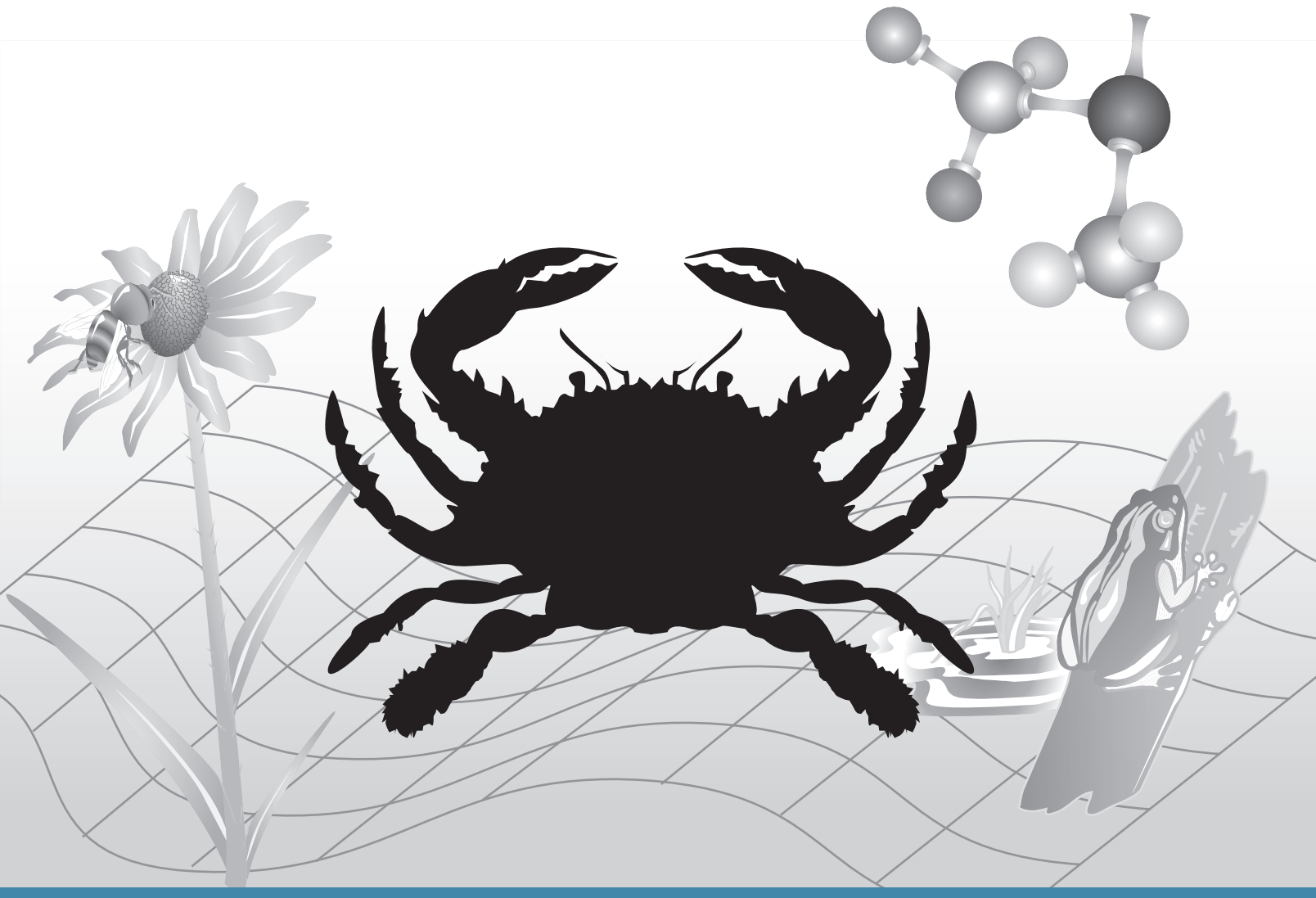
HSA

Maryland High School Assessment

Maryland State Department of Education

Achievement Matters Most



BIOLOGY

Public Release, Fall 2004

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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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Directions

Use the information below to answer Numbers 1 and 2.

Aphids are insects that feed on fluids from the stems of plants. After the aphids ingest the plant fluids, they excrete a liquid called honeydew.

1 **Ladybugs eat aphids, which are a source of protein for the ladybugs. Which of these terms <u>best</u> describes the relationship between the ladybugs and the aphids?**

A mutualism

B parasite–host

C predator–prey

D commensalism

2 **Some species of ants protect aphids from predators. The ants benefit by feeding on the honeydew produced by the aphids. Which of these terms <u>best</u> describes the relationship between the aphids and the ants?**

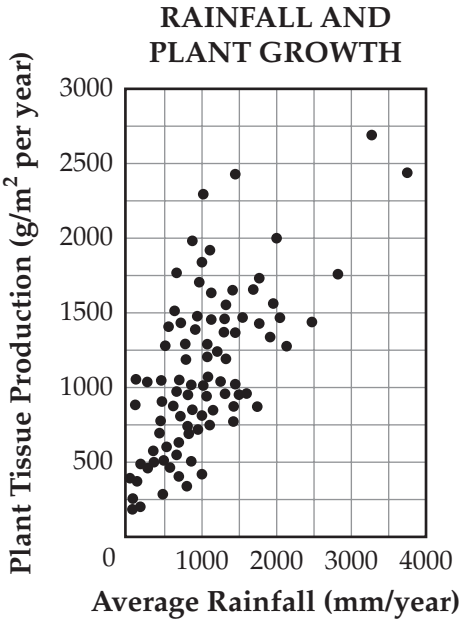
F mutualism

G parasite–host

H predator–prey

J commensalism

3 **The graph below shows the relationship between annual rainfall and plant tissue growth rates in an ecosystem.**



Which of these statements describes the trend shown by the data in the graph?

A As rainfall increased, the amount of plant material decreased.

B The amount of rainfall decreased as the amount of plant material increased.

C As rainfall increased, the amount of plant material increased.

D Rainfall had no effect on the amount of plant material.

GO ON

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4 **How many nucleotides are needed to code for one amino acid?**

F 1

G 3

H 4

J 6

5 **Cyanide is a poison that prevents mitochondria from using oxygen. As a result, the mitochondria cannot produce**

A lipids

B sugar

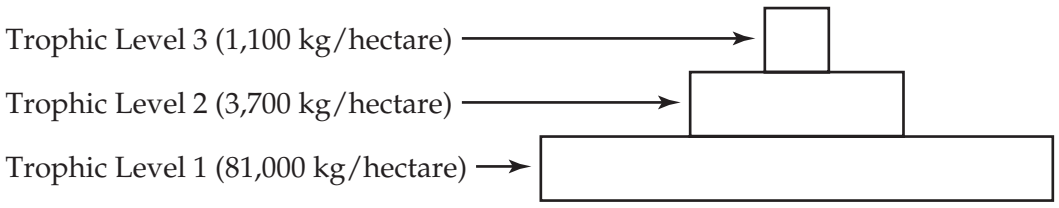
C minerals

D energy

6
BCR

A team of scientists conducted a study of a wetland. Using samples collected from the wetland, the scientists estimated the total biomass at each trophic level. Their data are shown below.

BIOMASS SAMPLE FROM A WETLAND



Explain the relationship between trophic levels and biomass. In your response, be sure to include

- **the roles of the organisms found at the different trophic levels**
- **how each trophic level obtains energy**
- **why the available energy changes at each level**
- **why the amount of mass differs at each of the trophic levels**

Write your answer in your Answer Book.

GO ON

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7 **A scientist is trying to discover a new treatment to stop cancer cells from dividing. In the cancer cells, which of these processes will stop if the treatment is successful?**

A mitosis

B chemosynthesis

C binary fission

D genetic recombination

8 **The presence or absence of freckles is determined by one gene. The allele for freckles (F) is dominant and the allele for the absence of freckles (f) is recessive.**

A couple has several children. All of the children have freckles because their parents' genotypes can only produce children with freckles.

Which of these are <u>most likely</u> the genotypes of the two parents?

F Ff and ff

G FF and ff

H Ff and Ff

J ff and ff

9 **On Earth, water cycles through the atmosphere, oceans, land, and organisms. By what process does <u>most</u> of the water in plants return to the environment?**

A evaporation from the roots

B condensation on the leaves

C evaporation from the leaves

D diffusion from the roots

GO ON

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Directions

Use the information below to answer Numbers 10 and 11.

The largest flower in the world, called a rafflesia, is three feet wide and weighs up to 36 pounds. The rafflesia has no roots, stems, or leaves. It lives on and takes nourishment from a vine called tetrastigma. The rafflesia harms the vine.

The seeds of the rafflesia are dispersed in an unusual way. Plantain squirrels and tree shrews eat parts of the rafflesia plant. Scientists observe that when the animals chew the rafflesia, seeds get caught in their teeth. The animals will then chew on tetrastigma vines, leaving the seeds where they can germinate.

10 **Specialized cells in the rafflesia flowers undergo a process that produces gametes. What is this process called?**

F binary fission

G meiosis

H fertilization

J enzyme regulation

11 **Rafflesia flowers produce the smell of rotting flesh. This smell attracts flies. When the flies land on the flowers, the pollen attaches to them. The flies then transport the pollen to other flowers.**

Producing a smell to attract flies is an example of

A parasitism

B adaptation

C replication

D predation

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Directions

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

ELEPHANTS DON'T NEED EMAIL

Researchers have observed that elephants seem to know where other elephants are and where they are going, even when they are separated by miles of dense forest. Elephant families will suddenly stop grazing, turn their heads in the same direction, and walk into the forest. The elephants act as if they are communicating with each other.

It is believed that these elephants are responding to low frequency sounds, called infrasound. Human ears cannot hear most elephant rumbles, but sometimes humans can feel the vibrations. Infrasound vibrations are below 20 cycles per second. The frequencies of sounds normally heard by elephants and humans are shown in the table below.

RANGE OF NORMAL HEARING

Animal	Hearing Range	
	Minimum Frequency (cycles per second)	Maximum Frequency (cycles per second)
Elephant	14	16,000
Human	20	20,000

Katherine Payne, a researcher from Cornell University, felt vibrations in the air while she was watching the elephants at the Metro Washington Park Zoo in Portland, Oregon. She believed the elephants might be communicating using infrasound.

Payne and other researchers conducted a study on wild elephants living in southwest Africa. The researchers placed microphones and speakers in areas where elephants live. They recorded the elephants' rumbles and observed their behavior. They found that elephants "talk" to each other in frequencies ranging from 14 cycles per second to 16,000 cycles per second.

To learn how far the rumbles could be heard, they played recordings of low frequency elephant rumbles and watched the reactions of distant elephants. The researchers found that elephants hear low frequency sounds that are produced as far as two and one half miles away. The researchers did not test beyond two and one half miles. The sounds that elephants produce and hear may travel even farther.

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12 **Elephants travel long distances in search of food. Using infrasound, family members traveling separately can communicate with each other.**

The ability of the elephants to communicate over long distances probably developed

F slowly over millions of years

G over a ten year period

H as a strategy to decrease reproduction

J as a way to communicate with other species

13 **BCR**

The researchers found that the elephants could communicate with each other using infrasound over a distance of two and one half miles. The sounds that elephants hear may travel even farther.

Design an experiment that would determine the maximum distance from which elephants can hear infrasound.

Be sure to include

- **a hypothesis**
- **a materials list**
- **the specific steps to follow in the experiment**
- **the method of collecting data**

Write your answer in your Answer Book.

14 **Loggerhead turtles in the Atlantic Ocean return to lay their eggs on the same beaches where they hatched. Scientists have observed that the turtles have a "compass sense." This sense allows them to use Earth's magnetic field to find their way back to the beaches where they were hatched.**

Which of these terms <u>best</u> describes the turtle's ability to use Earth's magnetic field?

F diversity

G habitat

H succession

J adaptation

GO ON

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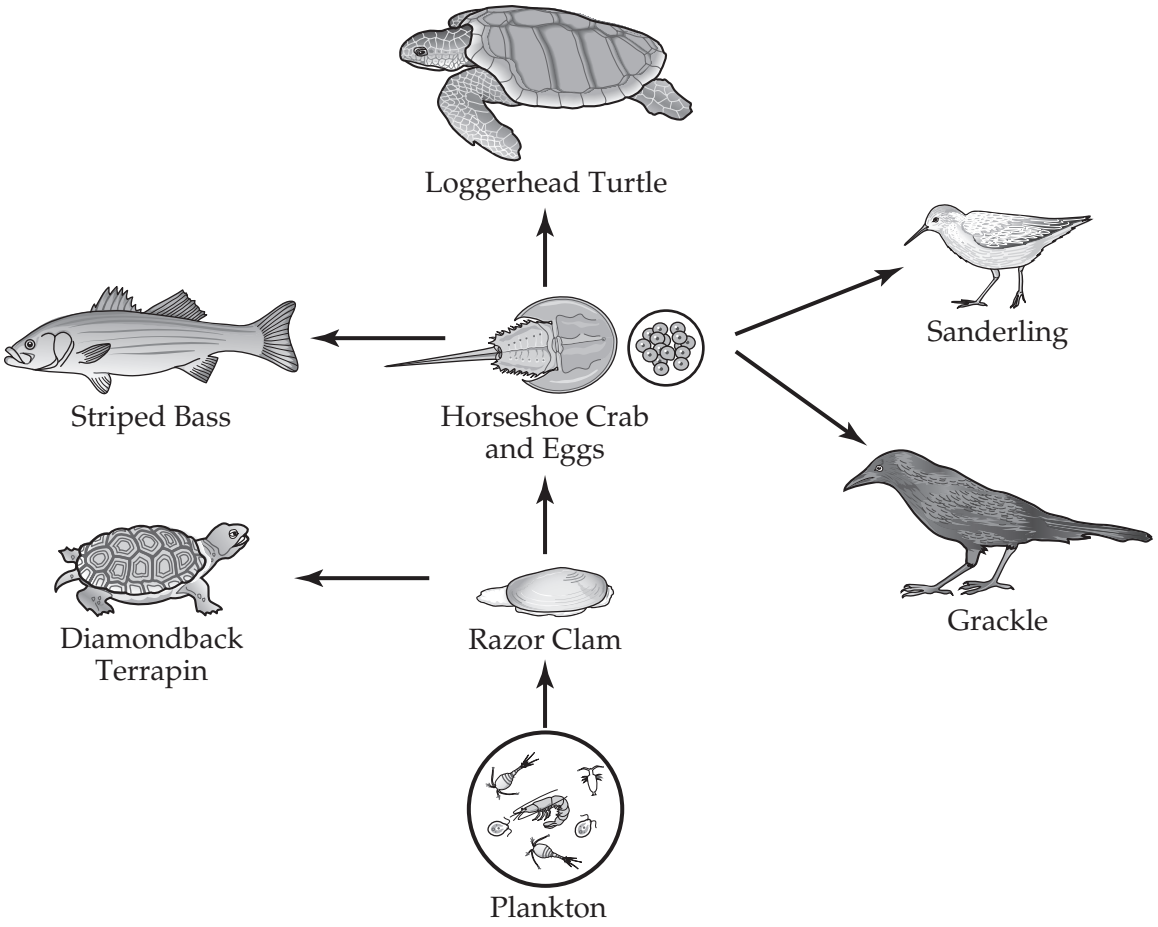
Directions

Use the information and the food web below to answer Numbers 15 and 16.

A marine environment provides a habitat for a variety of plants and animals. A small part of a marine food web is shown below.

MARINE FOOD WEB



15 **Which of these describes the role of the sanderling in the marine food web?**

A producer

B herbivore

C carnivore

D omnivore

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16 **Horseshoe crabs are used by fisherman for bait. If the horseshoe crab population were reduced by overfishing, which of these groups of organisms would <u>most likely</u> decrease in number?**

F plankton, razor clams, and loggerhead turtles

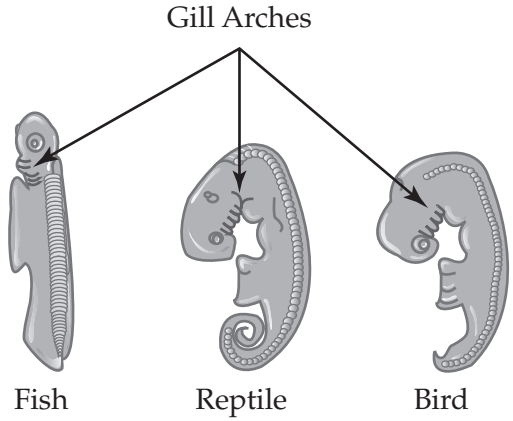
G sanderlings, loggerhead turtles, and striped bass

H grackles, plankton, and diamondback terrapin

J striped bass, sanderlings, and razor clams

17 **BCR** **The diagram below shows the early embryos of a fish, a reptile, and a bird. The embryos of these organisms are similar in structure and appearance.**

EARLY EMBRYOS



- **What other evidence do you see that could be used to determine relatedness?**
- **Explain what would provide the most reliable evidence that two organisms are related.**
- **What evidence in adult fish, reptiles, and birds would show relatedness?**

Write your answer in your Answer Book.

GO ON

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18 **Students are conducting an experiment to determine if sugars are present in foods. They heat a test tube containing a sugar solution in a beaker of water.**

Which of these is an unsafe laboratory practice in this experiment?

F heating the sugar solution in a closed test tube

G rinsing hands with water after handling the materials

H using a test tube clamp to hold the test tube

J wearing safety goggles while heating the sugar solution

GO ON

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Directions

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

Mammals, birds, modern reptiles, and theropod dinosaurs are vertebrates. The table below shows some of the differences and similarities among these groups of vertebrates.

CHARACTERISTICS OF VERTEBRATE GROUPS

	Mammals	Birds	Modern Reptiles	Theropod Dinosaurs
Number of ear bones	3	1	1	1
Legs directly under body	yes	yes	no	yes
Produce milk	yes	no	no	no
Constant body temperature	yes	yes	no	yes
Live birth	yes	no	some	no
Skin covering	hair	feathers/scales	scales	feathers/scales

19 **According to the table, which of these vertebrates are <u>most closely</u> related?**

A mammals and modern reptiles

B theropod dinosaurs and modern reptiles

C mammals and theropod dinosaurs

D birds and theropod dinosaurs

20 **Birds, mammals, and theropod dinosaurs can maintain a constant body temperature. The ability to maintain a constant body temperature is an example of**

F respiration

G homeostasis

H a reptilian trait

J an acquired trait

GO ON

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21
BCR

All organisms must be able to exchange chemical substances between their cells and their environment. Some organisms are unicellular and others are multicellular. These organisms have different strategies to obtain and use these chemical substances.

- **What chemical substances must be exchanged between each organism and its environment?**
- **Describe the processes that cause these chemical substances to move into and out of cells.**
- **Describe the role of the cell membrane in the exchange of materials in both types of organisms.**
- **Describe the role of body systems in the exchange of materials in a multicellular organism.**

Write your answer in your Answer Book.

GO ON

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Directions

Use the information and the table below to answer Numbers 22 and 23.

The breathing rate of a goldfish can be measured by the number of times the goldfish opens its mouth. In an experiment, students placed a goldfish in a container of water at 26°C and counted the number of times the fish opened its mouth. They gradually lowered the water temperature and counted the number of times the fish opened its mouth at 20°C, 14°C, 8°C, and 2°C. The results are shown in the table below.

BREATHING RATES OF GOLDFISH

	Water Temperature				
Trial	**26°C**	**20°C**	**14°C**	**8°C**	**2°C**
1	101	80	54	30	2
2	98	75	52	27	3
3	102	81	53	29	2
4	103	78	55	28	4

22 **Which of these descriptions best explains the decrease in the breathing rate of the goldfish?**

F The demand for oxygen increased.

G The rate of metabolic activity decreased.

H The demand for carbon dioxide decreased.

J The fish's activity levels increased.

23 **Which of these procedures would be a good control for this experiment?**

A Use a different kind of fish for each water temperature.

B Determine the breathing rate of a goldfish kept at a constant 26°C.

C Put the goldfish in 2°C water and then increase the temperature.

D Repeat the experiment using a different species of goldfish.

GO ON

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24 **Maryland white oak trees make their own food. Their cells contain structures that capture energy from the sun. What are these structures?**

F chloroplasts

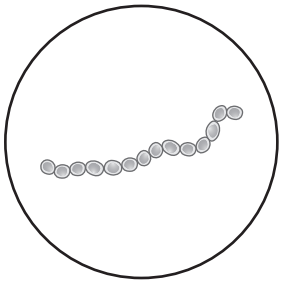
G nuclei

H mitochondria

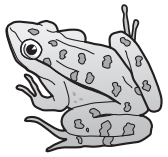
J ribosomes

Directions

Use the diagram of the two different organisms and the information below to answer Numbers 25 and 26.



Streptococcus (1000×)



Frog

***Streptococcus* is a type of bacteria that causes strep throat in humans. A frog is a multicellular organism that lives in aquatic environments.**

25 **Which of these is the type of reproduction used by *Streptococcus?***

A binary fission

B meiosis

C crossing-over

D budding

26 **Which system in the frog produces chemicals that regulate functions in different parts of its body?**

F respiratory system

G excretory system

H endocrine system

J circulatory system

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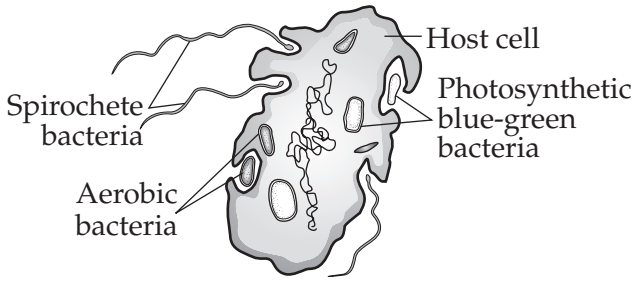
Directions

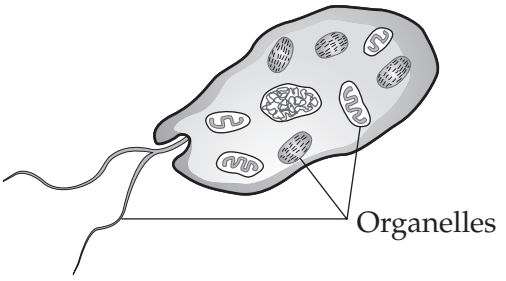
Use the information and the figure below to answer Numbers 27 and 28.

The diagram below shows a colony of prokaryotes and a single-celled eukaryote. The eukaryote contains organelles that resemble the three types of bacteria found in the colony of prokaryotes. More than a billion years ago, bacteria like these may have joined other prokaryotes to form colonies of cells. Researchers think that these once free-living prokaryotes became the organelles of modern-day eukaryotes.

COLONY OF PROKARYOTES



EUKARYOTE



27 **In the eukaryote, which of these organelles are used to make sugars?**

A flagella

B ribosomes

C mitochondria

D chloroplasts

28 **One of the organelles in the eukaryote releases energy from sugars. What is this process called?**

F respiration

G transpiration

H photosynthesis

J chemosynthesis

GO ON

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29 **Which of these results when one nitrogen base replaces another in a segment of genetic material?**

A an enzyme substrate

B a mutation

C a feedback loop

D an adaptation

30 **Scientists classify humans as omnivores, based on their teeth. As omnivores, humans eat**

F only fungi

G mostly plants and animals

H only animals

J mostly bacteria and fungi

31 **Which statement describes the major role of lipids within a cell?**

A They cause DNA to replicate.

B They move RNA in the cytoplasm.

C They catalyze chemical reactions in the cell cytoplasm.

D They are the main structural components of membranes.

STOP

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Session 2

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32 **After an egg cell containing 16 chromosomes is fertilized, how many chromosomes will be present in the zygote?**

F 8

G 16

H 32

J 64

GO ON

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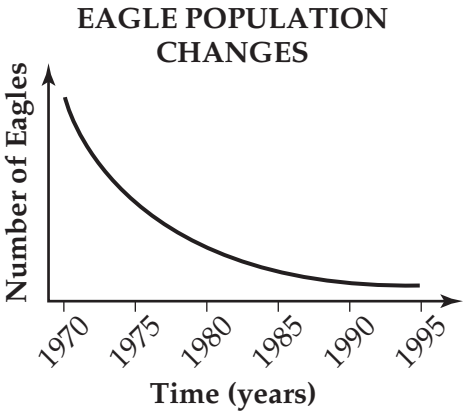
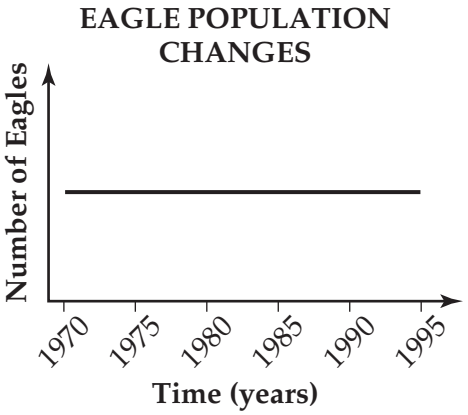
33 **The pesticide DDT was used to kill mosquitoes for many years. DDT entered bodies of water, moved up the food chain, and built up in the tissues of fish. When female bald eagles ate these fish, they produced eggs with very thin shells. The eggs broke when the eagles sat on their nests. The U.S. government banned the use of DDT in 1972.**

Which of these graphs <u>most likely</u> shows how the ban of DDT affected the bald eagle population?

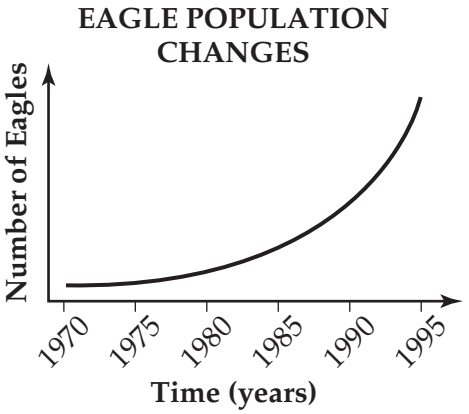
A



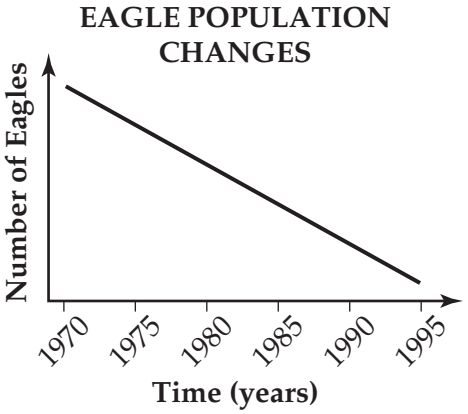
C



B



D



GO ON

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34
BCR

Rafael was given an assignment to determine how the appearance of frog blood cells change when they are placed in distilled water. He is using an incorrect setup to perform his investigation. His laboratory setup is shown in the figure below.

Critique Rafael's setup shown in the figure. In your response, be sure to include

- **any unsafe laboratory equipment and procedures shown in the figure**
- **a description of the materials and safe setup for the correct investigation**
- **an explanation of why it is important to follow the correct procedures in the laboratory**
- **any safety precautions you have used during an investigation in biology; provide specific details and the reasons for taking the precautions**

Write your answer in your Answer Book.

GO ON

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35 **What molecules control the reaction rate of photosynthesis?**

A sugars

B enzymes

C fatty acids

D nucleic acids

36 **In horses, the allele for straight hair (B) is dominant to the allele for curly hair (b). Which of these sets of parents can produce offspring with curly hair?**

F a heterozygous male with straight hair and a homozygous female with straight hair

G a homozygous male with curly hair and a homozygous female with straight hair

H a heterozygous male with straight hair and a heterozygous female with straight hair

J a homozygous male with straight hair and a homozygous female with straight hair

37 **Which of these is <u>not</u> a use for DNA fingerprinting?**

A to determine how individuals are related

B to make messenger RNA

C to determine a genetic sequence

D to study inherited diseases

GO ON

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38
BCR

Hemoglobin, a protein found in red blood cells, carries oxygen. Abnormal hemoglobin cannot carry as much oxygen as normal hemoglobin. The sequences below show sections of the DNA sequence that produce both the normal and abnormal types of hemoglobin.

SECTION OF GENE FOR HEMOGLOBIN			
Normal DNA sequences:	GGA	CTC	CTC
Abnormal DNA sequences:	GGA	CAC	CTC

MESSENGER RNA CODON TABLE

Codon	Amino Acid
GUG	Valine
CAC	Histidine
CUC	Leucine
ACU	Threonine
CCU	Proline
GAG	Glutamic acid

- **Write the messenger RNA sequences that would be produced from the normal and abnormal DNA sequences shown above.**
- **Using the codon table, write the amino acid sequences produced from the DNA for normal and abnormal hemoglobin.**
- **Beginning with DNA, describe the process that forms proteins such as hemoglobin.**

Write your answer in your Answer Book.

GO ON

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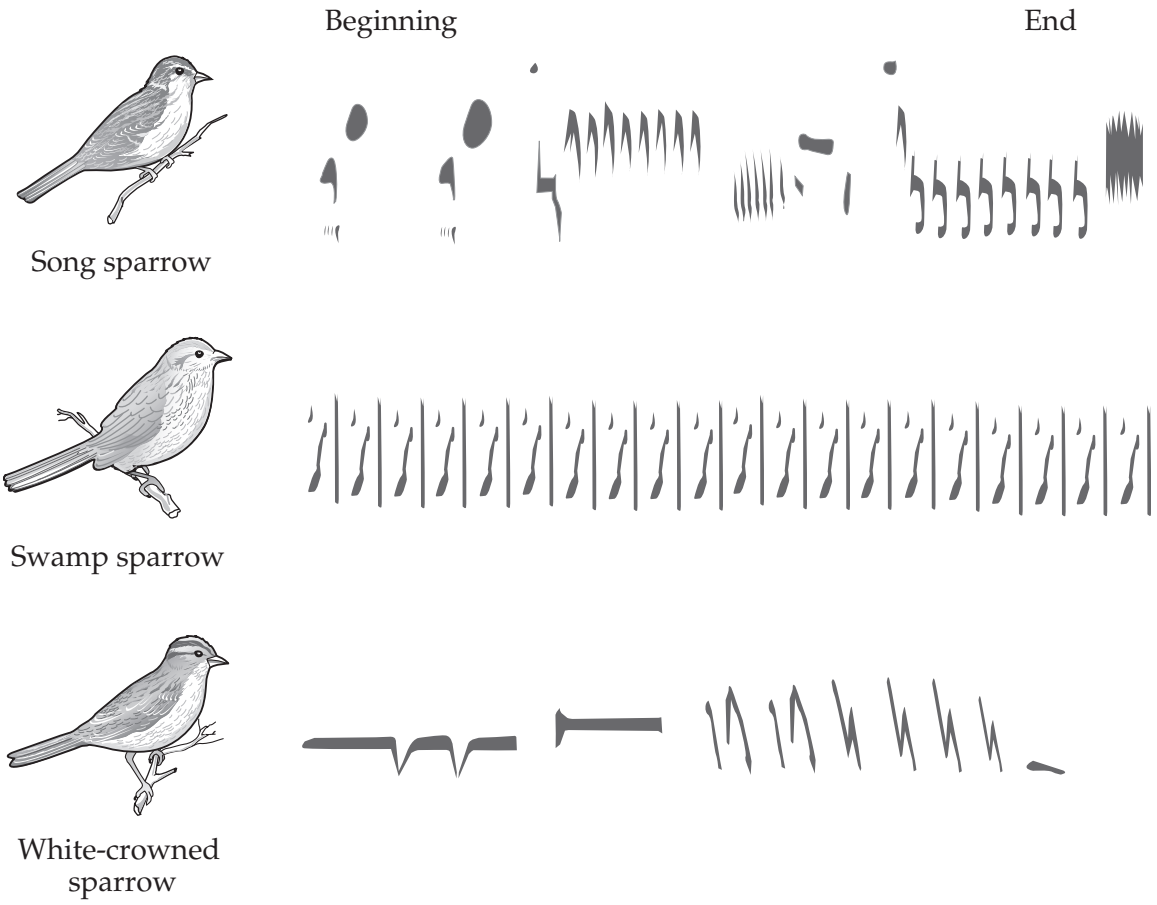
39 **A scientist is comparing the bird sound patterns among three species of sparrow. He uses a machine to produce an image of their sounds. His data are shown in the figure below.**

SPARROW SOUND PATTERNS



Which of these is an accurate statement about the data?

A The beginning and the end of the song sparrow's sound pattern are identical.

B The swamp sparrow's sound pattern is similar to the white-crowned sparrow's sound pattern.

C The end of the white-crowned sparrow's sound pattern is very different from its beginning.

D The end of the swamp sparrow's sound pattern is identical to the end of the song sparrow's sound pattern.

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40 **In a recent experiment, scientists studied the effects of increased carbon dioxide levels on the growth of pine trees. The scientists observed that increased levels of carbon dioxide resulted in an increase in the average circumference of the tree trunks. The change in circumference is a result of the process of**

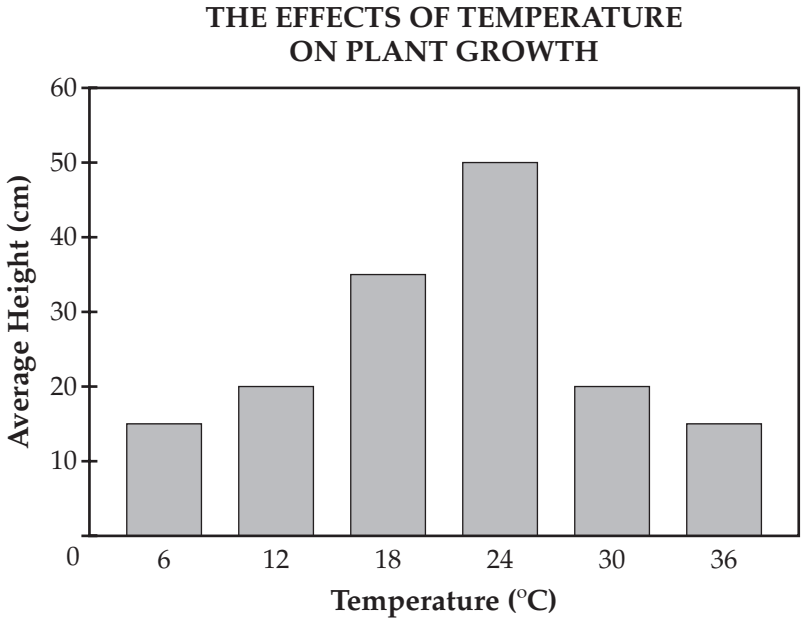
F osmosis

G adaptation

H transpiration

J photosynthesis

41 **A student performed an experiment to determine the relationship between air temperature and growth in plants. She divided 36 seedlings into six groups and grew each group at a different temperature. She recorded the average height of the plants in each group after a four-week period. Her results are shown below.**



Which of these statements <u>best</u> describes the results shown in the graph?

A As temperature increases, the average height of the plants continually increases.

B Temperature only affects average height between 18°C and 24°C.

C As temperature increases, the average height of the plants first increases and then decreases.

D Average height levels off at a temperature of 18°C.

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Directions

Use the description of the experiment below to answer Numbers 42 and 43.

A student washes her hands with antibacterial soap and water. Then she touches the agar in a petri dish with her thumb. The agar contains nutrients that support the growth of bacteria. Other students repeat the procedure after washing their hands with three different kinds of antibacterial soap. The petri dishes are kept warm overnight to allow bacteria to grow. The next day the students count the number of bacterial colonies in each dish.

42 **Which of these questions are the students <u>most likely</u> trying to answer?**

F How long does it take soap to kill bacteria?

G Which soap is most effective in killing bacteria?

H Which nutrients are necessary to grow bacteria?

J How many bacteria are on the average thumb?

43 **What should be the effect of the soap in this experiment?**

A It should be toxic to the bacteria.

B It should help the bacteria to grow.

C It should change the pH of the agar.

D It should destroy the nutrients in the agar.

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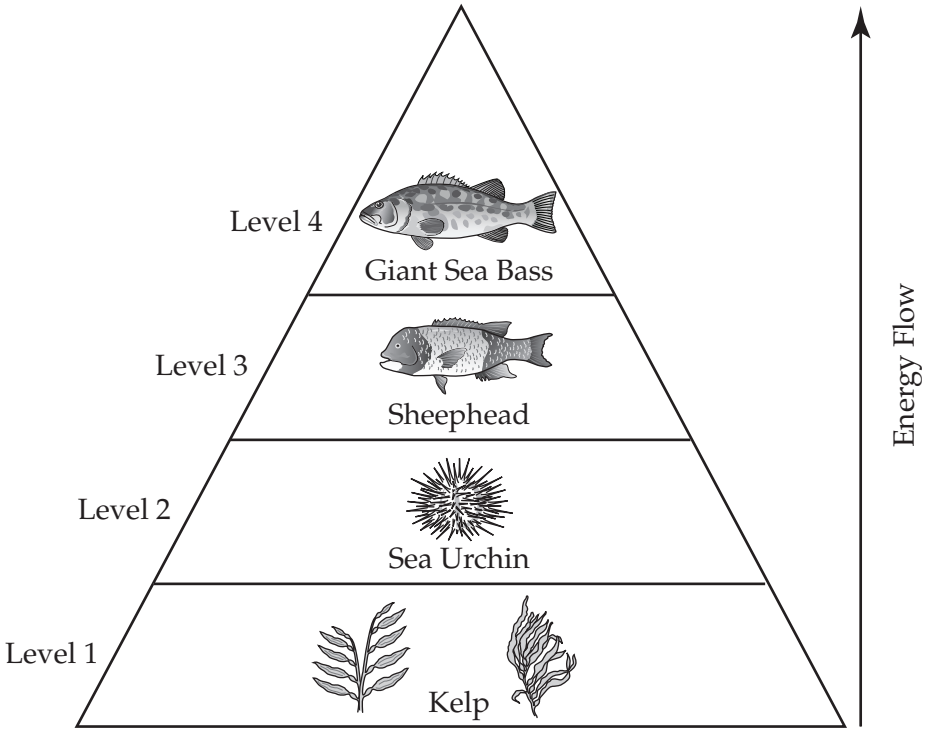
Directions

The energy pyramid below shows the flow of energy through the organisms in a kelp forest ecosystem in the Pacific Ocean. Use the energy pyramid to answer Numbers 44 and 45.

FLOW OF ENERGY IN A KELP FOREST ECOSYSTEM



44 **How would the populations of other organisms in the energy pyramid be affected if the population of sea urchins suddenly decreased?**

F Both the kelp and the sheephead populations would increase.

G Both the kelp and the sheephead populations would decrease.

H The kelp population would decrease, and the sheephead population would increase.

J The kelp population would increase, and the sheephead population would decrease.

45 **What is the <u>lowest</u> level of the energy pyramid that contains carnivores?**

A Level 1

B Level 2

C Level 3

D Level 4

GO ON

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46 **Which RNA sequence is produced using the DNA sequence AGC-TAC-ACT?**

F UCG-AUG-UGA

G UCG-UAC-ACU

H TCG-ATG-TGA

J AGC-UAC-ACU

47 **A dog gets many nutrients from its food including amino acids. Which of these can be built directly using the amino acids?**

A proteins

B carbohydrates

C lipids

D minerals

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Directions

Use the information and the table below to answer Numbers 48 and 49.

***Elodea*, a freshwater plant, releases gas bubbles when it is placed in direct light. In an investigation, a student placed a lamp at different distances from an aquarium containing *Elodea*. The student counted the number of bubbles produced by the *Elodea* plant. His data are shown in the table below.**

GAS BUBBLE PRODUCTION BY *ELODEA*

Distance of Plant From Light (cm)	Production of Gas Bubbles/Minute
10	40
20	20
30	10
40	5

48 **What energy source is used by *Elodea*?**

F heat

G light

H oxygen

J carbon dioxide

49 **The bubbles released by *Elodea* contain mostly**

A oxygen

B carbon dioxide

C nitrogen

D water vapor

GO ON

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50
BCR

Cardinals are birds that spend the winter in Maryland. Many people feed them sunflower seeds during the winter months. Some of the carbohydrates in the cardinal's diet come from these seeds. Describe

- **the building blocks of carbohydrates**
- **how the sunflowers produce carbohydrates**
- **how carbohydrates are used by living organisms**

Write your answer in your Answer Book.

51 **A rare disorder is caused by changes in a gene. Parents of individuals with the disorder have only normal copies of this gene. Which of these <u>most likely</u> causes this disorder?**

A mitosis

B gene splicing

C mutation

D natural selection

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52 **Four important scientific discoveries are listed below.**

1. Some animals can regrow their limbs.
2. All plant and animal tissues are made up of cells.
3. Dominant and recessive traits are passed from parents to offspring.
4. Chromosomes replicate during cell division.

Which two discoveries required the use of a microscope?

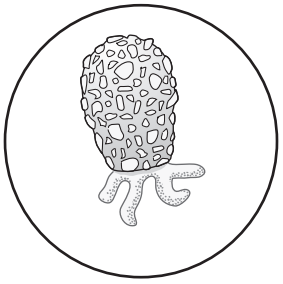
F 1 and 2

G 2 and 4

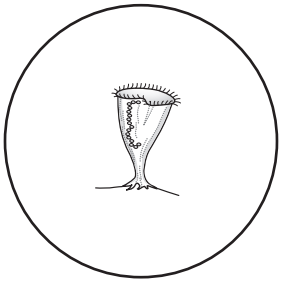
H 1 and 3

J 3 and 4

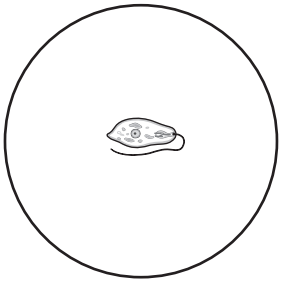
53 **A student used a microscope to observe several protists. The student sketched the protists and recorded their magnifications. The drawings and measurements are shown below.**



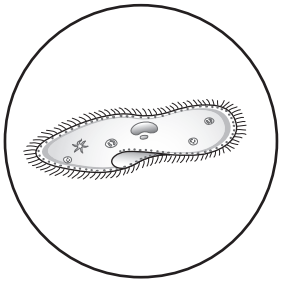
Difflugia (4×)



Stentor (4×)



Euglena (10×)



Paramecium (10×)

Which of these protists is the largest?

A *Difflugia*

B *Stentor*

C *Euglena*

D *Paramecium*

STOP

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BIOLOGY

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