteria.

D The bacteria in the surviving colony had genetic variations that allowed them to survive.

GO ON

18
BCR

In an experiment, a group of students placed ten raisins in a container with 100 milliliters of water. They covered the container and let the raisins sit overnight. The students removed the raisins from the container and observed that they were larger. They also observed that the volume of water in the container had decreased.

What happened to the raisins to cause them to become larger? In your response, be sure to

- **name the process that caused the raisins to become larger**
- **describe how this process caused the raisins to become larger**
- **explain the role of this process in living systems**

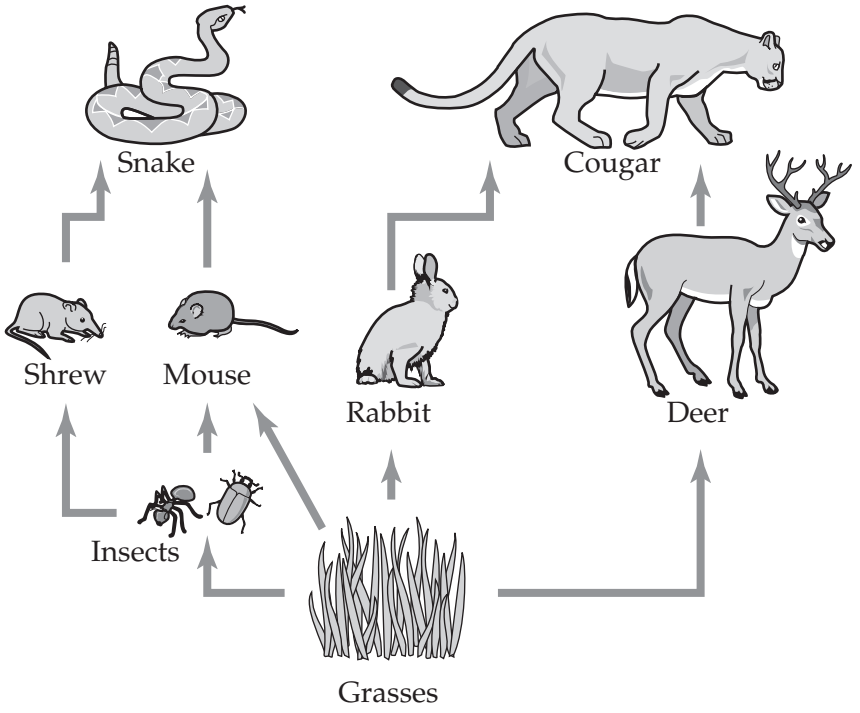
Write your answer in your Answer Book.

GO ON

Directions

Use the relationships in the food web below to answer Numbers 19 through 21.

TERRESTRIAL FOOD WEB



19 **Which of these lists all of the predators shown in the food web?**

A cougars only

B cougars and snakes

C cougars, snakes, and shrews

D cougars, snakes, shrews, and mice

GO ON

20 **The relationship between the mice and the insects is an example of**

F commensalism

G mutualism

H parasite–host

J predator–prey

21 **According to the food web, which of these supply energy for all the other organisms?**

A snakes

B insects

C grasses

D cougars

GO ON

Directions

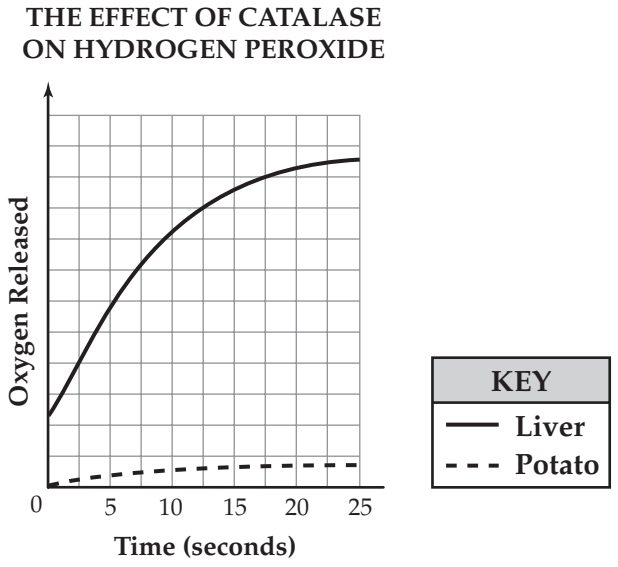
Use the information and the graph below to answer Numbers 22 through 24.

Catalase is an enzyme found in plant and animal cells. Hydrogen peroxide is a harmful substance found in cells. Catalase causes hydrogen peroxide to break down into water and oxygen.

A student conducted an experiment to determine whether plant and animal cells have the same amount of catalase. She used liver and potato tissues in the experiment. The student followed the procedures below.

1. **Label two identical test tubes, 1 and 2.**
2. **Pour 10 milliliters of hydrogen peroxide solution (1% concentration) into each test tube.**
3. **Add a small piece of liver tissue to Test Tube 1.**
4. **Add a small piece of potato tissue to Test Tube 2.**
5. **Collect the oxygen released from each test tube for 25 seconds.**
6. **Measure and record the volume of oxygen for each test tube.**

The graph below shows the results from the experiment.



GO ON

22 **Which of these factors was not controlled in the experiment?**

F the time for oxygen release

G the volume of hydrogen peroxide solution

H the volume of the test tubes

J the mass of the liver and potato tissues

23 **What type of molecule is catalase?**

A a lipid

B a protein

C a nucleic acid

D a carbohydrate

24 **The student conducted a second experiment. She boiled the liver tissue completely and added it to the hydrogen peroxide solution. She observed that little to no oxygen was released in the second experiment.**

Which of these statements best supports the student's observations?

F Exposing catalase to high temperatures makes it inactive.

G Exposing catalase to high temperatures changes it into a different enzyme.

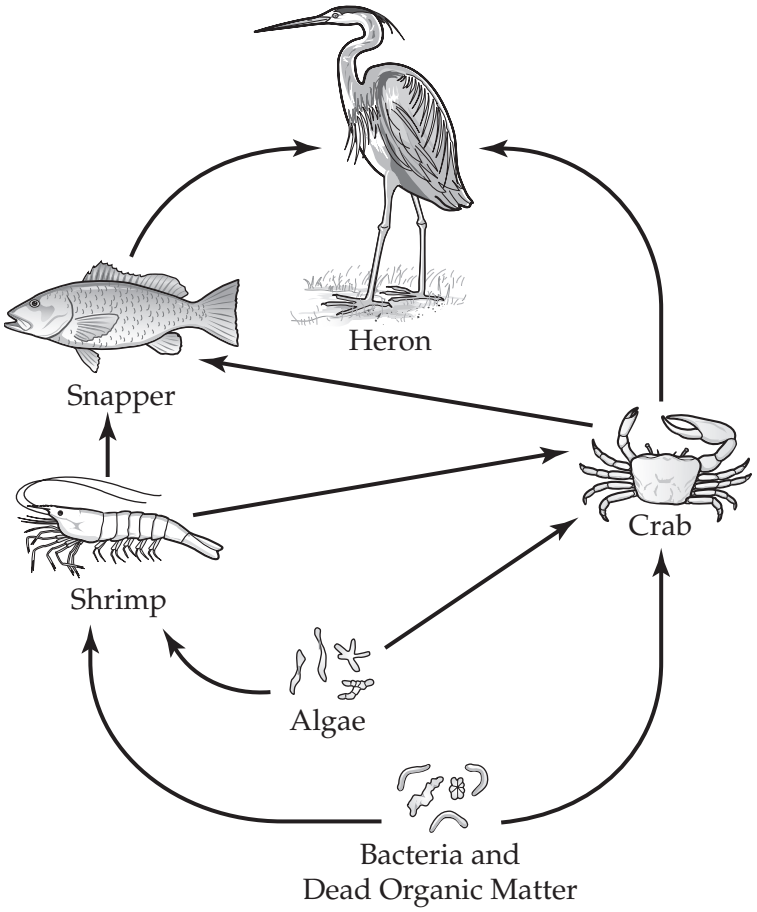
H Boiling liver breaks down hydrogen peroxide faster.

J Boiling removes oxygen from the liver.

GO ON

25 BCR **Some of the relationships among organisms living in a wetland are shown in the figure below.**

WETLAND FOOD WEB



Describe the flow of energy in the wetland food web. In your response, be sure to

- **name the biotic and abiotic factors affecting the heron**
- **identify the trophic levels of the different organisms in the wetland food web**
- **describe how the energy is transferred between the organisms in the wetland food web**
- **explain how the other organisms in the wetland ecosystem would be affected by the sudden disappearance of the heron population**

Write your answer in your Answer Book.

STOP

Session **2**

26 **A group of students conducted an experiment to study the growth of bean plants. They used two pots labeled "A" and "B." Each pot contained 20 small bean plants of similar height. All the plants were treated alike except for the solution they received. Each day for five days, the plants in Pot A were given 40 milliliters of distilled water, while the plants in Pot B were given 40 milliliters of distilled water containing one gram of fertilizer. The table below shows the average height of the plants in each pot for each day of the experiment.**

PLANT GROWTH EXPERIMENT

Day	Average Height (centimeters)	
	Pot A: Water Only	Pot B: Water plus Fertilizer
1	2.0	2.0
2	2.2	2.3
3	2.3	2.8
4	2.5	3.2
5	2.6	3.8

Which of these is being tested in this experiment?

F the effectiveness of the water used on the plants

G the effectiveness of the fertilizer used on the plants

H the maximum height the plants will reach

J the number of days the plants will grow

GO ON

27 **Which cell structure contains molecules that direct cell activities?**

A nucleus

B ribosome

C mitochondrion

D chloroplast

28 **Which of these statements about photosynthesis and respiration is true?**

F Both processes produce food.

G Both processes release energy from food.

H Photosynthesis produces oxygen; respiration does not.

J Photosynthesis produces carbon dioxide; respiration does not.

29 **Which of these is an example of a heterozygous genotype?**

A Rr

B RR

C wrinkled

D round

GO ON

Directions

Read the description of the experiment and use the table of results below to answer Numbers 30 and 31.

A student designed an experiment to see if plants grow better when watered with a sugar solution. He divided the plants into six groups, measured the initial height of each plant, and calculated the average height for each group. Once a week for two months, he watered the plants in each group using a different sugar solution for each plant group. At the end of two months, he measured the final height of each plant and calculated the average height for each group. The student's data are shown in the table below.

EFFECT OF SUGAR SOLUTION ON THE HEIGHT OF PLANTS

Plant Group	Percent Sugar Solution	Average Initial Height (centimeters)	Average Final Height (centimeters)
A	0	2	30
B	10	2	28
C	20	3	15
D	30	2	10
E	40	3	(died)
F	50	3	(died)

30 **Which of these statements explains why the plants in Groups E and F died?**

F The high sugar content caused too much water to move out of the root cells.

G The high sugar content caused too much water to move into the root cells.

H The high sugar content prevented the plant from capturing energy.

J The high sugar content clogged the pores in the cell membranes.

31 **Which of these structures transport water throughout the plant?**

A epidermal tissues

B vascular tissues

C chloroplasts

D mitochondria

GO ON

32
BCR

In humans, the allele for having a hairline with a widow's peak (H) is dominant to having a straight hairline (h).

A woman that is homozygous dominant for having a widow's peak and a man that is heterozygous for having a widow's peak have a child. What is the probability that their child will have a widow's peak? In your response, be sure to include

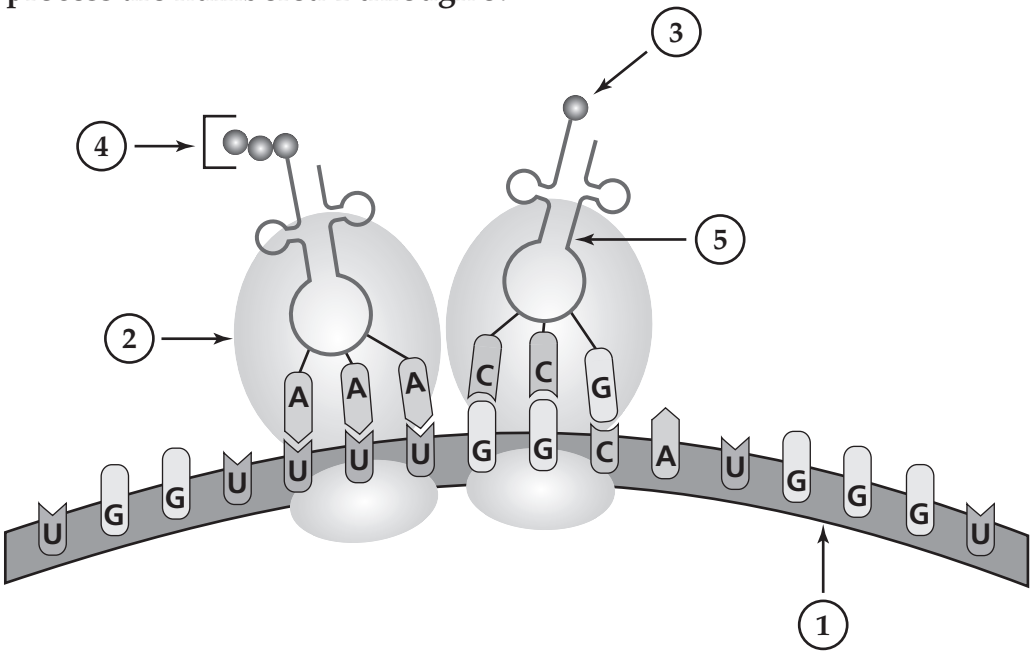
- **a completed Punnett square**
- **the genotypes and phenotypes of the parents**
- **the possible genotypes and phenotypes of the child**
- **an explanation of how DNA determines a trait such as widow's peak**

Write your answer in your Answer Book.

Directions

Use the information and the diagram below to answer Numbers 33 through 35.

Part of the process of protein synthesis is shown below. The different structures in this process are numbered 1 through 5.



33 **Structure 2 in the diagram represents a**

A ribosome

B mitochondrion

C protein

D chloroplast

34 **The process shown in the diagram occurs in the**

F nucleus

G cytoplasm

H vacuole

J chromosome

35 **Structure 1 is produced in what part of the cell?**

A vacuole

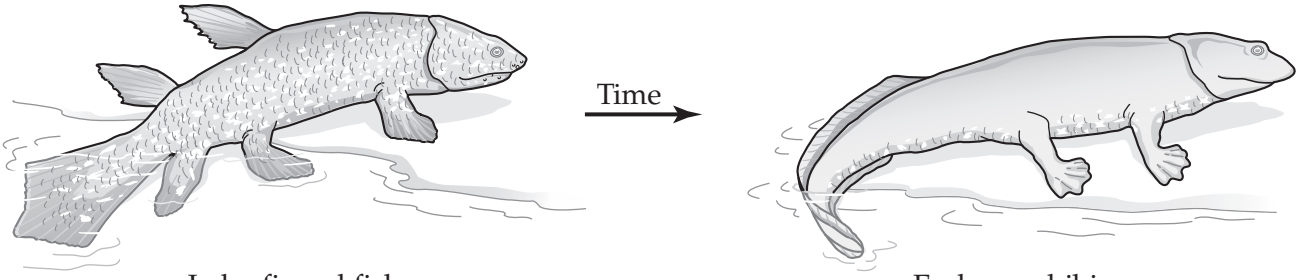
B cytoplasm

C mitochondria

D nucleus

GO ON

36 **Amphibians were the first vertebrates to live on land. The ancestors of amphibians were probably lobe-finned fish. The diagram below shows this development of amphibians over time.**



Lobe-finned fish

Early amphibian

Which of these terms best describes how amphibians could have developed from lobe-finned fish?

F selective breeding

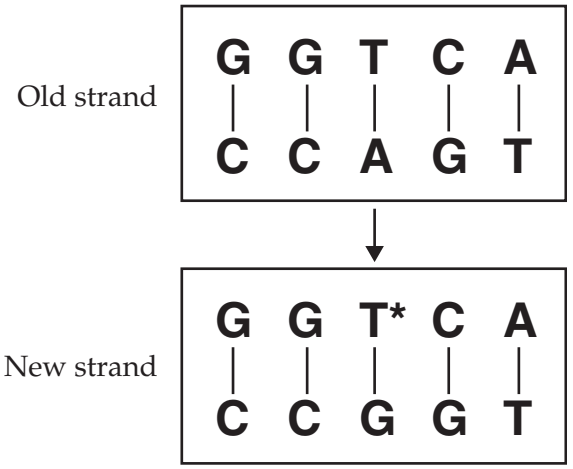
G cloning

H migration

J natural selection

37 **Two segments of DNA are shown in the diagram below.**

TWO DNA SEGMENTS



Normal thymine (T) is found in the old strand. It is replaced by an abnormal molecule (T*) in the new strand. The abnormal molecule (T*) binds to guanine (G) instead of binding to adenine (A). This is an example of

A an adaptation

B protein synthesis

C a mutation

D binary fission

38 **Some cells have many short, hairlike structures on their surfaces. These structures are used mainly for**

F cell movement

G DNA replication

H energy production

J waste removal

39
BCR

A student enjoys watching birds. She wants to attract goldfinches to the feeders in her backyard in the winter. She observed goldfinches eating thistle seeds during the summer, but is not sure if that is their favorite food. She planned an experiment to find out their favorite food, and bought three different kinds of seeds: thistle, sunflower, and corn.

- **State a possible hypothesis for her experiment.**
- **Identify the independent and dependent variables in her experiment.**
- **Describe specific experimental procedures she could use to test her hypothesis.**
- **Describe the data she should record.**
- **What data would support her hypothesis?**

Write your answer in your Answer Book.

GO ON

Directions

Use the information below to answer Numbers 40 and 41.

A particular toxin prevents cellular production of usable energy. Cells that are affected by this toxin are unable to carry out many of their normal functions.

40 **Which of these organelles would be most directly harmed by this toxin?**

F ribosomes

G the nucleus

H mitochondria

J the vacuole

41 **If cells were exposed to this toxin, which of these processes would probably be least affected?**

A mitosis

B diffusion

C respiration

D photosynthesis

42 **Some types of bacteria live deep in the ocean where sunlight cannot reach. These bacteria use the energy stored in inorganic molecules to make sugars.**

Which of these processes do the bacteria use to produce sugars?

F photosynthesis

G chemosynthesis

H aerobic respiration

J nitrogen fixation

43 **Which of these correctly matches the molecule with its function?**

A lipid—stores genetic information

B vitamin—supplies energy to cells

C enzyme—speeds up chemical reactions

D carbohydrate—manufactures cell membranes

GO ON

44
BCR

Marine and land iguanas are two different species that inhabit the Galapagos Islands. Some scientists believe that both species diverged from a common ancestor. Marine iguanas eat algae. Land iguanas feed on cacti. Algae are more abundant in the ocean than cacti are on the islands. Both species lay their eggs in the sand.

Rats, cats, and goats have recently been introduced to the islands. Rats often feed on iguana eggs, cats eat baby iguanas, and goats eat cacti.

Explain how the two species of iguanas could have developed from a common ancestor. In your response, be sure to

- **name the process that explains how marine and land iguanas developed from a common ancestor**
- **describe the steps involved in this process**
- **explain how the introduction of rats, cats, and goats might affect both iguana species**

Write your answer in your Answer Book.

GO ON

Directions

Use the information and the Punnett square below to answer Numbers 45 and 46.

In guinea pigs, the allele for black fur (B) is dominant. The allele for brown fur (b) is recessive. Two guinea pigs were crossed as shown in the Punnett square below. Numbers 1, 2, 3, and 4 represent the types of offspring produced from the cross.

	B	b
B	1	2
B	3	4

45 **What is the probability that an offspring from this cross would have brown fur?**

A 0%

B 25%

C 50%

D 75%

46 **Which of these describes the phenotypes of the parent guinea pigs?**

F Both parents have black fur.

G Both parents have brown fur.

H One parent has black fur, and the other has brown fur.

J One parent has a mixture of black and brown fur, and the other has black fur.

GO ON

47 **A student's hypothesis is that increased exercise causes increased heart rate. Heart rate is determined by taking the pulse, which is measured in beats per minute (BPM).**

Which of the following data would support this student's hypothesis?

A When sitting, her pulse was 70 BPM; when standing, her pulse was 50 BPM.

B When running, her pulse was 100 BPM; when sitting, her pulse was 60 BPM.

C When sitting, her pulse was 90 BPM; when walking, her pulse was 90 BPM.

D When running, her pulse was 65 BPM; when standing, her pulse was 70 BPM.

48 **The genetic information for making a protein must move from the nucleus to the cytoplasm. Which of these moves this information to the cytoplasm?**

F a ribosome

G DNA

H RNA

J an amino acid

GO ON

Directions

Use the information below to answer Numbers 49 and 50.

A scientist wanted to find out if low numbers of fish found in a nearby lake were related to acid rain. During his three-year study, he analyzed rainwater and lake water samples. By gathering samples of fish, he estimated the number of fish in the lake.

Each year he found that both the rainwater and lake water became more acidic, and the number of fish decreased.

His data suggested that acid rain may be responsible for the decrease in the number of fish found in the lake.

49 **The lake ecosystem includes frogs, freshwater algae, and inorganic sediment. Which of these is an abiotic factor contained within the lake ecosystem?**

A frogs

B algae

C fish

D sediment

50 **What most likely led to the rainwater's increasing acidity?**

F ultraviolet radiation

G sedimentation

H burning fossil fuels

J global warming

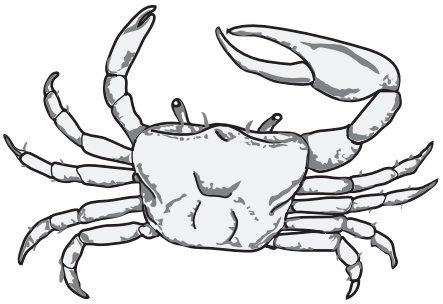
GO ON

Directions

Use the information and the figure below to answer Numbers 51 and 52.

Male fiddler crabs attract females by quickly waving their large front claw. If a claw is lost in a fight or accident, they quickly grow a hollow claw of equal length. Because the new claw is lighter, they can wave it faster. A male fiddler crab is shown below.

MALE FIDDLER CRAB



51 **The male fiddler crab's new claw can be described as**

A a clone

B a genotype

C an adaptation

D a dominant trait

52 **The new claw probably helps the male fiddler crab to**

F successfully reproduce

G maintain homeostasis

H fight more successfully

J evolve into a new species

GO ON

53 **The populations of wolves and other large predators have decreased throughout the United States. This disruption of the natural food web will most likely lead to**

A a decrease in prey animals

B an increase in producers

C the overpopulation of prey animals

D the overpopulation of scavengers

STOP

BIOLOGY

Public Release 2007