

BIOLOGY
ITEM SPECIFICATIONS
FOR THE
ALABAMA HIGH SCHOOL
GRADUATION EXAM



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State Superintendent of Education
Alabama State Department of Education
Montgomery, Alabama

October 2007

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TABLE OF CONTENTS

INTRODUCTION.....	1
ITEMS BY CONTENT STANDARD.....	3
CONTENT STANDARD 1.....	4
CONTENT STANDARD 2.....	7
CONTENT STANDARD 3.....	12
CONTENT STANDARD 4/9.....	14
CONTENT STANDARD 5.....	19
CONTENT STANDARD 6.....	25
CONTENT STANDARD 7.....	28
CONTENT STANDARD 8.....	34
CONTENT STANDARD 10.....	36
CONTENT STANDARD 11.....	39
CONTENT STANDARD 12.....	44
CONTENT STANDARD 13.....	47
CONTENT STANDARD 14.....	50
CONTENT STANDARD 15.....	56
CONTENT STANDARD 16.....	61

INTRODUCTION

This bulletin provides specific information about the *Alabama High School Graduation Exam (AHSGE)*, Third Edition. Educators representing each state school board district as well as both city and county school systems served on the committees that determined the eligible content for the biology subject-area test and reviewed, revised, and approved the actual items.

The content standards for the AHSGE biology subject-area test are found in *Alabama Course of Study: Science*, Bulletin 2005, No. 20, pages 39-42. The content standards for the biology subject-area test are specifically referenced in this document.

Teachers must be familiar with this document if they teach content that relates to the objectives measured on the graduation exam in the high school grades. Further, teachers must use this document in focusing instruction for students who have demonstrated weaknesses on objectives measured on the pre-graduation examination and the AHSGE.

An item specification has a distinct purpose and provides essential information concerning the testing of a content standard. Item specifications for biology will follow this order:

CONTENT STANDARD	Broad area of content to be assessed
ELIGIBLE CONTENT	Clarification and elaboration of a content standard (where applicable)
SAMPLE ITEMS	Item formats to test each content standard

The sample items in this bulletin will **not** be found on the pre-graduation examination or the AHSGE. The number of sample items in this bulletin does not necessarily reflect the weight of the content on the test. In order to identify the weight of the content, the following chart shows the number of items for each biology content standard.

CONTENT STANDARDS	NUMBER OF ITEMS
1. Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment.	6
2. Describe cell processes necessary for achieving homeostasis, including active and passive transport, osmosis, diffusion, exocytosis, and endocytosis.	6
3. Identify reactants and products associated with photosynthesis and cellular respiration, and the purposes of these two processes.	6
4/9. Describe similarities and differences of cell organelles, using diagrams and tables. Differentiate between the previous five-kingdom and current six-kingdom classification systems.	6
5. Identify cells, tissues, organs, organ systems, organisms, populations, communities, and ecosystems as levels of organization in the biosphere.	6
6. Describe the roles of mitotic and meiotic divisions during reproduction, growth, and repair of cells.	6
7. Apply Mendel's laws to determine phenotypic and genotypic probabilities of offspring.	6
8. Identify the structure and function of DNA, RNA, and protein.	6
10. Distinguish between monocots and dicots, angiosperms and gymnosperms, and vascular and nonvascular plants.	6
11. Classify animals according to type of skeletal structure, method of fertilization and reproduction, body symmetry, body coverings, and locomotion.	6
12. Describe protective adaptations of animals, including mimicry, camouflage, beak type, migration, and hibernation.	6
13. Trace the flow of energy as it decreases through the trophic levels from producers to the quaternary level in food chains, food webs, and energy pyramids.	6
14. Trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen.	6
15. Identify biomes based on environmental factors and native organisms.	6
16. Identify density-dependent and density-independent limiting factors that affect populations in an ecosystem.	6
TOTAL	90

**ITEMS
BY
CONTENT STANDARD**

CONTENT STANDARD

1. Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment.

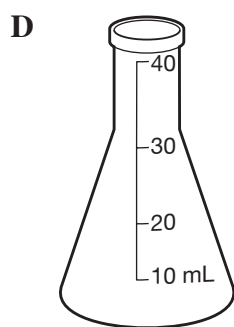
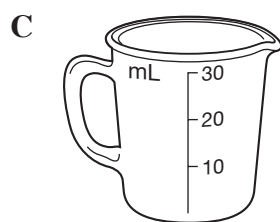
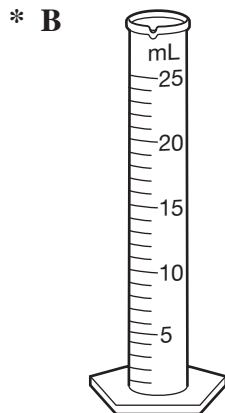
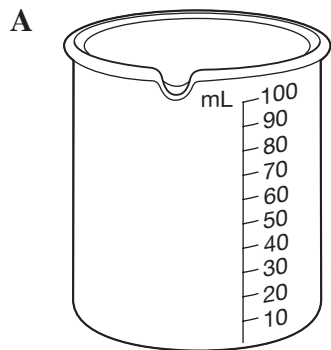
ELIGIBLE CONTENT

- Select appropriate glassware for conducting experiments including a graduated cylinder, a beaker, a flask, a test tube, a microscope slide, a pipette, and a Petri dish.
- Select appropriate measuring equipment for conducting experiments including a balance and a stopwatch.
- Select appropriate optical instruments for conducting experiments including a compound microscope, an electron microscope, and a magnifying glass.

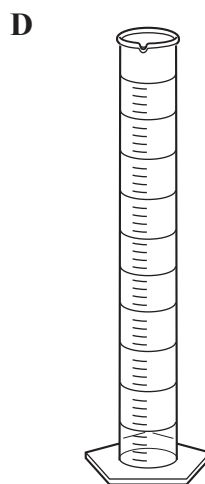
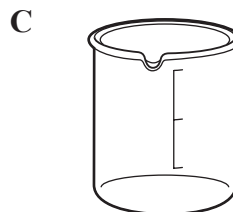
SAMPLE ITEMS

- | | |
|---|--|
| <p>1 Which piece of equipment can BEST measure the volume of ink in a pen?</p> <p>A 10 mL beaker</p> <p>* B 10 mL graduated cylinder</p> <p>C 100 mL beaker</p> <p>D 100 mL graduated cylinder</p>
<p>2 Students are repeating Louis Pasteur’s experiment in which he boiled broth over a flame to test his hypothesis related to spontaneous generation. Which piece of lab equipment should be selected for boiling the broth?</p> <p>* A flask</p> <p>B pipette</p> <p>C Petri dish</p> <p>D graduated cylinder</p> | <p>3 Which tool can be used to MOST accurately determine the volume of a paper clip?</p> <p>A ruler</p> <p>B beaker</p> <p>C electronic balance</p> <p>* D graduated cylinder</p>
<p>4 In addition to a stopwatch, which other tool can be used to determine how fast a single-celled organism moves?</p> <p>A pipette</p> <p>B watch glass</p> <p>C electron microscope</p> <p>* D compound microscope</p> |
|---|--|

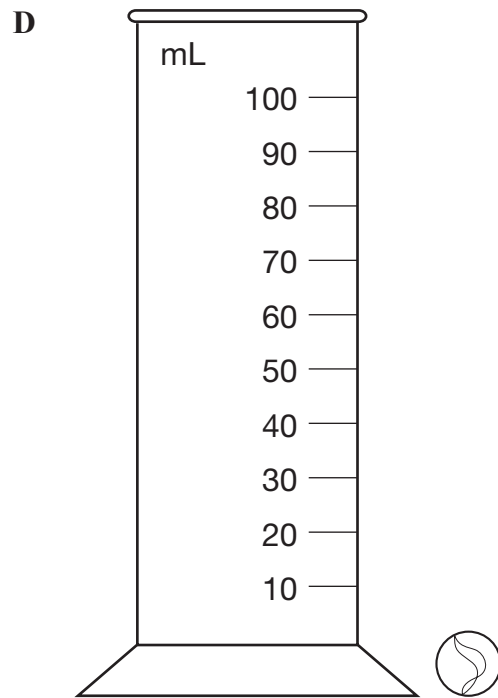
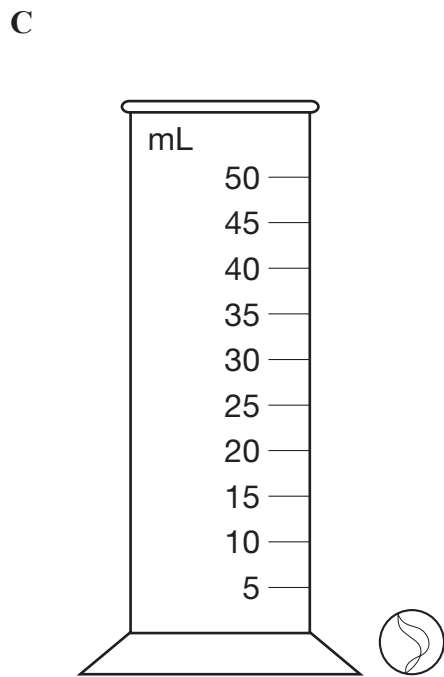
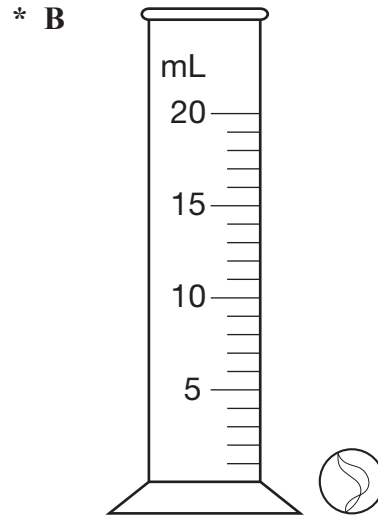
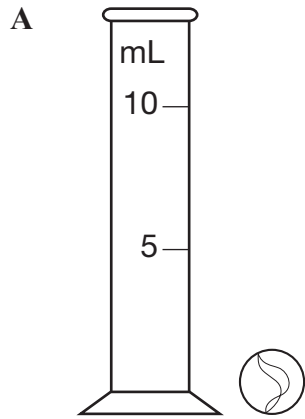
5 Which tool should be used to MOST accurately measure 22.0 mL of a liquid?



6 A student wants to grow bacteria on a solid nutrient agar. Which type of glassware is MOST appropriate for this procedure?



7 Which graduated cylinder should be used to MOST precisely determine the volume of a marble?



CONTENT STANDARD

2. Describe cell processes necessary for achieving homeostasis, including active and passive transport, osmosis, diffusion, exocytosis, and endocytosis.

ELIGIBLE CONTENT

- Recognize and apply the definition of homeostasis. (The ability of an organism or cell to maintain internal balance and stability by adjusting its physiological processes.)
- Recognize and apply the definition of active transport. (The movement of a substance across a biological membrane against its concentration or electrochemical gradient with the help of energy input and specific transport proteins.)
- Recognize and apply the definition of passive transport. (The diffusion of a substance across a biological membrane.)
- Recognize and apply the definition of osmosis. (The movement of water across a selectively permeable membrane.)
- Recognize and apply the definition of diffusion. (The spontaneous tendency of a substance to move down its concentration gradient from a more concentrated to a less concentrated area.)
- Recognize and apply the definition of exocytosis. (The cellular secretion of macromolecules by the fusion of vesicles with the cell membrane.)
- Recognize and apply the definition of endocytosis. (The cellular uptake of macromolecules and particulate substances by localized regions of the cell membrane that surround the substance and pinch off to form an intracellular vesicle.)

SAMPLE ITEMS

- 1 Molecules move from areas of low concentration to areas of high concentration through the process of
- A osmosis.
 - B diffusion.
 - C passive transport.
 - * D active transport.

- 2 Which statement describes a cell after it has been placed in a sugar solution?
- A It is larger because sugar entered the cell by diffusion.
 - B It is larger because water entered the cell by osmosis.
 - C It is smaller because sugar left the cell by diffusion.
 - * D It is smaller because water left the cell by osmosis.

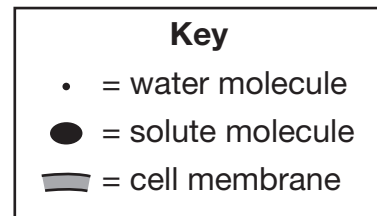
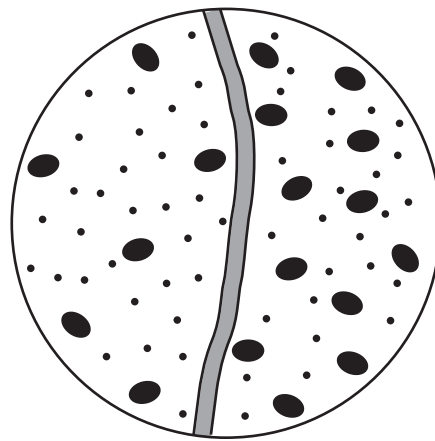
3 A single-celled paramecium is placed into a dish that contains distilled water. Which statement describes the cell processes that allow the paramecium to achieve homeostasis?

- A Water leaves the cell by osmosis, and contractile vacuoles obtain water by diffusion.
- B Water leaves the cell by osmosis, and contractile vacuoles obtain water by active transport.
- C Water enters the cell by osmosis, and contractile vacuoles eliminate excess water by diffusion.
- * D Water enters the cell by osmosis, and contractile vacuoles eliminate excess water by active transport.

4 Which statement describes the cellular conditions in which passive transport would occur?

- A Energy is used to move molecules from an area of low concentration to an area of high concentration.
- B Energy is used to move molecules from an area of high concentration to an area of low concentration.
- C There is a concentration gradient across a semi-permeable membrane where molecules move from an area of low concentration to an area of high concentration.
- * D There is a concentration gradient across a semi-permeable membrane where molecules move from an area of high concentration to an area of low concentration.

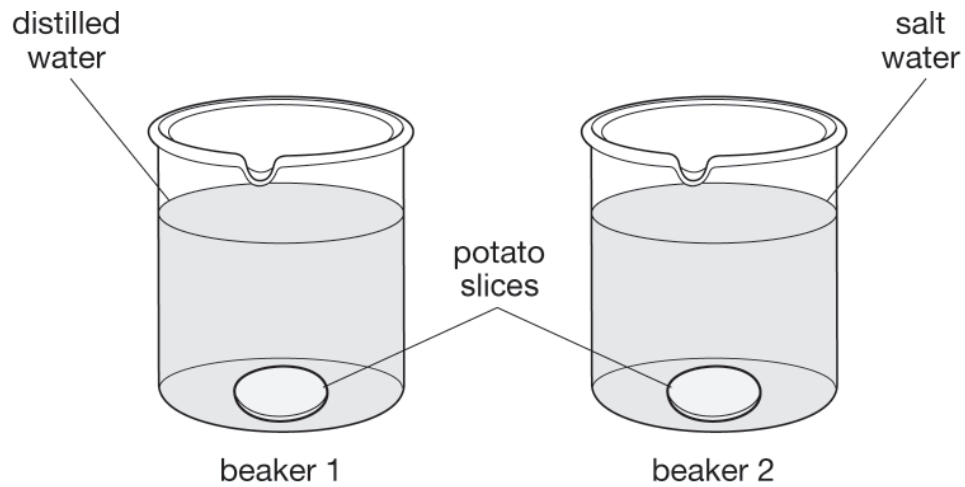
5 Study the diagram below.



Which arrow shows the direction the solute molecules would move to achieve homeostasis?

- A →
- * B ←
- C ↑
- D ↓

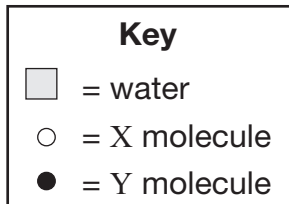
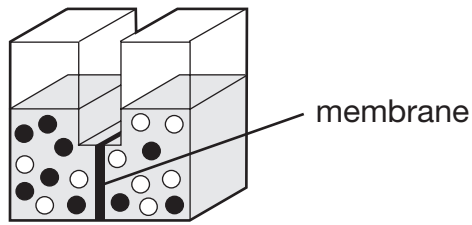
6 Study the diagram below.



A potato slice is placed in distilled water in beaker 1. A similar potato slice is placed in salt water in beaker 2. Which statement correctly explains the movement of water across cell membranes in one of the potato slices?

- A Water will move out of the potato cells in beaker 1 because the solution is more concentrated.
- B Water will move into the potato cells in beaker 1 because the solution is more concentrated.
- * C Water will move out of the potato cells in beaker 2 because the solution is more concentrated.
- D Water will move into the potato cells in beaker 2 because the solution is more concentrated.

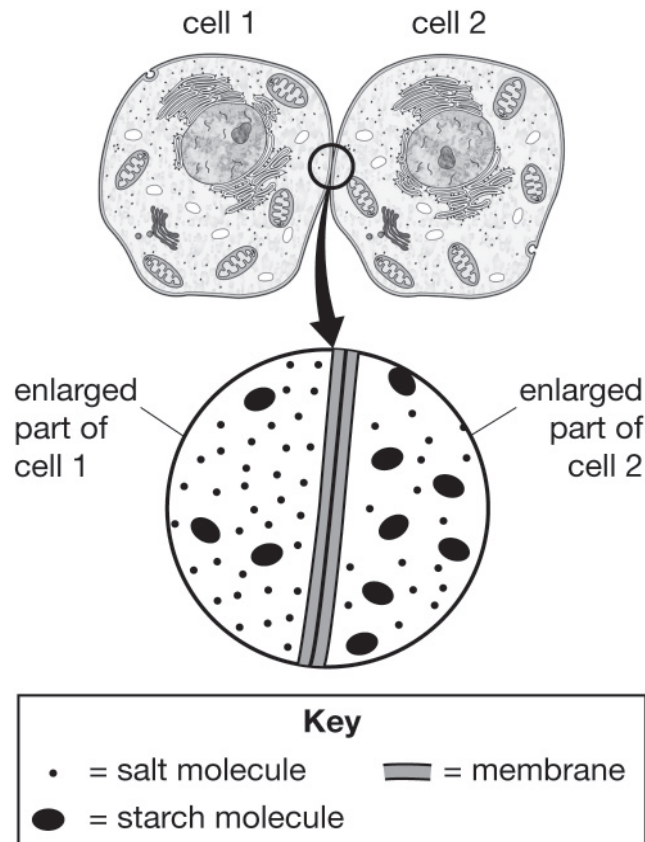
7 Study the figure below.



If the membrane shown is permeable to molecules of X, but impermeable to molecules of Y, what will be the result of diffusion over time?

- * **A** Molecules of X on each side of the membrane will become equal in concentration.
- B** Molecules of Y on each side of the membrane will become equal in concentration.
- C** Molecules of X will increase in concentration on the right side.
- D** Molecules of Y will increase in concentration on the right side.

8 Study the information below.



Two cells are separated by semi-permeable membranes. The starch molecules cannot pass through the membranes, but the salt molecules can pass through the membranes. Which statement describes the process for achieving homeostasis between the cells?

- A Salt will move from 2 to 1 by diffusion.
- * B Salt will move from 1 to 2 by diffusion.
- C Salt will move from 2 to 1 by osmosis.
- D Salt will move from 1 to 2 by osmosis.

CONTENT STANDARD

3. Identify reactants and products associated with photosynthesis and cellular respiration, and the purposes of these two processes.

ELIGIBLE CONTENT

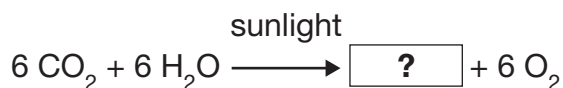
- Identify the chemical formula for photosynthesis.
- Identify the function of photosynthesis.
- Identify the chemical formula for respiration.
- Identify the function of respiration.
- Identify the relationship between photosynthesis and respiration.

SAMPLE ITEMS

- 1 Which factor does NOT affect the process of photosynthesis?

- A light intensity
- B water availability
- * C nitrogen concentration
- D temperature fluctuation

- 2 Study the equation below.



Which product is missing from the equation?

- * A sugar
- B water
- C carbon
- D hydrogen

- 3 Cellular respiration is a chemical process and can be represented by a chemical equation. What are the products in this chemical process?

- A hydrocarbons and oxygen
- B hydrocarbons and carbon dioxide
- * C water, carbon dioxide, and energy
- D water, carbon dioxide, and oxygen

- 4 What is the primary purpose of cellular respiration?

- A to store chemical energy in glucose molecules
- B to store chemical energy in carbon dioxide and water molecules
- * C to use chemical energy from glucose molecules
- D to use chemical energy from carbon dioxide and water molecules

5 Which equation shows the reactants and products of cellular respiration?

A carbon dioxide + water \rightarrow sugar + oxygen

B carbon dioxide + oxygen \rightarrow sugar + water

C sugar + carbon dioxide \rightarrow water + oxygen

* D sugar + oxygen \rightarrow water + carbon dioxide

6 Which two substances are products of cellular respiration?

A glucose and water

B glucose and oxygen

* C carbon dioxide and water

D carbon dioxide and oxygen

CONTENT STANDARD

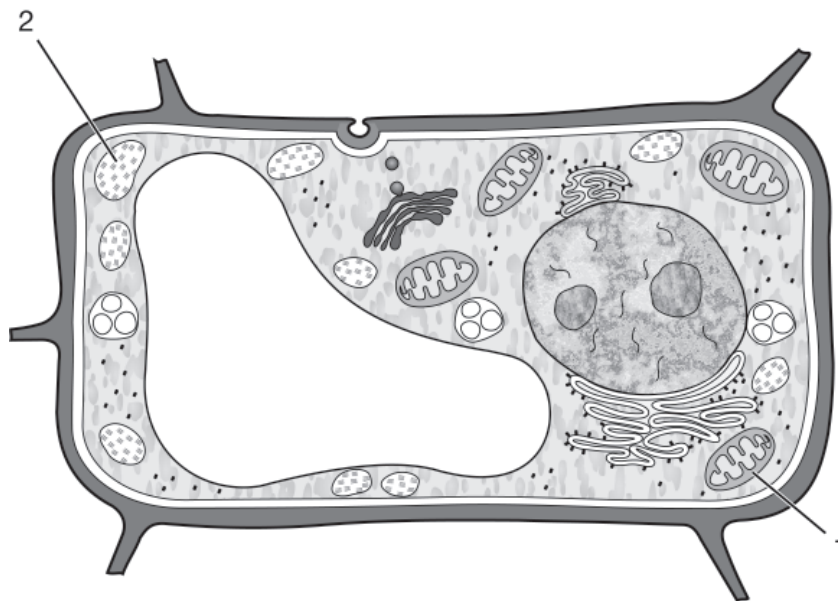
4. Describe similarities and differences of cell organelles, using diagrams and tables.
9. Differentiate between the previous five-kingdom and current six-kingdom classification systems.

ELIGIBLE CONTENT

- Identify cell structures including cell membrane, cell wall, nucleus, ribosome, smooth endoplasmic reticulum, rough endoplasmic reticulum, Golgi body, vacuole, chloroplast, and mitochondrion.
- Classify organisms as prokaryotic or eukaryotic.
- Identify and define similarities and differences between the five-kingdom and six-kingdom classification systems.

SAMPLE ITEMS

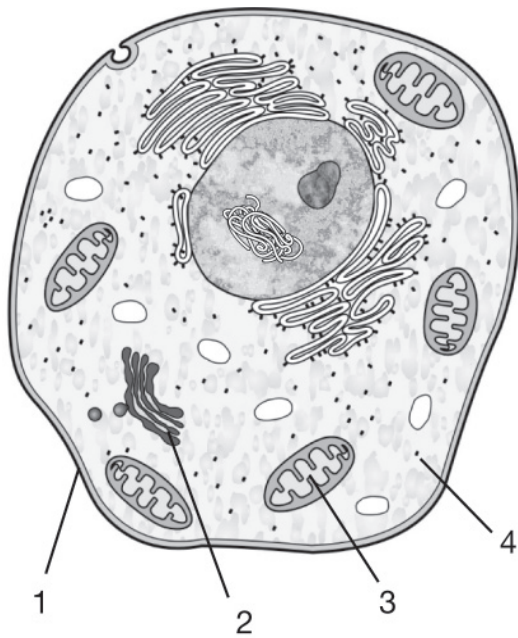
- 1 Examine the diagram below.



What are the similarities and differences between organelles 1 and 2?

- * **A** Both are double membrane-bound organelles, but 1 conducts respiration while 2 conducts photosynthesis.
- B** Both are double membrane-bound organelles, but 1 conducts photosynthesis while 2 conducts respiration.
- C** Both are single membrane-bound organelles, but 1 conducts respiration while 2 conducts photosynthesis.
- D** Both are single membrane-bound organelles, but 1 conducts photosynthesis while 2 conducts respiration.

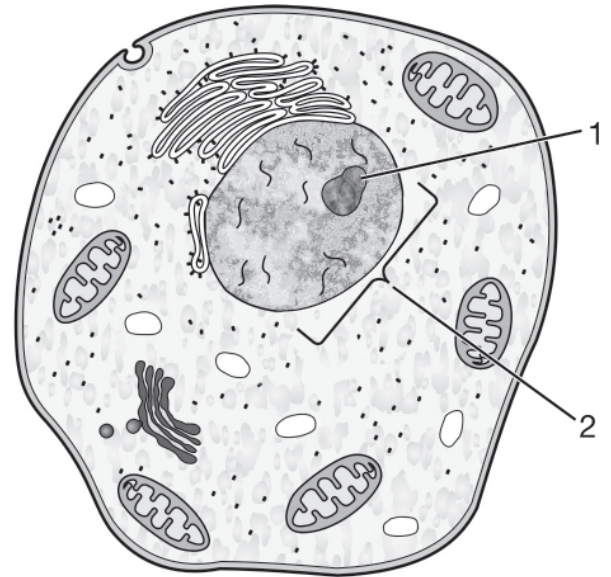
2 Study the cell below.



Which cellular structures are involved in synthesizing and packaging protein?

- A 1 packages protein, and 3 synthesizes protein.
- B 1 packages protein, and 4 synthesizes protein.
- C 2 packages protein, and 3 synthesizes protein.
- * D 2 packages protein, and 4 synthesizes protein.

3 Examine the diagram below.



What are the differences between structures 1 and 2?

- * A Ribosomes are produced in structure 1, and DNA is stored in structure 2.
- B DNA is stored in structure 1, and ribosomes are produced in structure 2.
- C RNA is stored in structure 1, and DNA is stored in structure 2.
- D DNA is stored in structure 1, and RNA is stored in structure 2.

- 4 Study the data table below. Which student has correctly identified the typical characteristics of a prokaryotic cell?

Characteristics of Cells

Student	Nucleus	Cytoplasm	Membrane-Bound Organelles	Cell Membrane
1	yes	yes	no	yes
2	no	no	yes	yes
3	yes	no	yes	no
4	no	yes	no	yes

- A student 1
 B student 2
 C student 3
 * D student 4
- 5 Look at the list of organism characteristics below. Which two statements correctly differentiate Archaeobacteria from other bacteria?

Organism Characteristics	
Statement	Characteristics
1	Archaeobacteria have membrane-bound DNA.
2	Archaeobacteria have cell membranes that contain lipids not found in any other organisms.
3	Archaeobacteria lack peptidoglycan in their cell walls.
4	Archaeobacteria lack DNA and store their genetic information on proteins.

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

6 To which group does an organism with the following characteristics belong?

- prokaryotic
- unicellular
- unique ribosomal RNA
- commonly found in harsh environments
- commonly found in anaerobic environments

- A Protista
- B Fungi
- C Eubacteria
- * D Archaeobacteria

7 A scientist is given several bacterial samples. Which characteristic can be used to classify the bacteria as either Eubacteria or Archaeobacteria in the six-kingdom classification system?

- A the presence of DNA
- B how the bacteria move
- C how the bacteria ingest food
- * D the structure of ribosomal RNA

8 Which kingdom includes organisms with specialized cells that perform individual functions?

- * A Plantae
- B Monera
- C Eubacteria
- D Archaeobacteria

9 Which statement correctly describes the main difference between the five-kingdom and the six-kingdom systems for classification?

- A Monera in the five-kingdom system is divided into Protista and Fungi in the six-kingdom system.
- * B Monera in the five-kingdom system is divided into Eubacteria and Archaeobacteria in the six-kingdom system.
- C Eubacteria and Archaeobacteria in the five-kingdom system are combined to form Monera in the six-kingdom system.
- D Fungi and Protista in the five-kingdom system are combined to form Eubacteria in the six-kingdom system.

10 Which correctly lists the kingdoms in the current six-kingdom classification?

A

- Monera
- Eubacteria
- Protista
- Fungi
- Plantae
- Animalia

* B

- Archaeobacteria
- Eubacteria
- Protista
- Fungi
- Plantae
- Animalia

C

- Archaeobacteria
- Monera
- Protista
- Fungi
- Plantae
- Animalia

D

- Monera
- Eubacteria
- Archaeobacteria
- Fungi
- Plantae
- Animalia

11 Study the table below. Which student correctly compares prokaryotic and eukaryotic cells?

Cell Comparison

Student	Internal Structure		Nucleus Present		Membrane-Bound Organelles	
	Eukaryote	Prokaryote	Eukaryote	Prokaryote	Eukaryote	Prokaryote
1	simple	complex	yes	no	no	yes
2	simple	complex	yes	yes	no	no
3	complex	simple	yes	yes	yes	yes
4	complex	simple	yes	no	yes	no

A student 1

B student 2

C student 3

* D student 4

CONTENT STANDARD

5. Identify cells, tissues, organs, organ systems, organisms, populations, communities, and ecosystems as levels of organization in the biosphere.

ELIGIBLE CONTENT

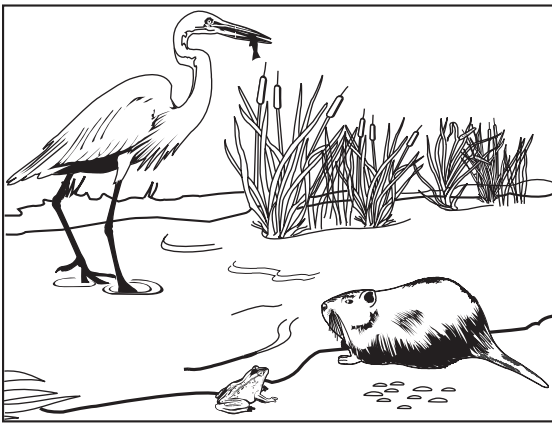
- Identify the levels of organization in the biosphere including cells, tissues, organs, and organ systems, as well as organisms, populations, communities, and ecosystems.

SAMPLE ITEMS

- 1 A pod of bottlenose dolphins living in a specific region can be identified as which level of organization?

- A biosphere
- B ecosystem
- * C population
- D community

- 2 Study the picture below.



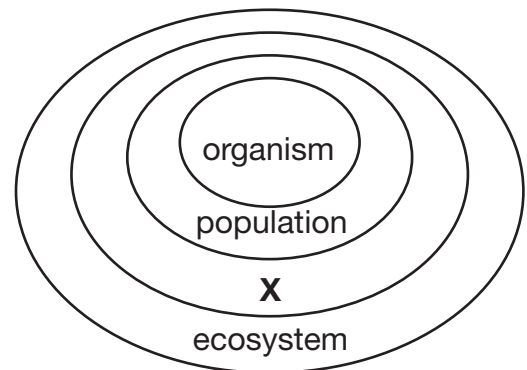
Which level of organization in the biosphere is BEST represented by the entire picture?

- A organism
- * B ecosystem
- C population
- D community

- 3 A group of cells that work together for a common function is MOST LIKELY described as

- * A a tissue.
- B an organ.
- C an organelle.
- D a community.

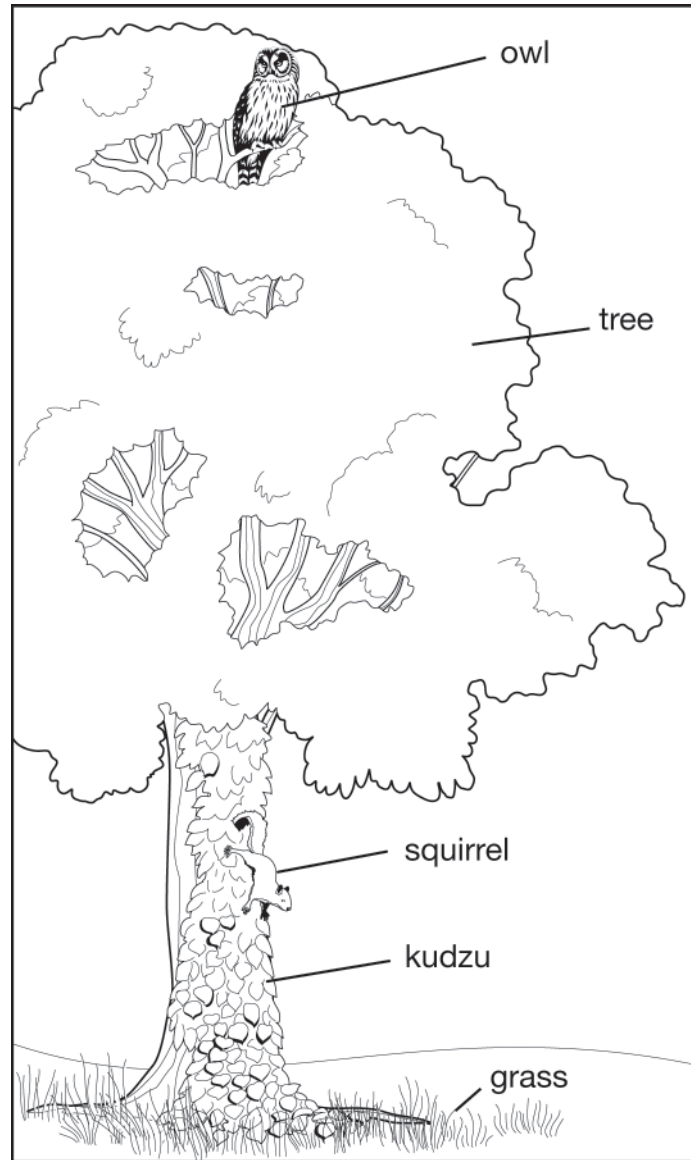
- 4 Study the diagram below.



Which is a level of organization that could be represented by the X?

- A plant
- B animal
- C biosphere
- * D community

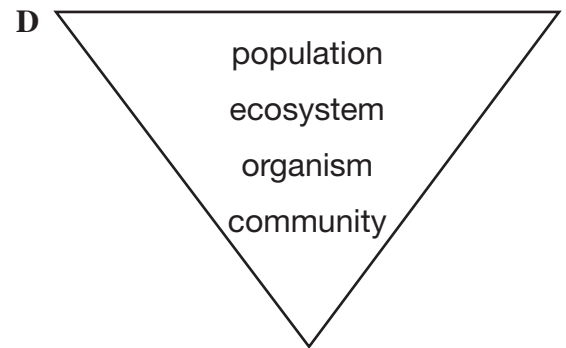
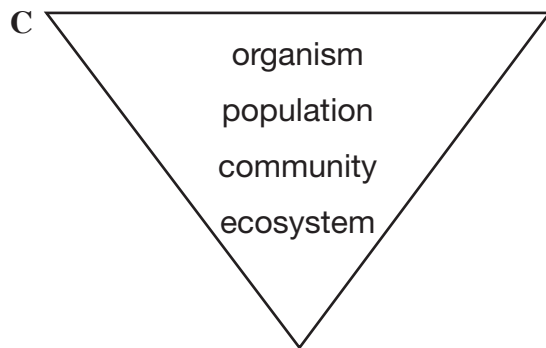
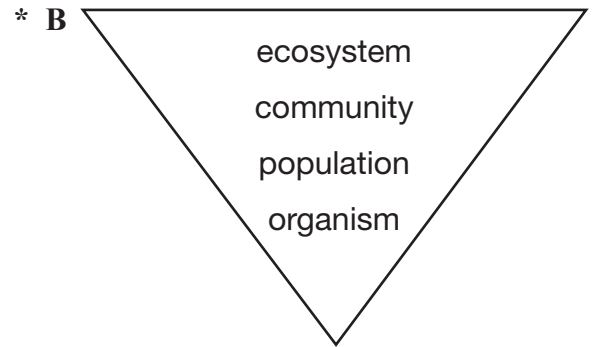
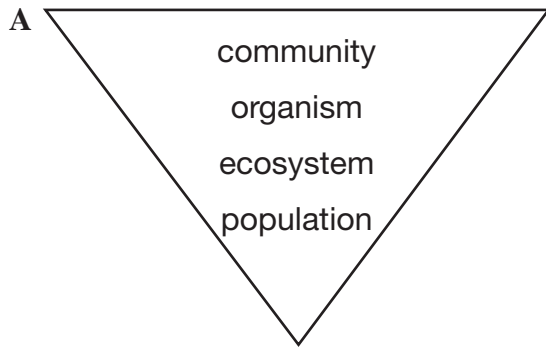
5 Study the picture below.



Which level of biological organization results from the combination of the living organisms shown in the picture?

- A biosphere
- B ecosystem
- C population
- * D community

6 Which figure BEST represents the levels of organization in an ocean?



7 Which sequence correctly identifies the levels of organization in a biosphere from most complex to least complex?

- A organism → population → community → ecosystem
- * B ecosystem → community → population → organism
- C community → organism → ecosystem → population
- D population → ecosystem → organism → community

- 8 Study the tables below. Ospreys, egrets, and cranes were observed in an area around a small oxbow lake at Perry Lakes Park in Alabama.

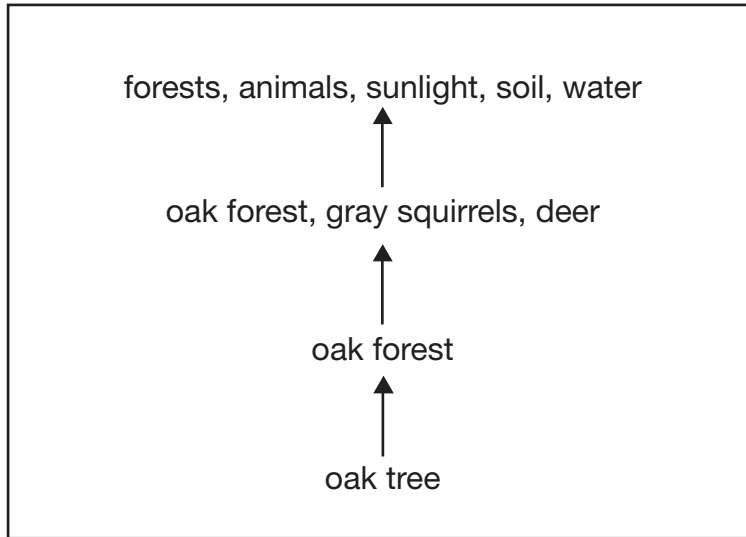
Birds Observed During One Year	
Bird	Number Observed
osprey	63
egret	85
crane	22

Which student correctly categorized the observations according to the levels of organization in the biosphere?

Student	Organisms	Population(s)	Communities
1	3	3	1
2	3	1	3
3	170	3	1
4	170	1	3

- A student 1
- B student 2
- * C student 3
- D student 4

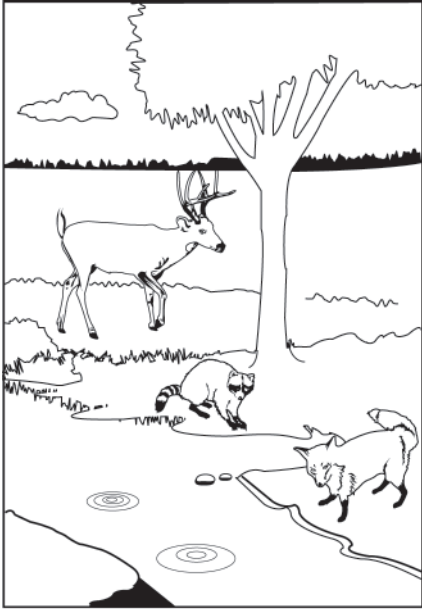
9 Study the diagram below.



Which example below represents the organizational levels shown in this diagram?

- A** organism
↑
population
↑
community
↑
ecosystem
- * B** ecosystem
↑
community
↑
population
↑
organism
- C** community
↑
ecosystem
↑
organism
↑
population
- D** population
↑
organism
↑
ecosystem
↑
community

10 Study the picture below.



Which level of organization is BEST represented by the entire picture?

- A population
- B community
- * C ecosystem
- D organism

11 A scientist studied a coral reef in an ocean. The scientist made a data table to record what was observed. How many populations are represented by the data?

Coral Reef Observations

Organism	Number Observed
sea turtle	6
sea star	9
nurse shark	3
clownfish	16
parrotfish	42
sea urchin	25

- A 2
- * B 6
- C 67
- D 101

12 Study the list of terms below.

Terms to Know

- lymphocyte
- lung
- tendon
- skeleton

A student preparing for a test in human anatomy studied the terms in the list. Which of the following represents a tissue in the human body?

- A lymphocyte
- B lung
- * C tendon
- D skeleton

CONTENT STANDARD

6. Describe the roles of mitotic and meiotic divisions during reproduction, growth, and repair of cells.

ELIGIBLE CONTENT

- Demonstrate an understanding of how meiosis leads to variation.
- Describe the role of meiosis in producing variation.
- Describe the role of meiosis in reproduction.
- Describe the role of mitosis in cell repair.
- Describe the role of mitosis in growth.
- Describe the role of both mitosis and meiosis.

SAMPLE ITEMS

- 1 Meiosis and mitosis are two different reproductive processes. What happens **ONLY** during meiosis?
- * **A** crossing over occurs
 - B** replication of organelles
 - C** disappearance of the nucleolus
 - D** complete breakdown of the nuclear membrane
- 2 Which statement is correct?
- A** Meiosis is a way to reproduce, but mitosis is not.
 - * **B** Meiosis is a way to create diversity, but mitosis is not.
 - C** During mitosis, chromosomes are copied, but during meiosis chromosomes double.
 - D** During mitosis, chromosome numbers double, but during meiosis chromosome numbers remain constant.

- 3 Which process requires meiosis?

- * **A** egg production
- B** bacterial fission
- C** flatworm regeneration
- D** vegetative propagation

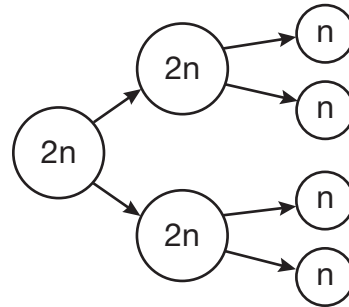
- 4 Which statements about cell division are **CORRECT**?

- | |
|---|
| <ol style="list-style-type: none">1. Mitosis leads to variation in a species.2. Meiosis leads to variation in a species.3. Mitosis produces haploid cells used in reproduction.4. Meiosis produces haploid cells used in reproduction. |
|---|

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

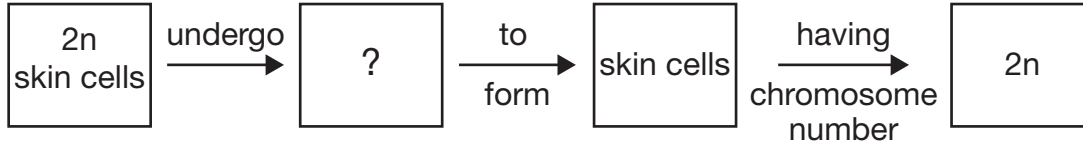
- 5 Red blood cells carry oxygen to the body during respiration and typically have a lifespan of four months. What is the role of mitosis during respiration?
- A allows cells to absorb oxygen from the air
 - B causes cells to release oxygen to the body
 - * C helps replace cells that are destroyed or damaged
 - D produces molecules needed to maintain cell structures
- 6 Which of the following is a true statement about asexual reproduction?
- * A Only one organism is needed.
 - B A mutation needs to occur.
 - C Meiosis is necessary.
 - D DNA is not required.
- 7 Which reproductive process is MOST like the regenerative process of skin cells?
- A yeast creating buds
 - B ovaries forming eggs
 - C ferns producing spores
 - * D muscles growing in size

- 8 Which cell process is represented below?
of reproduction?



- A meiosis
- * B mitosis
- C respiration
- D fertilization

- 9 Study the sequence below. Which cellular process missing from this sequence produces cells having a chromosome number of $2n$?



- A meiosis
- * B mitosis
- C respiration
- D fertilization

CONTENT STANDARD

7. Apply Mendel's laws to determine phenotypic and genotypic probabilities of offspring.

ELIGIBLE CONTENT

- Use Punnett squares to determine phenotypic and genotypic percentages.
- Recognize dominant and recessive alleles and their roles in determining the phenotypes of offspring.
- Compare the terms heterozygous and homozygous, and demonstrate an understanding of how these terms relate to phenotypes and genotypes of offspring.

SAMPLE ITEMS

- 1 Blood type in humans is controlled by three alleles, designated as I^A , I^B (both dominant alleles), and i (recessive allele). Genotypes for each of the four possible blood types are shown in the table.

Blood Type Information

Blood Type	Genotype(s)
A	$I^A I^A$ or $I^A i$
B	$I^B I^B$ or $I^B i$
AB	$I^A I^B$
O	ii

A man with blood type A, whose mother was type O, has a child with a woman that has type AB blood. Which blood types are possible in their children?

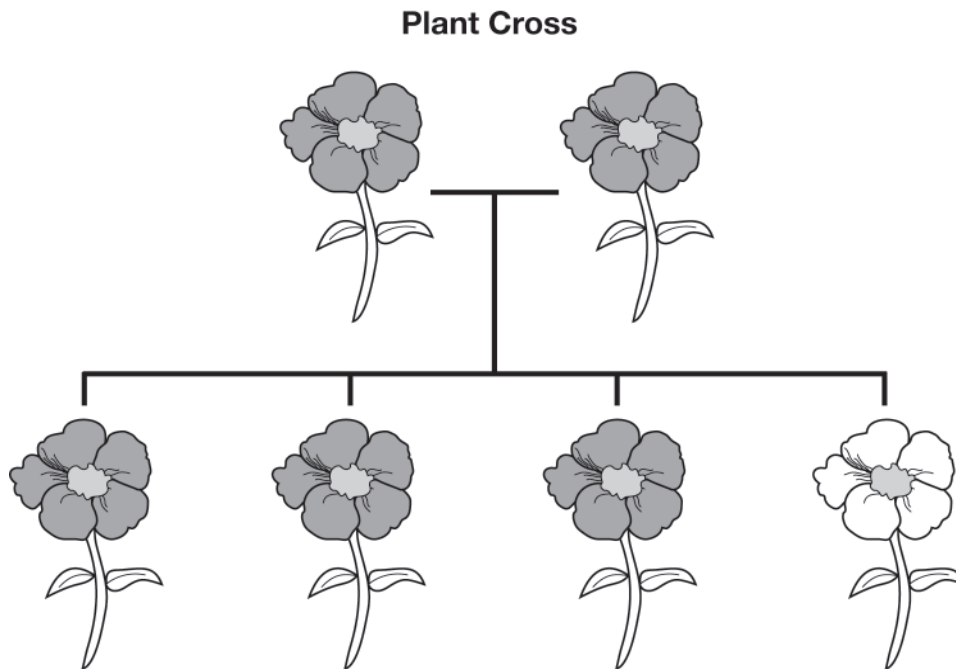
- A types A and B only
- * B types A, B, and AB only
- C types A, B, and O only
- D types A and AB only

- 2 Egyptian Mau cats are genetically crossed for certain lengths of fur. A breeder knows that short hair is dominant over long hair. If 75% of the kittens are born with short hair, what are the parents' MOST LIKELY genotypes?

- A The male is a heterozygous shorthair cat, and the female is a homozygous shorthair cat.
- B The male is a homozygous longhair cat, and the female is a heterozygous shorthair cat.
- C The male is a homozygous shorthair cat, and the female is a homozygous longhair cat.
- * D The male is a heterozygous shorthair cat, and the female is a heterozygous shorthair cat.

- 3 Brown eye color is dominant to blue eye color. A heterozygous brown-eyed father and a blue-eyed mother have four children. Which statement BEST describes the childrens' predicted phenotype(s)?
- * A 50% of the children will have brown eyes, and 50% will have blue eyes.
 - B 75% of the children will have brown eyes, and 25% will have blue eyes.
 - C 75% of the children will have blue eyes, and 25% will have brown eyes.
 - D 100% of the children will have brown eyes.
- 4 In rabbits, black hair is dominant to brown. If a heterozygous black-haired rabbit and a brown-haired rabbit were crossed, what percentage of their offspring would be brown-haired?
- A 0%
 - B 25%
 - * C 50%
 - D 75%
- 5 Which genetic cross will produce all heterozygous offspring?
- * A $RR \times rr$
 - B $rr \times rr$
 - C $RR \times RR$
 - D $Rr \times Rr$
- 6 Brown eyes are dominant to blue eyes, and dark hair is dominant to blond hair. A woman is heterozygous for brown eyes and dark hair. A man is also heterozygous for both traits. What is the chance that their child will have blue eyes and blond hair?
- * A 1/16
 - B 1/4
 - C 3/8
 - D 9/16
- 7 In pea plants, the allele for round seeds is dominant over wrinkled seeds. Plant 1 has round seeds, and plant 2 has wrinkled seeds. When these plants are crossed, 50 percent of their offspring have round seeds and 50 percent have wrinkled seeds. Which statement about the parent plants is correct?
- A Plant 1 is heterozygous, and plant 2 is heterozygous.
 - * B Plant 1 is heterozygous, and plant 2 is homozygous recessive.
 - C Plant 1 is homozygous dominant, and plant 2 is heterozygous.
 - D Plant 1 is homozygous dominant, and plant 2 is homozygous recessive.
- 8 In lions, white color is a recessive trait, and the color brown is dominant. If a white lion mates with a homozygous brown lion, approximately what percentage of their offspring would be white?
- * A 0%
 - B 25%
 - C 50%
 - D 75%

9 Study the figure below.



Which statement is the MOST reasonable explanation of these experimental results?

- A One parental plant was homozygous for dark flower color, and the other was homozygous for light flower color.
- B One parental plant was heterozygous, and the other was homozygous for dark flower color.
- C Both parental plants were homozygous for dark flower color.
- * D Both parental plants were heterozygous.

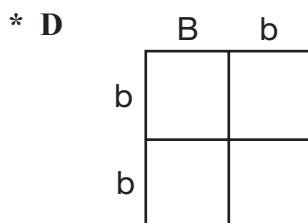
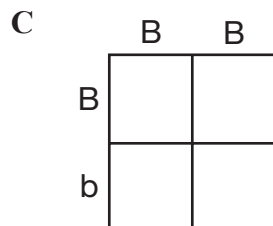
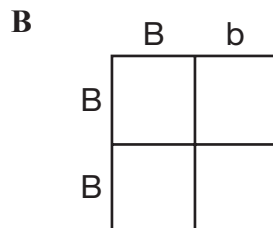
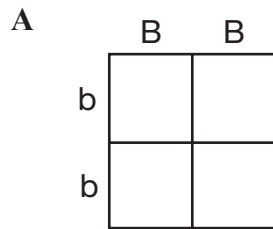
10 Gray fur (B) in mice is dominant over white fur (b). Two mice that are homozygous for white fur color are crossbred. If they have a total of 334 offspring, approximately how many can be expected to have gray fur?

- A 33
- B 22
- C 11
- * D 0

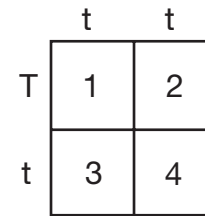
11 Which genotype is heterozygous for two traits?

- A ggTt
- * B GgTt
- C GgTT
- D GGTT

12 In gerbils, brown fur is dominant to black fur. Which Punnett square shows a cross between one brown-furred gerbil and one black-furred gerbil that could produce offspring with black fur?



13 Which parts of this Punnett square would contain the genotype that results in the expression of only the recessive phenotype?



A parts 1 and 2

B parts 1 and 4

C parts 2 and 3

* D parts 3 and 4

14 In a certain squirrel population, a black fur gene is dominant to a gray fur gene. Which genotypes show a cross between a homozygous black-furred squirrel and a homozygous gray-furred squirrel?

* A GG x gg

B Gg x Gg

C GG x GG

D Gg x gg

15 Which genotype represents a heterozygous dandelion plant?

* A Dd

B DD

C dd

D D or d

- 16 In gray squirrels, the gene for white fur color (a) is recessive, and gray fur color (A) is dominant. Which Punnett square accurately represents the probabilities of offspring resulting from a cross between two homozygous squirrels?

A

	A	a
A	AA	Aa
a	Aa	aa

B

	A	A
A	AA	AA
a	Aa	Aa

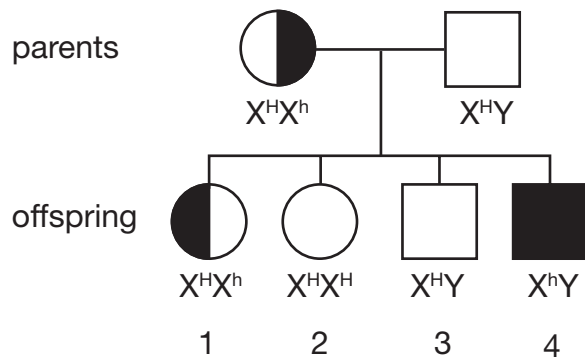
* C

	A	A
a	Aa	Aa
a	Aa	Aa

D

	A	a
a	Aa	aa
a	Aa	aa

- 17 Hemophilia is a recessive disorder (X^h) that is sex-linked and occurs on the X gene. Which offspring will likely develop hemophilia?



- A offspring 2
- * B offspring 4
- C offspring 1 and 2
- D offspring 3 and 4
- 18 In a breed of dogs, brown eyes (B) are dominant to blue eyes (b), and straight fur (F) is dominant to curly fur (f). If a male and a female that both have the genotype BbFf have an offspring, what is the probability that the offspring will have blue eyes?

Dihybrid Cross

	BF	Bf	bF	bf
BF	BBFF	BBFf	BbFF	BbFf
Bf	BBFf	BBff	BbFf	Bbff
bF	BbFF	BbFf	bbFF	bbFf
bf	BbFf	Bbff	bbFf	bbff

- A 1/16
- * B 4/16
- C 8/16
- D 9/16

CONTENT STANDARD

8. Identify the structure and function of DNA, RNA, and protein.

ELIGIBLE CONTENT

- Recognize that amino acids make up protein.
- Recognize that proteins can function as enzymes.
- Compare the functions of DNA and RNA in the production of protein.
- Identify patterns of base pairing of DNA and RNA.
- Recognize DNA as making up genes and chromosomes.

SAMPLE ITEMS

- | | |
|---|---|
| <p>1 Which statement describes a function of proteins in living organisms?</p> <ul style="list-style-type: none">* A They serve as enzymatic catalysts.B They transmit genetic information.C They are an energy storage molecule.D They serve as building blocks for RNA. <p>2 Which function is characteristic of RNA, but NOT of DNA?</p> <ul style="list-style-type: none">A transports proteinsB replicates itself* C transports amino acidsD carries genetic information | <p>3 A strand of DNA that contains the bases TACGAT replicates. Which base sequence is in the new strand produced during replication?</p> <ul style="list-style-type: none">* A ATGCTAB AUGCUAC TACGATD CGTGCC <p>4 As a result of base pairing in DNA, there is the same number of which two bases?</p> <ul style="list-style-type: none">A guanine and thymineB adenine and cytosineC adenine and guanine* D guanine and cytosine |
|---|---|

- 5 Study the nucleotide sequence below.

A C G C A G T

Consider the nucleotide sequence above.
Which nucleotide sequence below
represents the corresponding portion
of an RNA strand?

- A C T G C G T A**
B G A C A G C U
C T G C G T C U
* **D U G C G U C A**
- 6 Which sequence represents a DNA strand
that would complement the following mRNA
strand?

CUA UGC AUG CCA

- A GAU ACG UAC GGU**
B CUA UGC AUG CCA
* **C GAT ACG TAC GGT**
D CTA TGC ATG CCA

- 7 Which student correctly identified possible
percentages of nucleotide bases that could be
present in a complete sample of DNA?

Student	Amount of Base DNA (%)			
	A	T	G	C
1	35	15	35	15
2	20	30	30	20
3	15	15	30	30
4	10	40	40	10

- A** student 1
B student 2
* **C** student 3
D student 4
- 8 What preserves the genetic code from one
generation to the next?
- * **A** DNA replication
B RNA translation
C protein synthesis
D enzyme activation

CONTENT STANDARD

10. Distinguish between monocots and dicots, angiosperms and gymnosperms, and vascular and nonvascular plants.

ELIGIBLE CONTENT

- Demonstrate knowledge of structures and reproduction, identify the differences in venation patterns, and demonstrate knowledge about the significance of the number of cotyledons.
- Distinguish between monocots and dicots.
- Distinguish between angiosperms and gymnosperms.
- Distinguish between vascular and nonvascular plants.

SAMPLE ITEMS

- 1 Which student has correctly classified each plant?

Plant Classifications

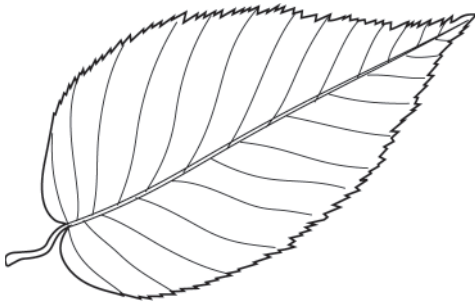
Student	Oak Tree	Corn	Dandelion	Carrot
1	monocot	dicot	monocot	monocot
2	monocot	dicot	dicot	dicot
3	dicot	monocot	monocot	dicot
4	dicot	monocot	dicot	dicot

- A student 1
- B student 2
- C student 3
- * D student 4

2 Which process is prevented from occurring when the stamens are removed from an angiosperm?

- * A self-pollination
- B cross-pollination
- C sexual reproduction
- D asexual reproduction

3 Study the leaf below.



A plant with the leaf-venation pattern shown would be classified a

- * A dicot, with two cotyledons.
- B dicot, with one cotyledon.
- C monocot, with two cotyledons.
- D monocot, with one cotyledon.

4 A class observes an unknown plant and discovers that the plant's seeds have only one cotyledon. When the class examines the leaves and stem, what will they MOST LIKELY find?

- A parallel veins and a ring of vascular bundles
- * B parallel veins and scattered vascular bundles
- C a netted arrangement of veins and a ring of vascular bundles
- D a netted arrangement of veins and scattered vascular bundles

5 Why are nonvascular plants typically smaller and shorter than vascular plants?

- A Nonvascular plants use mitosis to produce cells.
- B Nonvascular plants use photosynthesis to obtain energy.
- * C Nonvascular plants lack tubes to transport materials.
- D Nonvascular plants lack deep fibrous roots to obtain water.

6 Study the table below. Which plant is an angiosperm?

Plant Characteristics		
Plant	Main Method of Pollination	Location of Seeds
1	wind	fruit
2	wind	cones
3	insects	fruit
4	insects	cones

- A plant 1
- B plant 2
- * C plant 3
- D plant 4

7 Study the table below. Which statement is correct?

Plant Comparisons			
Plant	Number of Flowering Parts	Arrangement of Vascular Tissue in Stem	Number of Embryo Parts
1	multiples of 3	scattered	1
2	multiples of 4 or 5	in a ring	2

- A Plants 1 and 2 are gymnosperms.
- B Plants 1 and 2 are nonvascular plants.
- * C Plant 1 is a monocot, and plant 2 is a dicot.
- D Plant 1 produces seeds, and plant 2 produces cones.

CONTENT STANDARD

- 11.** Classify animals according to type of skeletal structure, method of fertilization and reproduction, body symmetry, body coverings, and locomotion.

ELIGIBLE CONTENT

- Compare invertebrates and vertebrates.
- Compare endoskeletons and exoskeletons.
- Compare internal and external fertilization.
- Compare sexual and asexual reproduction.
- Compare bilateral and radial symmetry.
- Classify animals according to type of skeletal structure.
- Classify animals according to method of fertilization and reproduction.
- Classify animals according to type of body symmetry.
- Classify animals according to type of body coverings.
- Classify animals according to type of locomotion.
- Classify animals according to multiple physical characteristics.

SAMPLE ITEMS

1 Item deliberately omitted.

2 A new organism is discovered. After careful observation, scientists conclude that it is a mammal. Which two characteristics would the organism possess to lead the scientists to this conclusion?

- A endoskeleton and scales
- B exoskeleton and asymmetry
- * C fur or hair and warm-blooded
- D have live young and radial symmetry

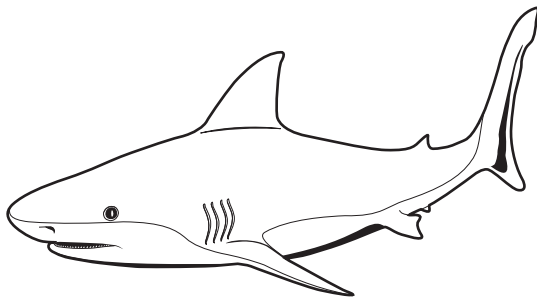
3 Which group of animals contains members that move using cilia and flagella?

- A birds
- * B protists
- C mammals
- D amphibians

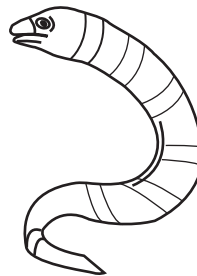
- 4 Four students each examine different animals and report their information in the table below. Which student correctly identified two characteristics of an amphibian?

Student	Body Covering	Body Temperature
1	dry scales	ectothermic
2	hair	endothermic
3	feathers	endothermic
4	moist skin	ectothermic

- A student 1
B student 2
C student 3
* D student 4
- 5 Study the two animals below.



shark



moray eel

Which characteristic is used to place the shark and the moray eel into two different taxonomic classes?

- A gas exchange through gills
B tail extending from the nerve cord
* C composition of skeleton
D habitat in water

6 Study the table below. Which organism is MOST LIKELY a clam?

Adult Characteristics of Organisms			
Organism	Support	Respiration	Habitat
1	endoskeleton	gills, skin	aquatic
2	shell	gills	aquatic
3	endoskeleton	lungs, skin	terrestrial
4	shell	lungs	terrestrial

- A organism 1
- * B organism 2
- C organism 3
- D organism 4

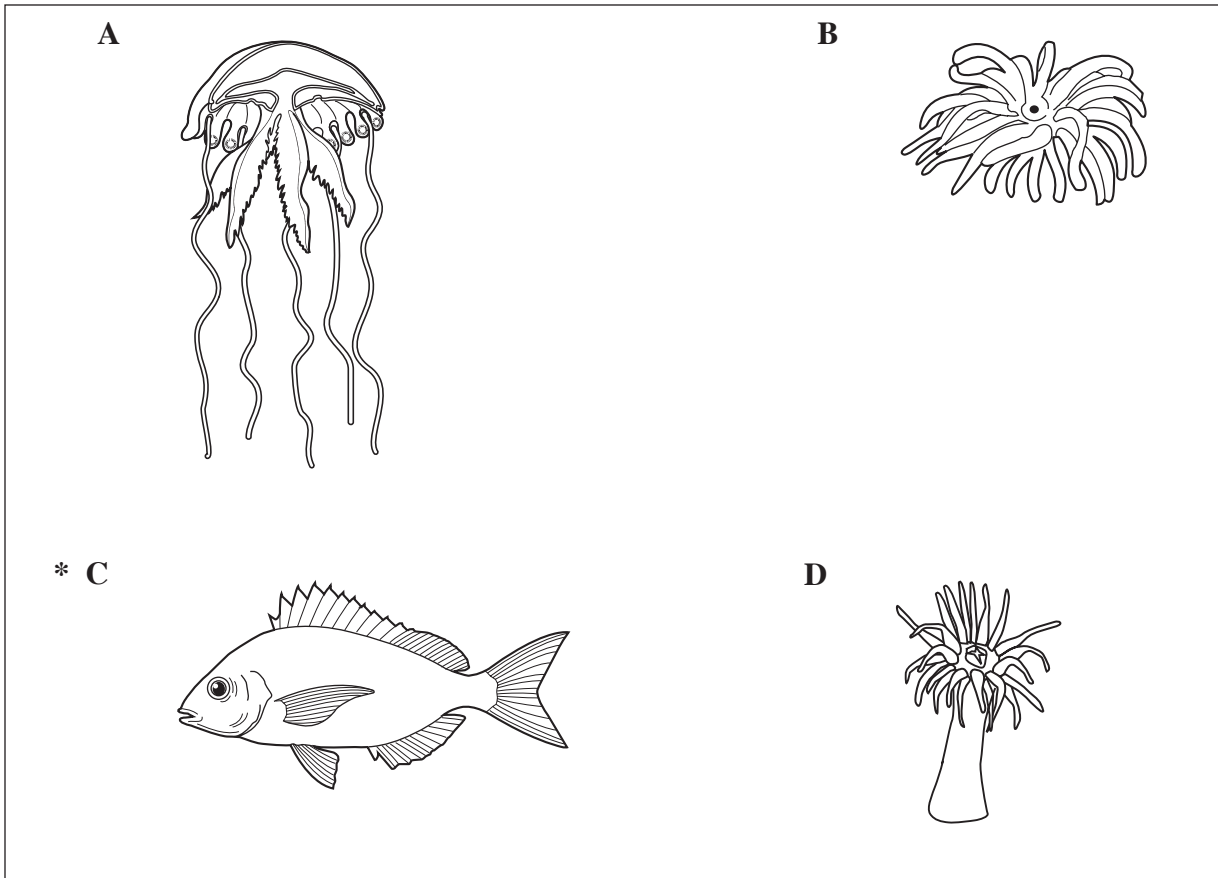
7 Four students record data in a chart comparing mammals and reptiles. Which student has correctly classified the two classes of animals?

Comparing Mammals and Reptiles

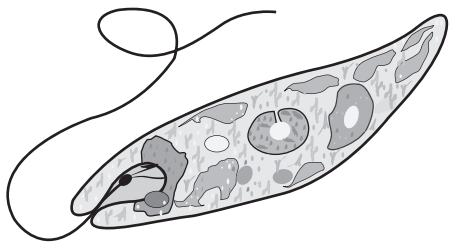
Student	Mammals	Reptiles
1	<ul style="list-style-type: none">• warm-blooded• fur	<ul style="list-style-type: none">• cold-blooded• scales
2	<ul style="list-style-type: none">• cold-blooded• invertebrate	<ul style="list-style-type: none">• warm-blooded• invertebrate
3	<ul style="list-style-type: none">• warm-blooded• lungs	<ul style="list-style-type: none">• cold-blooded• gills
4	<ul style="list-style-type: none">• cold-blooded• live birth	<ul style="list-style-type: none">• warm-blooded• lays eggs

- * A student 1
- B student 2
- C student 3
- D student 4

8 Which animal's body shape shows bilateral symmetry?



9 Study the picture below.



The whip-like structure on this organism is MOST LIKELY

- A excreted waste products.
- B an organelle for absorbing food.
- * C used for locomotion.
- D an adaptation for defense.

CONTENT STANDARD

12. Describe protective adaptations of animals, including mimicry, camouflage, beak type, migration, and hibernation.

ELIGIBLE CONTENT

- Recognize and apply the definition of mimicry. (The resemblance of one organism to another or to an object in its surroundings for concealment and protection from predators.)
- Recognize and apply the definition of camouflage. (The method or result of concealing by disguise or protective coloration such that the organism appears to be part of the natural surroundings.)
- Distinguish between different beak types, and identify what each type is used for.
- Recognize and apply the definition of migration. (The process of changing location periodically, especially by moving seasonally from one region to another.)
- Recognize and apply the definition of hibernation. (The process of passing winter in an inactive or dormant state.)

SAMPLE ITEMS

1 Which example BEST describes mimicry?

- A moving to a new location to obtain food
- * B appearing to look like a different animal
- C catching prey with sharp teeth
- D keeping warm with thick fur

2 Animals hibernate for many reasons. What is one reason animals would NOT hibernate?

- A to conserve energy
- B to avoid harsh climate conditions
- * C to locate prey
- D to survive when food is hard to find

3 Which statement describes how some animals may adapt to an environmental change?

- A Urbanization causes some birds to mimic other birds.
- B Deforestation causes some birds to change their beak shape.
- C Natural disasters cause some mammals to hibernate.
- * D Seasons cause some mammals to change fur coloration.

4 Study the two animals below.



hoverfly

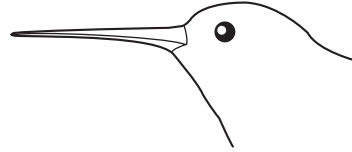


wasp

The hoverfly and the wasp have similar coloration and physical characteristics. However, only the wasp can defend itself by stinging potential predators. Which type of protective adaptation is demonstrated by the hoverfly?

- A stinger
 - * B mimicry
 - C camouflage
 - D countershading
- 5 Which statement describes an organism's behavioral adaptation?
- * A A chameleon changes its body coloring to blend into its environment.
 - B An elk has a four-chambered stomach to help digest the foods it eats.
 - C A shark has a light-colored belly and a darker top side to camouflage it in its habitat.
 - D A trumpeter swan has a sharp beak so it can dig for roots underwater.

6 Study the picture below.



For which activity is this bird's beak best adapted?

- A tearing flesh
 - B spearing fish
 - * C sipping nectar
 - D chiseling wood
- 7 A walking stick is an insect that resembles a stick or branch of a plant. What is the BEST description of this protective adaptation?
- A The walking stick is attracting a mate.
 - B The walking stick is searching for food.
 - C The walking stick is preparing for hibernation.
 - * D The walking stick is camouflaging itself from predators.
- 8 Some species of lizards change their body colors to resemble their environment, inflate their bodies or throats, or secrete substances to mark territories. Which of these protective strategies is NOT an adaptation of the lizard?
- * A migration
 - B camouflage
 - C physical change
 - D chemical defense

9 The diet of a species of bird consists mainly of small rodents. Which type of beak would this species of bird MOST LIKELY have?

A



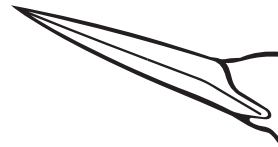
* B



C



D



CONTENT STANDARD

13. Trace the flow of energy as it decreases through the trophic levels from producers to the quaternary level in food chains, food webs, and energy pyramids.

ELIGIBLE CONTENT

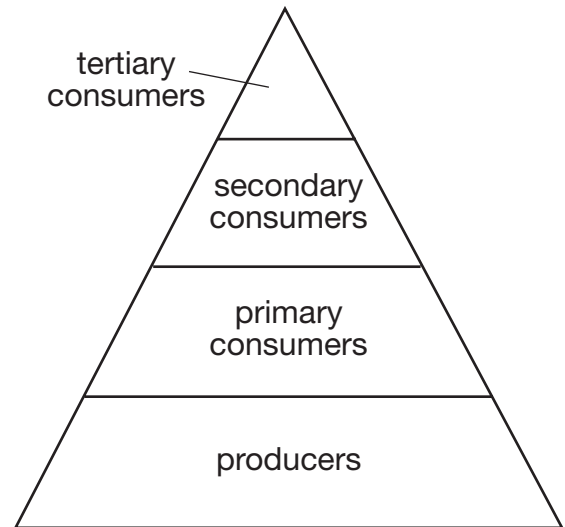
- Trace the flow of energy through food chains, food webs, and energy pyramids.

SAMPLE ITEMS

- 1 If the producers in a community provide 10,000 kcal of energy, approximately how much of the Sun's original energy is available for the secondary consumers?

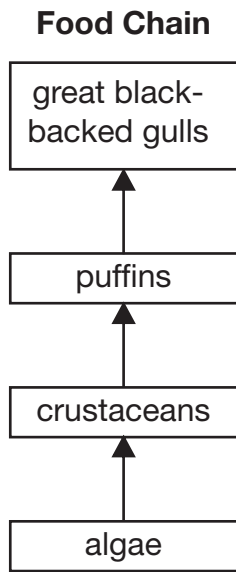
- A 10 kcal
- * B 100 kcal
- C 1000 kcal
- D 10,000 kcal

- 2 Producers have greater amounts of energy available to them than primary consumers. Which statement about producers is NOT correct?



- A Energy is released by producers as heat.
- * B Energy is created by producers.
- C Energy is used for metabolism.
- D Energy is used for active transport.

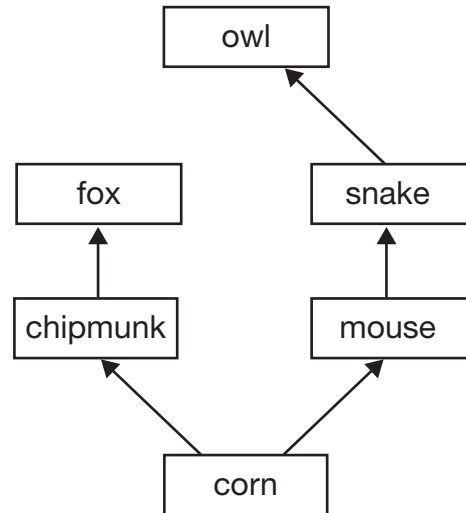
3 Study the food chain below.



Which statement correctly compares the available energy between trophic levels in this food chain?

- * A Energy is highest in algae and lowest in great black-backed gulls.
- B Energy is highest in great black-backed gulls and lowest in algae.
- C Energy is highest in crustaceans and puffins and lowest in algae and great black-backed gulls.
- D Energy is highest in algae and great black-backed gulls and lowest in crustaceans and puffins.

4 Study the food web below.



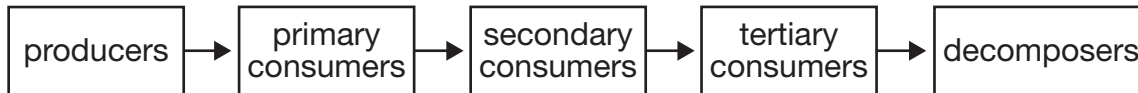
Which organism receives the MOST energy from corn?

- A fox
 - B owl
 - C snake
 - * D chipmunk
- 5 Which statement BEST explains why the snowy owl and the arctic fox can occupy the same trophic level in a tundra food web?
- A They have light coloring.
 - B They hunt at the same time of year.
 - * C They eat primary consumers.
 - D They take in oxygen and release carbon dioxide.

6 Which series correctly models the flow of energy in an aquatic food chain?

- * A plankton → sand eel → striped bass → cod
- B sand eel → cod → plankton → striped bass
- C striped bass → plankton → cod → sand eel
- D cod → striped bass → sand eel → plankton

7 Study the food chain below.



Which organisms receive the smallest amount of energy from the level directly before them in this food chain?

- A primary consumers
- B secondary consumers
- C tertiary consumers
- * D decomposers

CONTENT STANDARD

14. Trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen.

ELIGIBLE CONTENT

- Demonstrate an understanding of the water cycle.
- Describe all events of the water cycle.
- Demonstrate an understanding of the carbon cycle.
- Describe all events of the carbon cycle.
- Demonstrate an understanding of the oxygen cycle.
- Describe all events of the oxygen cycle.
- Demonstrate an understanding of the nitrogen cycle.
- Describe all events of the nitrogen cycle.

SAMPLE ITEMS

- | | |
|---|--|
| <p>1 Which process is MOST directly dependent on temperature reduction, small particles, and gravity to produce its product?</p> <p>A evaporation</p> <p>B transpiration</p> <p>* C precipitation</p> <p>D condensation</p> | <p>2 Which statement describes the changes that result from increased burning of fossil fuels?</p> <p>A Carbon dioxide in the atmosphere and carbon stored in fossil fuels both increase.</p> <p>B Carbon dioxide in the atmosphere and carbon stored in fossil fuels both decrease.</p> <p>C Carbon dioxide in the atmosphere decreases, and carbon stored in fossil fuels increases.</p> <p>* D Carbon dioxide in the atmosphere increases, and carbon stored in fossil fuels decreases.</p> |
|---|--|

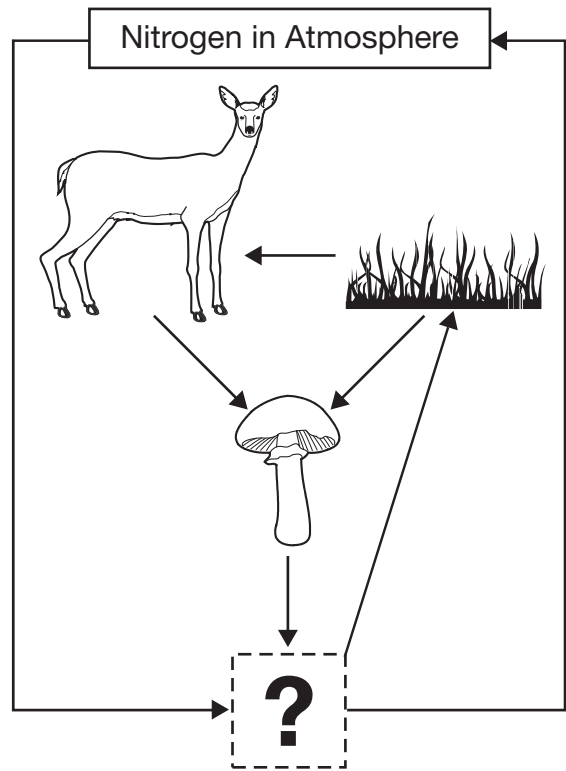
3 When green plants produce oxygen, from which molecule does the oxygen come?

- A ATP
- * B water
- C glucose
- D carbon dioxide

4 Which statement describes how oxygen can enter the atmosphere?

- A Oxygen is released from water through respiration by heterotrophs.
- * B Oxygen is released from water through photosynthesis by autotrophs.
- C Oxygen is released from glucose through respiration by autotrophs.
- D Oxygen is released from glucose through photosynthesis by heterotrophs.

5 Study the diagram below.



What is missing from the nitrogen cycle shown?

- A air
- B rocks
- C viruses
- * D bacteria

6 When coal is burned, sulfur dioxide (SO_2) gas combines with water vapor to produce acid rain. Which model traces the path of the water vapor?

* A water vapor \longrightarrow condensation \longrightarrow precipitation

B water vapor \longrightarrow precipitation \longrightarrow condensation

C water vapor \longrightarrow evaporation \longrightarrow precipitation

D water vapor \longrightarrow precipitation \longrightarrow evaporation

7 Which sequence is part of the carbon cycle?

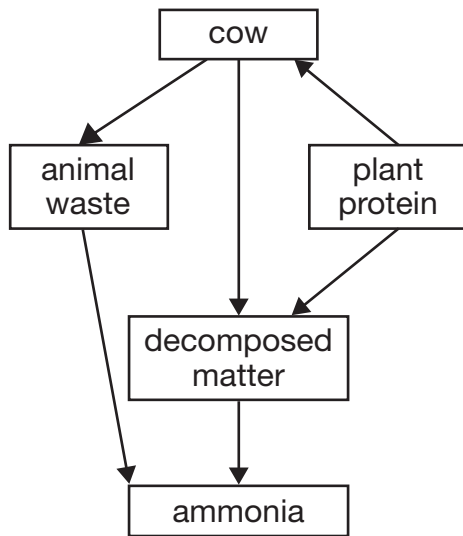
A transpiration \rightarrow evaporation \rightarrow condensation \rightarrow precipitation

* B respiration \rightarrow photosynthesis \rightarrow organic decay \rightarrow coal formation

C combustion \rightarrow evaporation \rightarrow respiration \rightarrow condensation

D decomposition \rightarrow infiltration \rightarrow plant uptake \rightarrow consumption

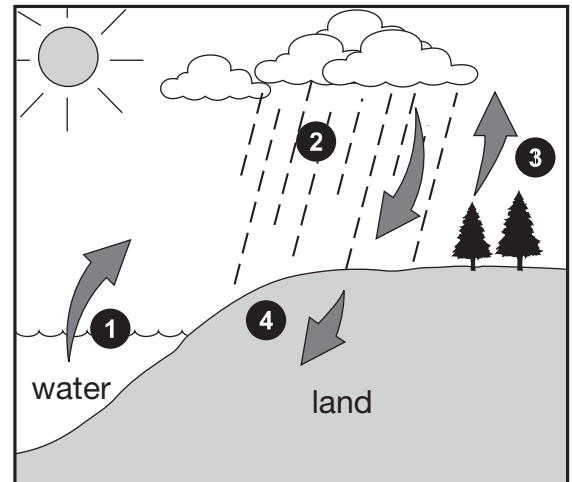
8 Study the diagram below.



Which element moves through ALL parts of this cycle?

- A carbon
- * B nitrogen
- C oxygen
- D phosphorous

9 Study the diagram below.



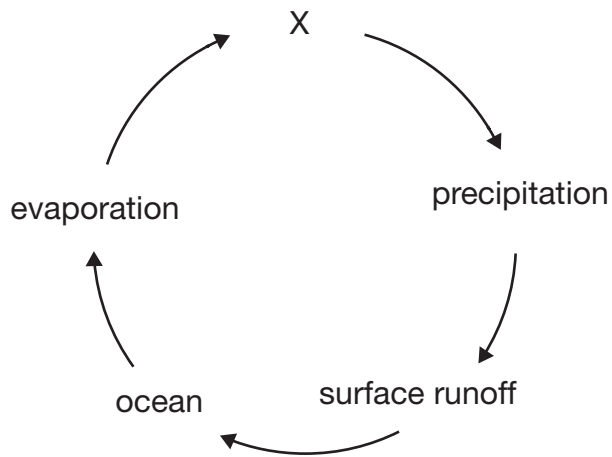
Which numbers in the diagram represent the movement of water vapor?

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

10 Which nitrogen compound is considered to be a pollutant released in jet exhaust?

- A nitrogen gas (N_2)
- B nitrate (NO_3^-)
- C ammonia (NH_4)
- * D nitrogen oxide (NO_2)

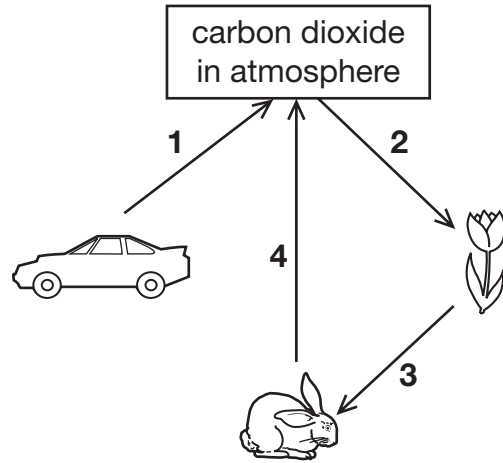
11 Study the water cycle below.



Which process in the water cycle is represented by the X?

- A infiltration
- * B condensation
- C freshwater storage
- D groundwater discharge

12 Study the carbon cycle diagram below.



Which arrow represents the release of carbon dioxide through combustion?

- * A arrow 1
- B arrow 2
- C arrow 3
- D arrow 4

- 13 Study the table below. Which student correctly identifies processes in the oxygen cycle?

Oxygen Cycle Table

Student	Uses Atmospheric Oxygen	Releases Oxygen to the Atmosphere
1	burning fossil fuels	raccoons breathing
2	ozone forming	forest fire burning
3	lighting matches	wheat growing
4	trees growing fruit	wolves howling

- A student 1
- B student 2
- * C student 3
- D student 4

CONTENT STANDARD

15. Identify biomes based on environmental factors and native organisms.

ELIGIBLE CONTENT

- Identify terrestrial biomes including the tundra, desert, rainforest, grassland, taiga (coniferous forest), and the temperate deciduous forest.
- Identify the aquatic biomes including freshwater and marine.
- Identify terrestrial and aquatic biomes based on the rainfall and temperature characteristics.

SAMPLE ITEMS

- | | |
|---|--|
| <p>1 Which of the following biomes has the lowest annual precipitation rate?</p> <p>A taiga</p> <p>* B tundra</p> <p>C deciduous forest</p> <p>D temperate grassland</p>
<p>2 Which biome has mostly shallow-rooted, low-growing plants that can reproduce by budding and division rather than by flowering?</p> <p>A taiga</p> <p>* B tundra</p> <p>C grassland</p> <p>D rainforest</p> | <p>3 Which two biomes have the MOST stable average daily temperature over a long period of time?</p> <p>A tundra and taiga</p> <p>B rainforest and desert</p> <p>* C marine and freshwater</p> <p>D grassland and deciduous forest</p>
<p>4 Which statement describes grassland soils?</p> <p>A They have a low level of nutrients and a dry, thin layer of topsoil.</p> <p>B They have a low level of nutrients and an acidic, thick layer of topsoil.</p> <p>C They have a moderate level of nutrients and a moist, thin layer of topsoil.</p> <p>* D They have a high level of nutrients and a dark, thick layer of topsoil.</p> |
|---|--|

- 5 Students obtained local monthly average precipitation and temperature data from the National Weather Service. Based on these data, in which biome do these students live?

Local Average Temperature and Precipitation

	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (°C)	-1	0	4	8	12	16	24	26	24	20	14	4
Precipitation (cm)	3	2	5	8	12	12	8	11	8	5	5	3

- A taiga
 B desert
 * C grassland
 D rainforest
- 6 Which student correctly compared the Antarctic desert and Arctic tundra biome characteristics?

Biome Characteristics

Student	Antarctic Desert Biome	Arctic Tundra Biome
1	warmer permafrost greater species diversity	cooler no permafrost lower species diversity
2	warmer no permafrost lower species diversity	cooler permafrost greater species diversity
3	low precipitation permafrost greater species diversity	low precipitation no permafrost lower species diversity
4	low precipitation no permafrost lower species diversity	low precipitation permafrost greater species diversity

- A student 1
 B student 2
 C student 3
 * D student 4

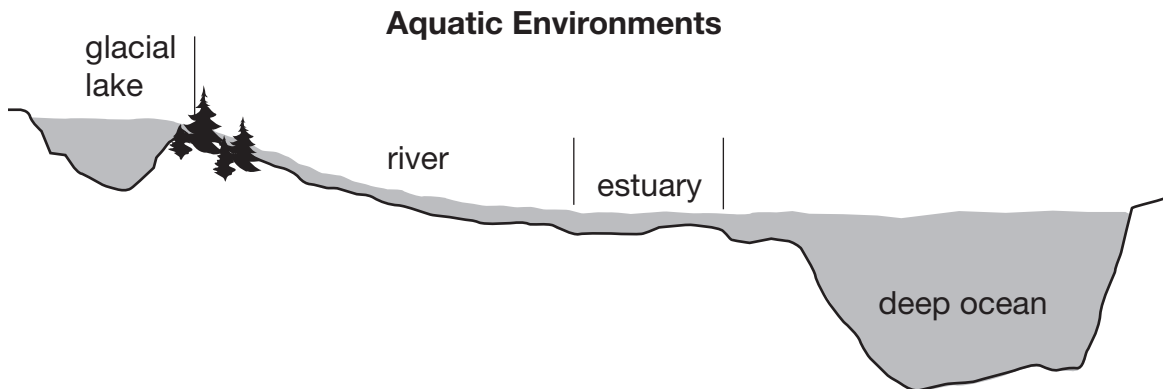
7 Which plant and animal types are characteristic of the taiga biome?

Plant Types	
1	mosses and evergreen trees
2	broad-leaf trees and many wildflowers
3	succulents and plants with very reduced leaf surfaces
4	orchids, bromeliads, vines, ferns, mosses, and palms

Animal Types	
1	numerous birds, bats, small mammals, insects, monkeys, and jaguars
2	birds and summer insects
3	rabbits, rodents, reptiles, and birds; all mostly active at night
4	deer, squirrels, mice, raccoons, salamanders, snakes, frogs, and insects

- * A plant type 1 and animal type 2
- B plant type 2 and animal type 3
- C plant type 3 and animal type 4
- D plant type 4 and animal type 1

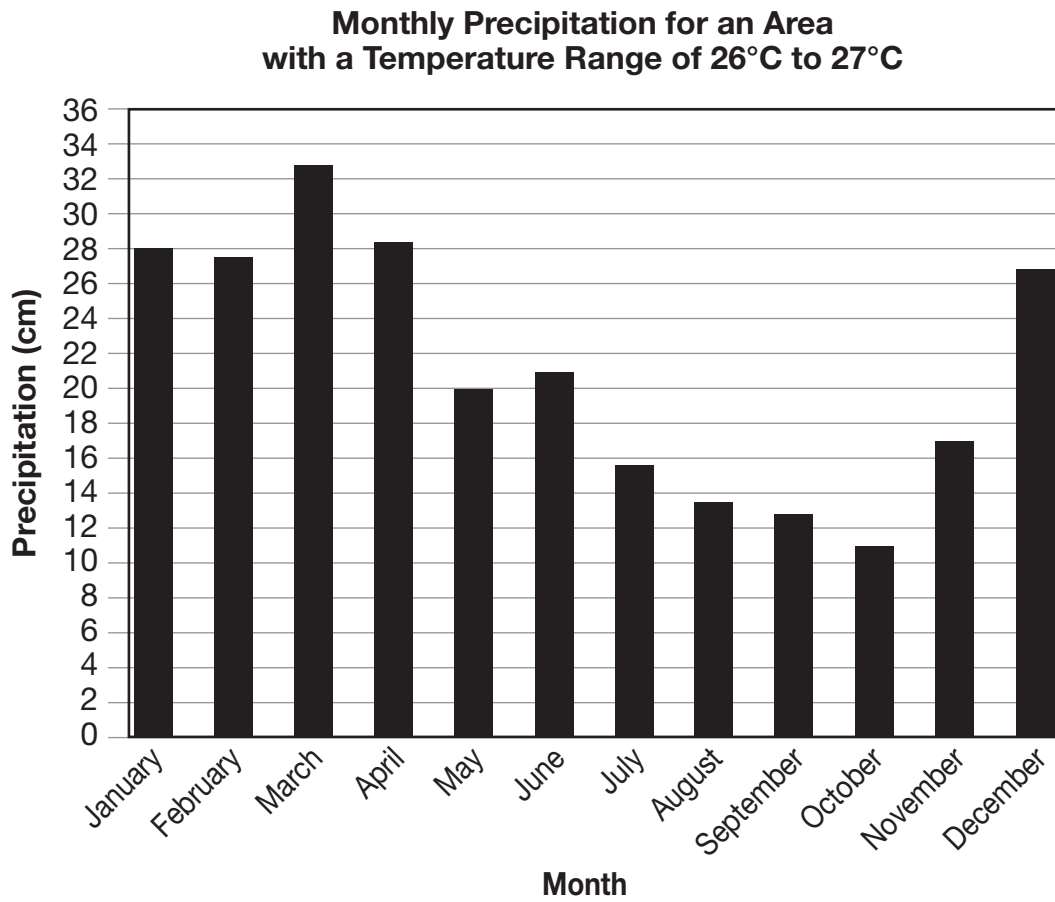
8 Study the diagram below.



Which aquatic environment contains organisms that thrive in water with varying salt concentrations?

- A river
- * B estuary
- C deep ocean
- D glacial lake

9 Study the table below. Which biome is represented by these data?



- A desert
- B tundra
- * C rainforest
- D grassland

10 Study the list below.

Biome Characteristics

- cold winters
- located across northern latitudes of North America and Eurasia
- patchy permafrost
- drought-resistant plants
- numerous lakes, ponds, rivers, and bogs

Which biome is described by the characteristics included in the list?

- * **A** taiga
- B** desert
- C** tundra
- D** grassland

11 Study the list below.

Biome Factors

- sandy soil
- precipitation ranges between 2–4 cm annually
- summer temperatures range from 21°–27°C
- animals include: kangaroo rats, rabbits, skunks, and burrowing owls

Which biome do these factors BEST describe?

- * **A** semi-arid desert
- B** deciduous forest
- C** tropical rainforest
- D** temperate grassland

CONTENT STANDARD

16. Identify density-dependent and density-independent limiting factors that affect populations in an ecosystem.

ELIGIBLE CONTENT

- Identify the limiting factors that affect populations in an ecosystem as either density-dependent or density-independent including natural disasters, space, food, water, air, abiotic and biotic factors, human activity, disease, and succession.

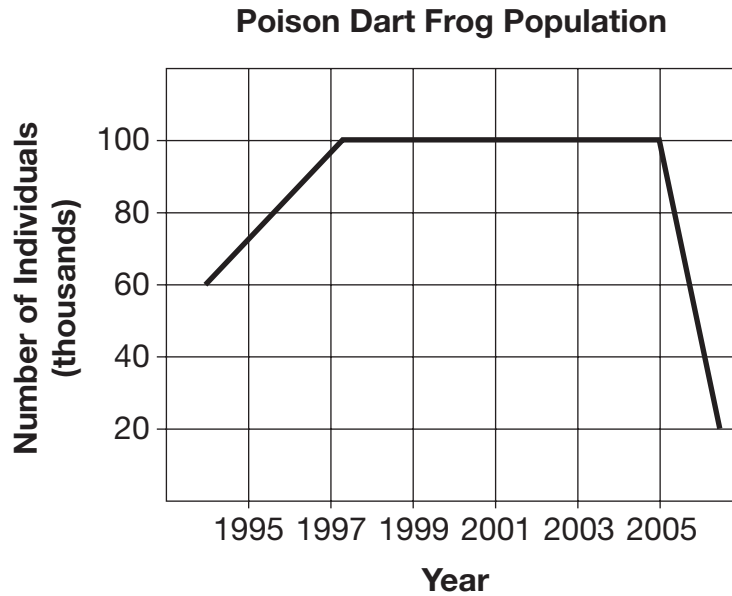
SAMPLE ITEMS

- | | |
|---|--|
| <p>1 Which situation is caused by a density-independent limiting factor?</p> <p>A The influenza outbreak of 1918–1919 killed over 20 million people.</p> <p>* B The cones of the jack pine need heat from a fire to help release seeds.</p> <p>C A parasite alters reproduction in a woodpecker population causing fewer births.</p> <p>D A queen bee regulates the number of eggs she lays according to the amount of food available.</p>
<p>2 Which limiting factor is density-independent for rainbow trout?</p> <p>* A size of the stream</p> <p>B spread of parasites</p> <p>C competition for food</p> <p>D supply of dissolved oxygen</p> | <p>3 Which statement BEST describes the relationship between natural disasters or human-caused disasters and population size?</p> <p>A Natural and human-caused disasters are density-dependent factors.</p> <p>* B Natural and human-caused disasters are density-independent factors.</p> <p>C Human-caused disasters are density-independent whereas natural disasters are density-dependent.</p> <p>D Human-caused disasters are density-dependent whereas natural disasters are density-independent.</p>
<p>4 Which relationship BEST identifies a density-dependent limiting factor?</p> <p>* A A bobcat population declines due to disease.</p> <p>B A fish population declines due to a severe drought.</p> <p>C A bird population declines due to pollution.</p> <p>D A wolf population declines due to a cold winter.</p> |
|---|--|

5 The front page of a newspaper in November 2006 had these headlines.

- Laws Limiting Deforestation Begin Third Year
- Earthquake Rocks Region
- Rainforest Snake Population Declines Due to Deadly Virus

The newspaper also featured a graph showing the population of the poison dart frog.



According to the information in the newspaper, which limiting factor MOST LIKELY accounts for the change in the frog's population?

- A disease
- B predation
- * C natural disaster
- D human activity

- 6 Study the table below. Gypsy moth caterpillars can destroy trees by eating too many leaves and making them susceptible to disease or drought. Which student has correctly identified the density-dependent and density-independent limiting factors associated with an invasion of gypsy moth caterpillars?

Forest Ecosystem Factors

Student	Population of Gypsy Moth Caterpillars	Disease	Drought
1	density-independent	density-dependent	density-dependent
2	density-dependent	density-independent	density-independent
3	density-independent	density-independent	density-dependent
4	density-dependent	density-dependent	density-independent

- A student 1
 B student 2
 C student 3
 * D student 4
- 7 Which type of management would provide the BEST short-term control of giant salvinia?

Giant Salvinia	
Description	aquatic fern that forms floating mats that shade and overcrowd native plants
Where Found	bodies of water in the southern region of the United States
Method of Distributing and Reproducing	reproduces by distributing fragments that break off when disturbed
Rate of Reproduction	can double its surface area in five to seven days
Problems Associated with Giant Salvinia	threatens water quality and oxygen supplies for native plants and animals

- A Add more fish to lakes containing giant salvinia.
 B Educate people about how fast giant salvinia reproduce.
 C Introduce new plant species into areas where giant salvinia is spreading.
 * D Clean propellers before moving boats from a lake containing giant salvinia.

- 8 Study the table below. Which student identified only density-independent limiting factors?

Students' Identification of Density-Independent Limiting Factors

Student	Disease	Clear-cutting	Predation	Filling Wetlands	Natural Disaster
1	x	x			x
2		x	x		x
3	x		x	x	
4		x		x	x

- A student 1
- B student 2
- C student 3
- * D student 4
- 9 Which statement BEST explains why a disease may affect one population more than another population?
- * A Because disease is a density-dependent limiting factor, a larger population makes it easier for the virus to spread from person to person.
- B Because disease is a density-independent limiting factor, a larger population makes it easier for the virus to spread from person to person.
- C Because disease is a density-dependent limiting factor, climate can influence the disease, making it more or less affective.
- D Because disease is a density-independent limiting factor, climate can influence the disease, making it more or less affective.



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