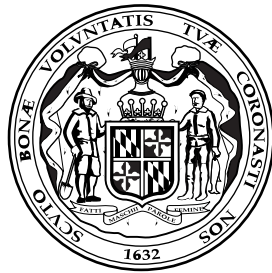


# *Biology*



*Maryland High School Assessment*

Public Release, Fall 2001

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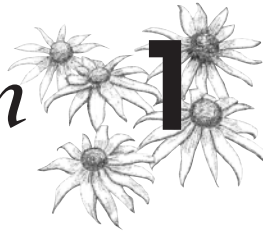


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# Session

# 1



## Sample A

Which of these animals has a body temperature that stays about the same throughout the year?

- A a frog
- B a fish
- C a duck
- D a snail

## Sample B

Which of these systems in the human body is directly involved in movement?

- F skeletal system
- G excretory system
- H endocrine system
- J reproductive system



Notice that the answer choices for Sample B are FGHIJ. Selected response answer choices will alternate ABCD and FGHIJ.

In addition to selected response questions such as Sample A and Sample B, there will be constructed response questions that require a written answer. Brief constructed response questions, which require a short written answer, are labeled "BCR" below the question number in the Student Test Book. The Rubric Sheet provides information about how constructed response questions will be scored. You may refer to the Rubric Sheet during the test.

Remember, read all directions and questions very carefully and choose the best answer for each question. If you are not sure about an answer, do the best you can, but don't spend too much time on any one question.

Answer all questions until you come to the end of Session 1, where you will see a stop sign. If you finish early, you may check your answers in Session 1, but do not go on to Session 2. You have 65 minutes to complete Session 1.

In order to protect the security of future test forms, one BCR item on the form administered in 2001 is not being released here.



- 1** Four teams of students independently tested the effects of temperature on the gill movements of goldfish. The results from their tests are shown in the tables below.

**NUMBER OF GILL MOVEMENTS AT VARIOUS TEMPERATURES**

**Team 1**

Trial	15°C	20°C	25°C
1	8	30	53
2	7	30	52
3	9	31	53
4	10	30	54
5	9	32	53

**Team 3**

Trial	15°C	20°C	25°C
1	21	32	51
2	21	31	50
3	22	31	52
4	21	30	52
5	20	31	51

**Team 2**

Trial	15°C	20°C	25°C
1	7	31	52
2	9	30	54
3	10	31	53
4	8	32	53
5	9	31	53

**Team 4**

Trial	15°C	20°C	25°C
1	8	31	53
2	9	32	53
3	9	31	54
4	8	31	53
5	9	32	54

Students from other teams questioned the results of Team 3. Which of these should the students on Team 3 do to validate their results?

- A use data from one of the other teams for the counts taken at 15°C
- B repeat the experiment at 15°C using the same set of goldfish
- C use containers made of different materials to test the goldfish again
- D repeat the experiment at 15°C using larger goldfish

**2** A laboratory procedure calls for heating 10 milliliters of a saltwater solution to 37°C. Which piece of laboratory equipment will not be needed?

- F protective eyewear
- G metric ruler
- H bulb thermometer
- J graduated cylinder

**3** Astrologers claim that the alignment of planetary bodies influences human events. Therefore, knowledge of the movement of planets can be used to predict future events. Astrologers also often claim that astrology is a science. Which of these statements best describes why astrology is not a true science?

- A Astrologers do not fully understand the nature of the universe.
- B Astrologers have been called “frauds” by many famous scientists.
- C Astrologers often disagree with each other about their theories and predictions.
- D Astrologers do not confirm their predictions in controlled studies.

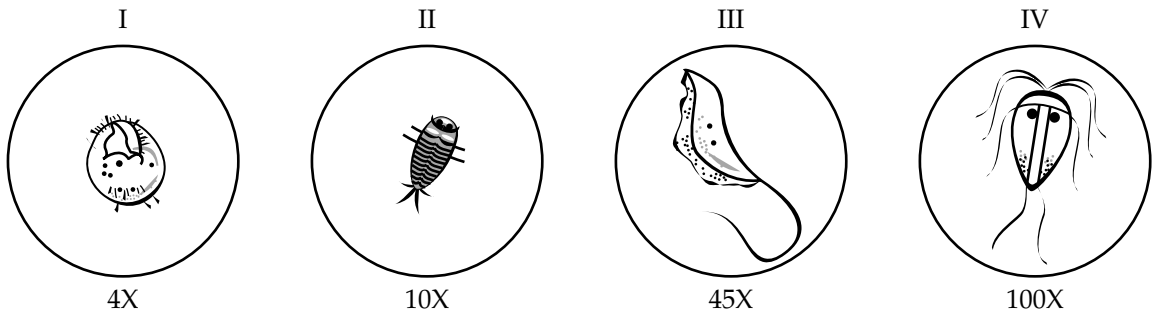
**4** In circulatory systems, a large part of the fluid is water. For example, human blood plasma is approximately 90% water. What property of water makes it an ideal material for transporting necessary chemical substances?

- F It freezes at 0°C.
- G It evaporates at 100°C.
- H It is made of hydrogen and oxygen.
- J It is a solvent for many substances.

**5** Starch from food is a source of energy for organisms. Starch is a type of

- A protein
- B vitamin
- C nucleotide
- D carbohydrate

- 6** The pictures below show four different organisms seen under a microscope. The degree of magnification is given below each illustration.



Which of these organisms has the largest actual size?

- F I
- G II
- H III
- J IV

- 7** A company that manufactures vitamins wanted to determine whether the vitamins had side effects. The company chose 2000 individuals to take one vitamin tablet per day for six months. Representatives from the company surveyed the participants to determine whether they had experienced any side effects. Which of these is the greatest problem with the procedure?

- A No control group was used.
- B The study lasted only six months.
- C The sample size was not large enough.
- D Only one brand of vitamin was tested.

**8**  
**BCR**

Gibberellic acid (GA) is a hormone that affects the growth of plants. A student predicted that spraying a gibberellic acid solution on corn plants would increase their rate of growth. To test this theory, he planted a corn plant and sprayed the same amount of gibberellic acid solution on it every day for one week. At the end of the week, he found that the corn plant had grown seven centimeters. Based on this observation, he concluded that gibberellic acid had caused the plant to grow faster.

- What was wrong with the student’s conclusion?
- Describe how he should have designed his investigation in order to get useful results.

Write your answer in your Answer Book.

**9**

Look at the table below.

**BACTERIAL GROWTH CONDITIONS**

Type of Bacteria	Optimal Growth pH	Optimal Growth Temperature (°C)
I	6.00	40
II	5.50	30
III	5.00	37
IV	7.00	37

Which of the four types of bacteria in the table has a better chance of growing in an environment with a pH of 5.75 and a temperature of 33°C?

- A I
- B II
- C III
- D IV





**10** Bears eat all summer to store energy for their winter hibernation. Which of these are their main energy source during hibernation?

- F lipids
- G proteins
- H vitamins
- J carbohydrates

**11** *Spartina*, a cord grass, grows in salt marshes and stores salt in its roots. This makes the salt concentration in its roots greater than that of the surrounding water. What most likely occurs in response to this salt concentration in the roots?

- A Salt moves into the roots.
- B Water moves into the roots.
- C Nutrients move out of the roots.
- D Water moves out of the leaves into the air.

**12** A biology class measured the pH of the water in four ponds. The data are recorded in the table below.

pH OF POND WATER

Pond	pH
1	6.0
2	7.5
3	7.0
4	5.3

Which pond has the most acidic water?

- F Pond 1
- G Pond 2
- H Pond 3
- J Pond 4

## Directions

Use the technical passage below and the Coastal Food Web on page 9 to answer Numbers 13 through 15.

### WHY ARE SEA OTTER POPULATIONS DECLINING?

The number of sea otters living along Alaska's Aleutian Islands has fallen to 10% of what it was a decade ago. The investigation into what is happening to this population is revealing a great deal of information about the complex nature of food webs. It is also showing how fragile the links in a food web can be.

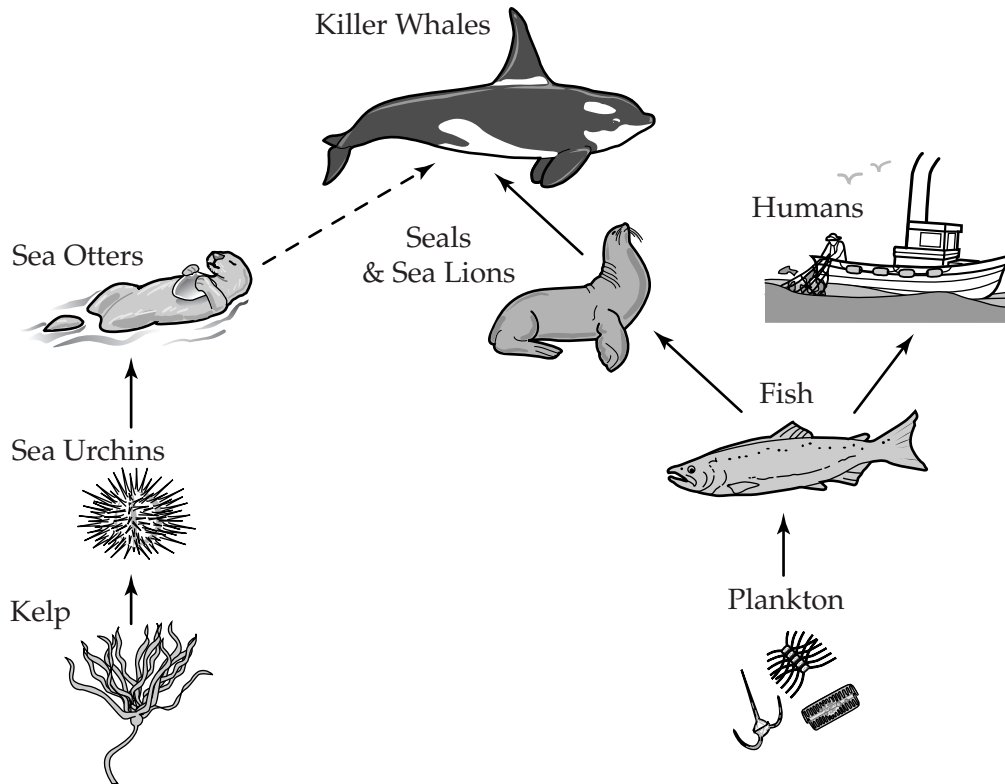
The immediate cause of the sea otters' decline seems to be predation by killer whales, which are turning to sea otters as a food source. James Estes, a University of California marine ecologist, first witnessed a killer whale eating a sea otter in 1991. Since then, a dozen such attacks have been reported. Estes suspected that these attacks were ultimately caused by disruption of the marine food web.

Many fish populations have declined dramatically, and species that marine mammals feed upon have been hit especially hard. The cause of this decline is not entirely understood, but it is thought to be due to a combination of overfishing, warming ocean temperatures, and other factors. Killer whales normally eat sea lions and harbor seals, but with local fish populations so low, these seal populations have rapidly declined. This has caused killer whales to resort to a new food source, the smaller and less nutritious sea otter.

This decline in the sea otter population has disrupted much of the coastal ecosystem along the Aleutian Islands. Sea otters prey upon sea urchins, which, in turn, feed upon kelp, a type of large seaweed that is abundant in many coastal ecosystems. Kelp beds provide protection for many species of fish and other small animals, and are an important basis of the coastal food web. (The food web is shown on page 9.)

In Estes' view, these changes are "an ecological chain reaction," with events that occur far out at sea causing massive changes to the coastal ecosystem.

## COASTAL FOOD WEB



**13** Which of these statements best summarizes James Estes' hypothesis about the decline of sea otter populations?

- A The killer whales are eating more seals and sea lions.
- B Kelp beds are an important basis of the coastal food web.
- C The sea otter population has fallen to 10% of what it was a decade ago.
- D Killer whale attacks on sea otters are caused by a disruption of marine food webs.

**14** Which of these follow-up studies would best evaluate James Estes' hypothesis about the decline of sea otter populations?

- F contrast the nutritional content of seal meat and sea otter meat
- G count the total population of sea urchins living off the Aleutian Islands
- H survey the number of attacks on sea otters by killer whales in the Aleutian Islands over the next ten years
- J survey the number of attacks on sea otters by killer whales in an area where both sea otters and seals are abundant

**15**  
**BCR**

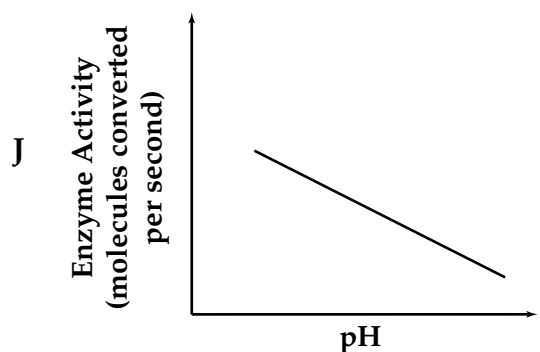
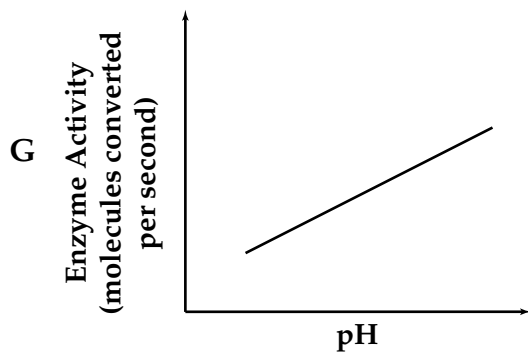
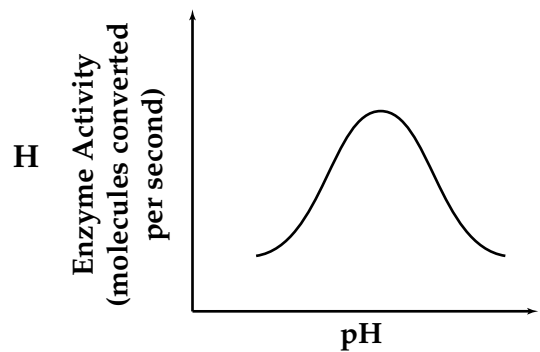
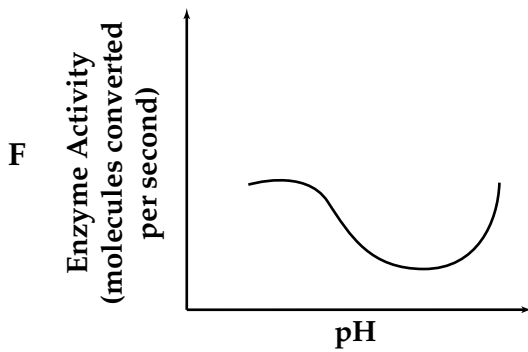
A plan has been suggested to help preserve the sea otter population in the Alaskan coastal food web, shown on page 9. This plan will reduce the number of fish that commercial fishing boats can catch from the coastal food web.

- Describe how the plan will affect the population of sea otters.
- Discuss the advantages and disadvantages of the plan with respect to
  1. animal and kelp populations
  2. commercial fishing

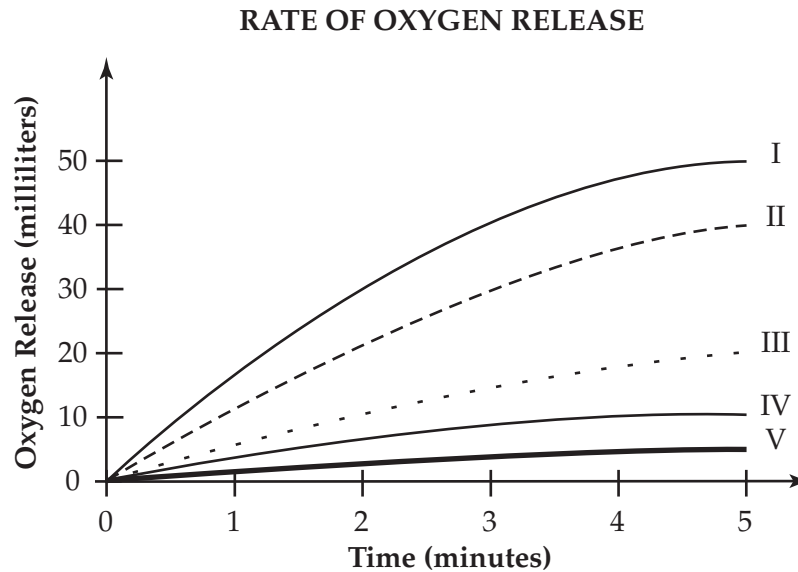
Write your answer in your Answer Book.

**16**

Which of these graphs shows how enzyme activity in mammals is typically affected by pH changes?



- 17** Catalase is an enzyme found in some animal cells. The enzyme speeds up the release of oxygen from the breakdown of hydrogen peroxide. The graph below shows the rate of oxygen release by catalase under different reaction conditions.



Catalase is most effective at a pH of 7. If Line IV represents catalase activity at pH 5, which line most likely shows the activity of the enzyme at pH 4?

- A Line I
- B Line II
- C Line III
- D Line V

**18** Some organisms that live in the intestines of cows do not require oxygen to survive. Which of these best describes the process by which these organisms obtain energy?

- F osmosis
- G mitosis
- H aerobic respiration
- J anaerobic respiration

**19** Which of these are used directly to make proteins in all cells?

- A nuclei
- B ribosomes
- C membranes
- D mitochondria

## Directions

Use the information below to answer Numbers 20 and 21.

A student is studying the growth of yeast, a single-celled eukaryotic organism that is used to make bread. He adds yeast cells to a flask containing a sugar solution and then places the flask in an incubator at 30°C. After 36 hours, he observes the flask to determine whether the yeast cells have grown.

**20** Which of these is directly involved in transporting nutrients from the sugar solution into the yeast?

- F the cell membrane
- G the nucleus
- H the vacuoles
- J the ribosomes

**21** Which part of the yeast cell converts the nutrients in the sugar solution into energy?

- A the cell membrane
- B the nucleus
- C the mitochondria
- D the ribosomes

**22** Which of these processes occurs during sexual reproduction but not during asexual reproduction?

- F meiosis
- G mitosis
- H binary fission
- J genetic mutation

**23** Which of these structures is found in plant cells but not in animal cells?

- A chloroplasts
- B mitochondria
- C a cell membrane
- D a nuclear membrane

**24** Which organelle is correctly matched with the cell process it performs?

- F vacuole—protein synthesis in leaf cells
- G chloroplast—diffusion of water in root systems
- H mitochondrion—energy production in muscle tissue
- J ribosome—production of messenger RNA molecules in yeast cells

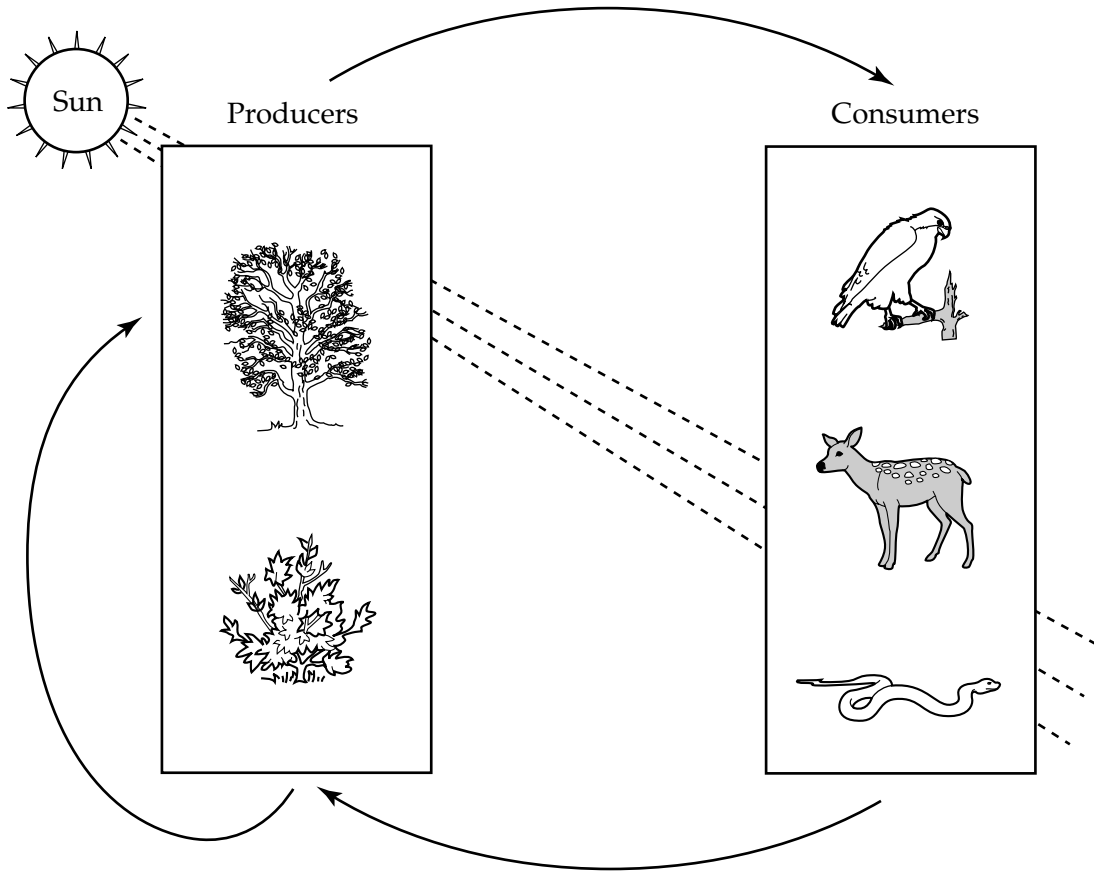
**25** A wildlife biologist is investigating a sudden increase in the death rate among several bird species. She has not been able to determine what disease or toxin is causing the deaths, but she has found that many of the sick birds are exhibiting a shortage of dissolved oxygen and a buildup of dissolved carbon dioxide in their cells.

Which of these body systems in the sick birds is most likely functioning improperly?

- A muscular
- B excretory
- C circulatory
- D reproductive

**26**  
**BCR**

The arrows in the diagram below show how energy and matter flow between organisms.



Describe how producers and consumers exchange energy and matter. In your response

- name and describe the chemical process producers use and the chemical process consumers use to contribute to the exchange
- identify the products of each process, and explain how these products are used in the exchange

Write your answer in your Answer Book.



**27** Keratin is a protein found in hair. Where in a cell is keratin made?

- A the nucleus
- B the vacuole
- C the ribosomes
- D the mitochondria

**28** Which of these will most likely happen if a change occurs in the sequence of bases in DNA?

- F An altered protein will be made.
- G Messenger RNA will not be transcribed.
- H A cell will die.
- J A gene will be deleted.

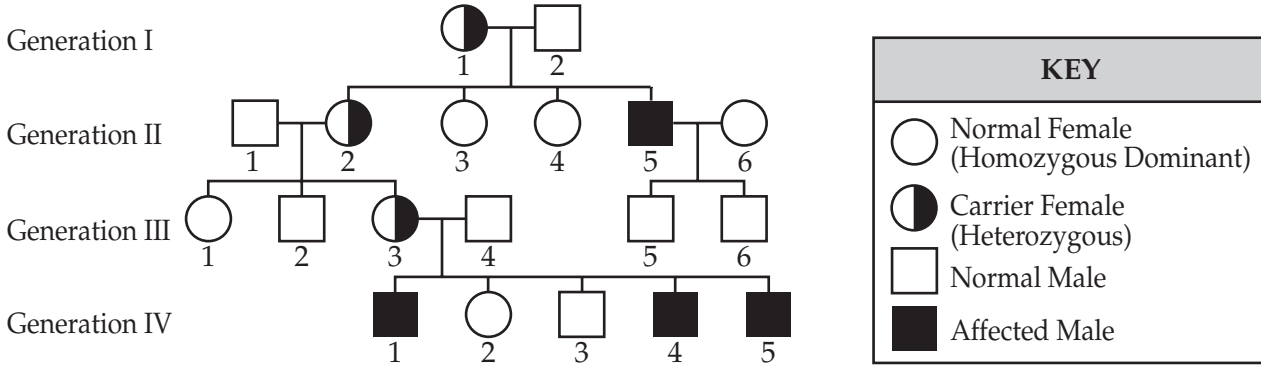
**29** A team of researchers discovered an enzyme in marine sponges that blocks a certain step of chromosomal separation. Which of these cell processes would be directly affected by this enzyme?

- A mitosis
- B diffusion
- C respiration
- D photosynthesis

# Directions

The pedigree below shows the occurrence of red-green colorblindness in four generations of a family. Use the information in the pedigree to answer Numbers 30 and 31.

COLORBLINDNESS PEDIGREE



- 30** How many individuals have red-green colorblindness in the four generations shown in the pedigree?
- F 3
  - G 4
  - H 7
  - J 12

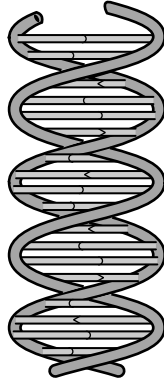
- 31** In generation IV, individual 5 married someone who is not a carrier of red-green colorblindness. If they have a female child, what is the chance that she will be born with red-green colorblindness?
- A 0%
  - B 25%
  - C 50%
  - D 100%



# *Session* **2**

Answer all questions until you come to the end of Session 2, where you will see a stop sign. If you finish early, you may check your answers in Session 2, but do not go back to Session 1. You have 55 minutes to complete Session 2.

**32** Look at the illustration below.



This illustration is a model of

- F RNA
- G DNA
- H a lipid
- J a protein

**33** An organism has gametes that contain 18 chromosomes. How many chromosomes are in each of its body cells?

- A 9
- B 18
- C 27
- D 36

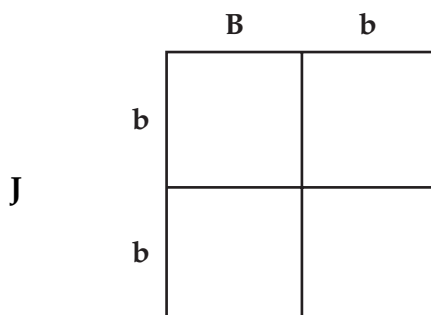
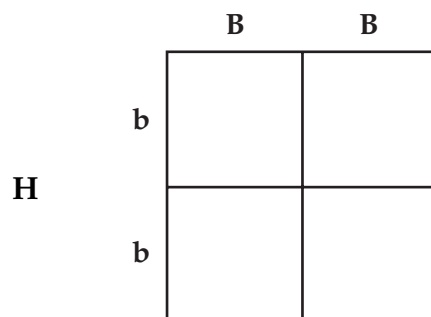
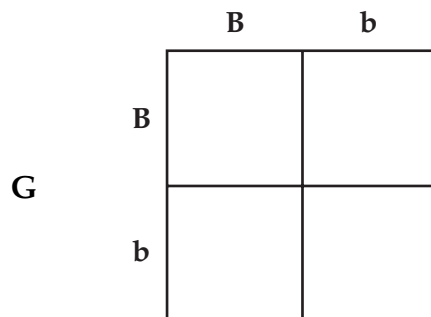
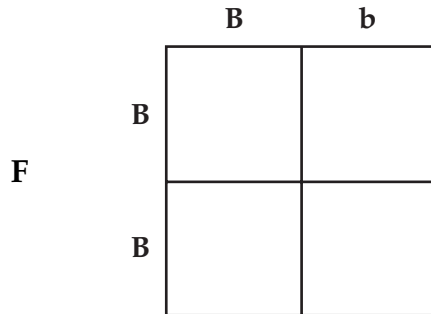
**34** A common mutation in cats is polydactyly, the presence of extra toes. Cats with the dominant allele (P) have extra toes on the front feet. Cats with the genotype pp have the normal number of toes. What is the probability that the offspring of two cats, one with the normal number of toes and one that is heterozygous, will display polydactyly?

- F 25%
- G 50%
- H 75%
- J 100%

**35**  
**BCR** In a freshwater pond, single-celled organisms may have a special structure called a *contractile vacuole*, which is used to pump water out of the cell.

Explain why this structure is necessary for maintaining a water balance between the cell and its environment. Write your answer in your Answer Book.

**36** In dogs, brown fur (B) is dominant to white fur (b). A dog has a litter of 12 puppies of which 6 are brown and 6 are white. Which of these Punnett squares shows the cross that occurred?



**37** Meiosis is the key process in the production of

- A RNA
- B gametes
- C body cells
- D white blood cells

**38** A child is born with a rare form of dwarfism that is caused by a dominant allele. There is no family history of this condition. Which of these best explains the appearance of this trait?

- F It is not an inheritable trait.
- G It is carried on the X-chromosome.
- H It is due to a new mutation.
- J It is the result of a poor diet.

**39** Compare a bacterial cell and a human body cell. Include in your response

- how they are similar and different in structure
- how they are classified

Write your answer in your Answer Book.

# Directions

Use the information and the table below to answer Numbers 40 through 42.

Cytochrome *c* is a molecule that is found in mitochondria. It can be an indicator of whether two different organisms are related.

CYTOCHROME C AMINO ACID DIFFERENCES

human	0									
monkey	1	0								
pig, sheep	10	9	0							
rabbit	9	8	4	0						
kangaroo	10	11	6	6	0					
chicken, turkey	13	12	9	8	12	0				
duck	11	10	8	6	10	3	0			
rattlesnake	14	15	20	18	21	19	17	0		
turtle	15	14	9	9	11	8	7	22	0	
tuna	21	21	17	17	18	17	17	26	18	0
	human	monkey	pig, sheep	rabbit	kangaroo	chicken, turkey	duck	rattlesnake	turtle	tuna

Comparisons are made between two different organisms by finding the place where the two lines intersect. The number where the columns and rows intersect shows how many amino acids are different in the cytochrome *c* of both organisms. For example, the number of amino acids that are different when comparing a rabbit's cytochrome *c* with a tuna's cytochrome *c* is 17. The larger the number, the greater the difference in the structure of the cytochrome *c* molecules of the two organisms.

**40** According to the table, which pair of organisms is least closely related?

- F a rabbit and a chicken
- G a monkey and a turtle
- H a rattlesnake and a tuna
- J a kangaroo and a duck

**41** According to the table, which of these pairs of organisms is most closely related?

- A a duck and a turtle
- B a rabbit and a kangaroo
- C a pig and a rabbit
- D a duck and a monkey

**42** According to the table, which of the following organisms is most closely related to monkeys?

- F a turtle
- G a pig
- H a rabbit
- J a duck

**43** DNA from four organisms was examined using gel electrophoresis. The results are shown in the diagram below.

DNA GEL ELECTROPHORESIS RESULTS

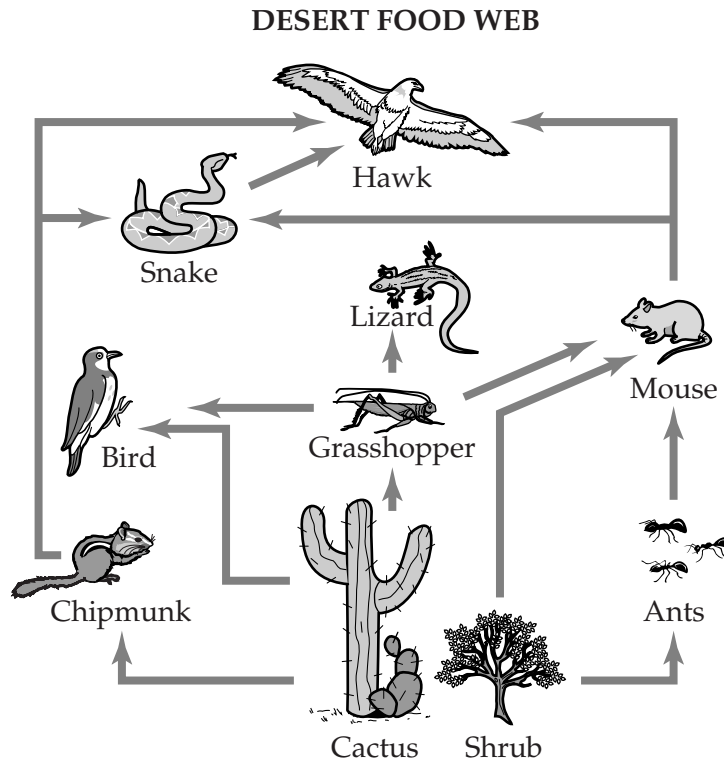
1	2	3	4
_____	_____	_____	_____
	_____		_____
_____	_____	_____	_____
_____		_____	_____
	_____	_____	_____

According to the data, which of these pairs of organisms are most closely related?

- A 1 and 2
- B 2 and 3
- C 2 and 4
- D 3 and 4

# Directions

The food web below shows the relationships among some of the organisms found in a desert environment. Use the relationships in the food web to answer Numbers 44 through 47.



**44** According to the food web, which of these organisms is an herbivore?

- F lizard
- G snake
- H hawk
- J grasshopper

**45** Which of these shows the relationship between the cactus and the bird?

- A producer–consumer
- B predator–prey
- C mutualism
- D commensalism



**46** Which of these shows the relationship between the lizard and the grasshopper?

- F parasite–host
- G predator–prey
- H mutualism
- J commensalism

**47** Which combination of organisms shows a food chain in this web?

- A cactus → snake → hawk
- B ant → grasshopper → lizard
- C cactus → chipmunk → snake
- D grasshopper → bird → hawk

**48**  
**BCR**

Even though DNA and messenger RNA share many characteristics, they are different in both structure and function.

Describe how DNA and messenger RNA are different. Include in your response how they differ in

- location in the cell
- size
- function
- structure

Write your answer in your Answer Book.

**49** A classification table is shown below.

CLASSIFICATION TABLE

Group	Contains a Nucleus	Type of Cells	Makes Own Food	Has Cell Walls
1	Yes	Unicellular or multicellular	No	Yes
2	No	Unicellular	Some species	Yes
3	Yes	Multicellular	Yes	Yes
4	Yes	Unicellular or multicellular	Some species	Some species
5	Yes	Multicellular	No	No

According to the table, which group contains oak trees?

- A Group 1
- B Group 2
- C Group 3
- D Group 5

- 50** While feeding on the nectar of flowers, many insects carry pollen from flower to flower. Which of these best describes the relationship between the flower and the insect?
- F predation
  - G mutualism
  - H parasitism
  - J competition
- 51** Lichens that colonize bare rocks are an example of a pioneer species. In which environment would a pioneer species be most successful?
- A an old-growth deciduous forest
  - B a hillside that has been cleared by a forest fire
  - C a mountain meadow after the spring snowmelt
  - D a grassland that has established itself on the site of an old farm
- 52** Which of these describes a parasite–host relationship?
- F Birds catch gypsy moths and eat them for food.
  - G A gypsy moth caterpillar eats the leaves of a plant.
  - H Bacteria feed on a dead gypsy moth.
  - J A fungus lives in the body of a live gypsy moth caterpillar.

- 53** Scientists create “transgenic” organisms when they transfer genes from one organism to a different kind of organism. Many people marvel at this technology, while others are concerned about its consequences and its effects on society. Which of these is not a realistic concern about the formation of “transgenic” organisms?
- A Transgenic plants may produce chemicals that are harmful to wildlife.
  - B Humans will acquire harmful transgenic traits by consuming transgenic foods.
  - C Eating fruit from transgenic plants could trigger allergies in sensitive individuals.
  - D This technology may be misused or unintentionally used to make products harmful to humans and other organisms.
- 54** The blue crab is a scavenger in the Chesapeake Bay. Which of these best describes the role of this organism?
- F eats dead and decaying materials
  - G converts light energy to food
  - H feeds entirely on plants for energy
  - J preys on other animals for food

