



Arkansas Comprehensive Testing, Assessment, and Accountability Program

RELEASED ITEM
BOOKLET
Biology
End-of-Course Examinations
2013–2014 Administrations

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Arkansas Department of Education

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PART I OVERVIEW

The criterion-referenced tests implemented as part of the **Arkansas Comprehensive Testing, Assessment, and Accountability Program** (ACTAAP) are being developed in response to Arkansas Legislative Act 35, which requires the State Board of Education to develop a comprehensive testing program that includes assessment of the challenging academic content standards defined by the Arkansas Curriculum Frameworks.

As part of this program, students in Arkansas public schools in 2014 who had completed or were completing Biology by the end of first semester participated in the *Mid-Year Biology End-of-Course Examination*. Students in Arkansas public schools who had completed or were completing Biology by the end of the spring semester participated in the *Spring Biology End-of-Course Examination*.

This Released Item Booklet for the Biology End-of-Course Examinations contains test questions or items that were asked of students during the 2013–2014 operational administrations. The test items included in Part II of this booklet are some of the items that contributed to the student performance results for these administrations.

Students were given approximately an hour and a half each day to complete assigned test sessions during the two days of Mid-Year testing and approximately two hours each day to complete assigned test sessions during the two days of Spring testing. All of the multiple-choice items within this booklet have the correct response marked with an asterisk (*).

The development of the Biology End-of-Course Examinations was based on the *Arkansas Biology Science Curriculum Framework*. This framework has distinct levels: Strands to be taught in concert, Content Standards within each Strand, and Student Learning Expectations within each Content Standard. An abridged version of the *Arkansas Biology Science Curriculum Framework* can be found in Part III of this booklet. It is important to note that this abridged version lists only the predominant Strand, Content Standard, and Student Learning Expectation associated with each item. However, since many key concepts within the *Arkansas Biology Science Curriculum Framework* are interrelated, there may be many cases in which there are other item correlations or associations across Strands, Content Standards, and Student Learning Expectations.

Part IV of the Released Item Booklet contains a tabular listing of the Strand, Content Standard, and Student Learning Expectation that each question was designed to assess. The multiple-choice and open-response items found on the Biology End-of-Course Examinations were developed in close association with the Arkansas education community. Arkansas teachers participated as members of the Biology Content Advisory Committee, providing routine feedback and recommendations for all items. The number of items associated with specific Strands, Content Standards, and Student Learning Expectations was based on approximate proportions suggested by the Content Advisory Committee, and their recommendations were accommodated to the greatest extent possible given the overall test design. Part IV of the Released Item Booklet provides Arkansas educators with specific information on how Biology End-of-Course Examination items align or correlate with the *Arkansas Biology Science Curriculum Framework* to provide models for classroom instruction.

PART I SCORING STUDENT RESPONSES TO BIOLOGY OPEN-RESPONSE ITEMS

While multiple-choice items are scored by machine to determine if the student chose the correct answer from four options, responses to open-response items must be scored by trained “readers” using a pre-established set of scoring criteria. Readers are trained to score in only one content area. Qualified readers for Arkansas scoring will be those with a four-year college degree in science, education, or related fields.

The Arkansas Biology Rangesfinding Committee assisted in the development of the scoring criteria. The committee comprises active Arkansas educators with expertise in science education.

Reader Training

Before readers are allowed to begin assigning scores to any student responses, they go through intensive training. The first step in that training is for the readers to read the Biology open-response items as they appear in the test booklet and to respond—just as the student test takers are required to do. This step gives the readers some insight into how the students might have responded. The next step is the readers’ introduction to the scoring rubric. All of the specific requirements of the rubric are explained by the Scoring Director who has been specifically trained to lead the scoring group. Then responses (anchor papers) that illustrate the score points of the rubric are presented to the readers and discussed. The goal of this discussion is for the readers to understand why a particular response (or type of response) receives a particular score. After discussion of the rubric and anchor papers, readers practice scoring sets of responses that have been prescored and selected for use as training papers. Detailed discussion of the responses and the scores they receive follows.

After three or four of these practice sets, readers are given “qualifying rounds.” These are additional sets of prescored papers, and, in order to qualify, each reader scoring Biology responses must score in exact agreement on at least 80% of the responses. Readers who do not score within the required rate of agreement are not allowed to score the Biology End-of-Course Examination responses.

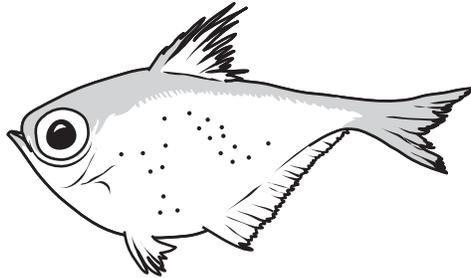
Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and Scoring Directors or Team Leaders reread selected responses scored by the readers. These procedures promote reliable and consistent scoring. Any reader who does not maintain an acceptable level of agreement is dismissed from the project.

Scoring Procedures

All student responses to the Biology End-of-Course Examination open-response test items are scored independently by two readers. Those two scores are compared, and responses that receive scores that are non-adjacent (a “1” and a “3,” for example) are scored a third time by a Team Leader or the Scoring Director for resolution.

PART II MID-YEAR RELEASED BIOLOGY ITEMS

1. Examine the picture of the fish and the dichotomous key below.



Step 1

- If fish has both eyes on the same side of the head, then go to step 2.
If fish has one eye on each side of the head, then go to step 3.

Step 2

- If fish has long whip-like tail, it is a **spotted eagle ray**.
If fish has short, blunt tail, it is a **flounder**.

Step 3

- If fish has spots, then go to step 4.
If fish does not have spots, then go to step 5.

Step 4

- If fish has chin “whiskers,” it is a **spotted goat fish**.
If fish does not have chin “whiskers,” it is a **band-tail puffer**.

Step 5

- If fish has stripes, then go to step 6.
If fish does not have stripes, it is a **glassy sweeper**.

Step 6

- If fish has a v-shaped tail, it is a **squirrel fish**.
If fish has a blunt tail, it is a **glass-eye snapper**.

Using the dichotomous key, identify this organism.

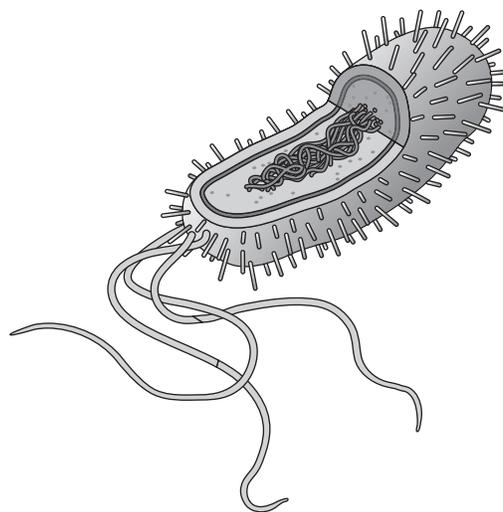
- A. flounder
- B. glassy sweeper
- * C. band-tail puffer
- D. glass-eye snapper

2. Which would science use to explain the natural world?
- A. survey
 - B. opinion
 - * C. physical evidence
 - D. supernatural phenomena
3. What is the function of the proteins embedded in the plasma membrane of a cell?
- A. to repel water from the surface of the membrane
 - B. to attach the membrane to the cell wall for support
 - C. to block lipids and carbohydrates from passing through the membrane
 - * D. to act as channels for the movement of large molecules through the membrane
4. In humans, the total number of chromosomes is 46 (diploid number). Meiosis halves the chromosome number to 23 (haploid number) in sex cells.

How is this process important to sexual reproduction?

- A. Halving the chromosome number results in identical sex cells.
- B. Halving the chromosome number decreases the risk of tumor growth.
- C. Halving the chromosome number allows larger numbers of sex cells to be produced.
- * D. Halving the chromosome number prevents the number of chromosomes from doubling in every new generation.

5. Examine the picture below.



Which type of cell is shown above?

- A. a eukaryotic cell because of the presence of a nucleus
 - * B. a prokaryotic cell because of the absence of a nucleus
 - C. a prokaryotic cell because of the presence of a cell wall
 - D. a eukaryotic cell because of the absence of membrane bound organelles
6. Which **best** describes evolution?
- A. a change in the number of alleles in a population across successive generations
 - * B. a change in the frequency of alleles in a population across successive generations
 - C. a change in the number of individuals in a population across successive generations
 - D. a change in the frequency of chromosomes in a population across successive generations

PART II MID-YEAR RELEASED BIOLOGY ITEMS

7. Which type of mutation reverses the order of part of a chromosome?

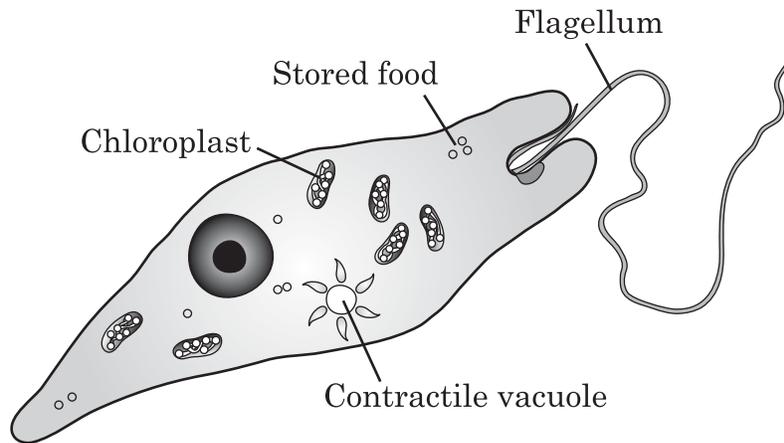
- A. point
- B. deletion
- * C. inversion
- D. frameshift

8. In a 19th century experiment, researchers removed the tails of mice and allowed them to reproduce. This was repeated for several generations with the offspring continuing to develop normal tails.

This disproved which proposed explanation about how organisms evolve?

- A. natural selection
- B. artificial selection
- C. inheritance based on need
- * D. inheritance of acquired characteristics

9. Examine the picture below.



Which type of organism is shown above?

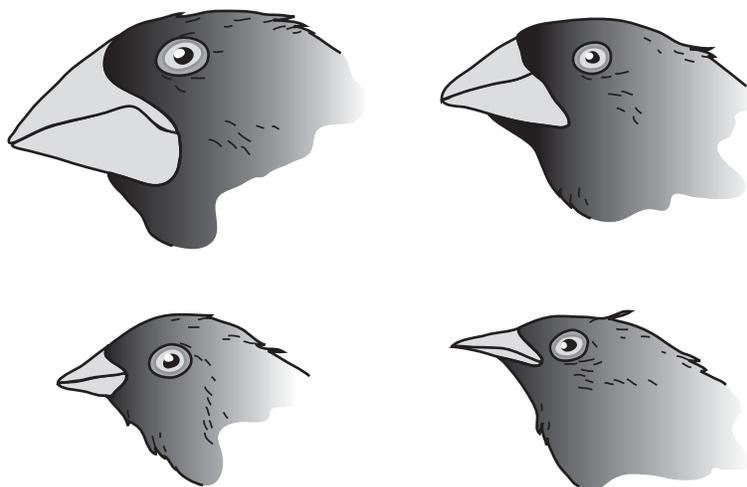
- A. fungal-like protist because it stores food
 - * B. plant-like protist because it has chloroplasts
 - C. bacteria-like protist because it has a flagellum
 - D. animal-like protist because it has a contractile vacuole
-

10. Which differentiates aquatic chordates from land vertebrates?

- * A. Aquatic chordates use gills for respiration; land vertebrates do not.
- B. Aquatic chordates have a hollow, dorsal nerve cord; land vertebrates do not.
- C. Aquatic chordates rely on kidneys to remove waste; land vertebrates do not.
- D. Aquatic chordates have a heart with two or four chambers; land vertebrates do not.

PART II MID-YEAR RELEASED BIOLOGY ITEMS

11. The four finches shown in the diagram below share a common ancestor.



Which statement describes how an ancestral species **most** likely developed into four distinct species?

- A. Four individual birds acquired many spontaneous mutations.
- B. The ancestral species became four new species through recombination.
- C. The ancestral species mated with other species and the offspring developed into four new species.
- * D. Groups of the ancestral species became isolated on different islands and adapted to different environments.

-
12. What is the function of the thick, waxy cuticle that covers the epidermis in plants?

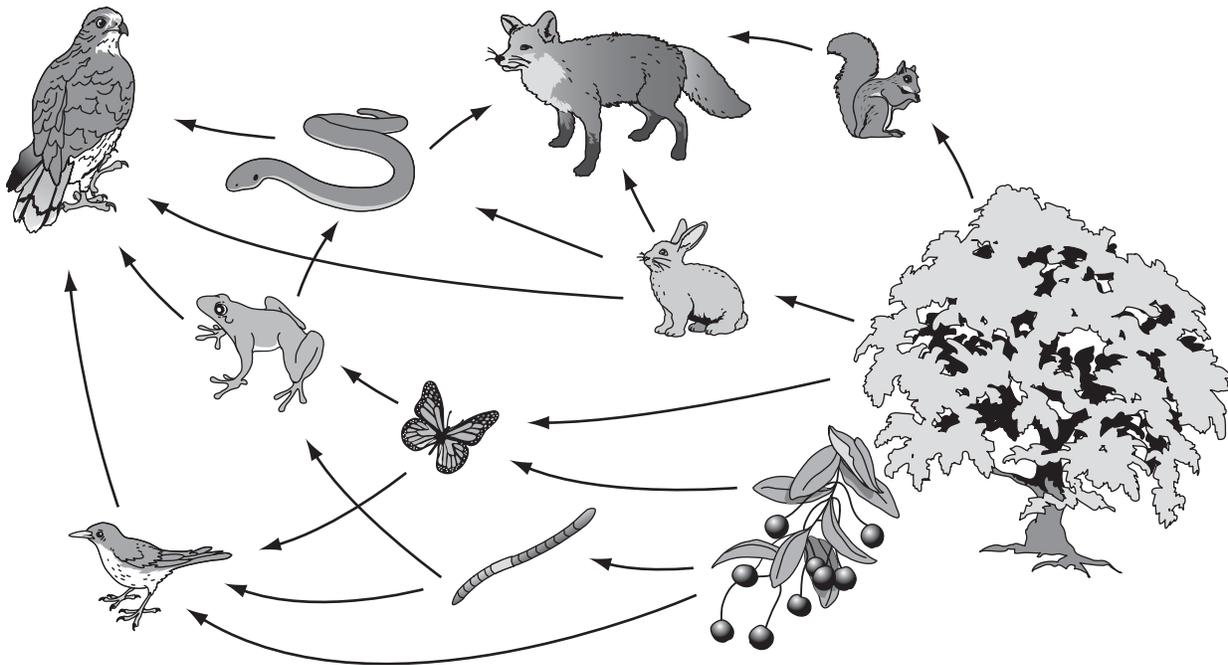
- * A. prevent water loss
- B. exchange of gases
- C. strengthen and support
- D. improve water absorption

13. Which is an observable trait of gymnosperms but **not** angiosperms?

- A. roots
- * B. cones
- C. seeds
- D. flowers

14. Which term **best** describes competition for resources between organisms living in the same area?
- A. carrying capacity
 - B. primary succession
 - * C. density-dependent limiting factor
 - D. density-independent limiting factor

15. Look at the diagram below.



In this food web example, which organism is a secondary consumer?

- * A. frog
- B. rabbit
- C. squirrel
- D. butterfly

PART II MID-YEAR RELEASED BIOLOGY ITEMS

16. Which is an abiotic factor?

- A. fungi
- B. plants
- C. bacteria
- * D. nutrients

17. Study the table below that shows the radius of an *E. coli* bacterial colony in a nutrient dish under optimal conditions.

***E. Coli* Growth**

Time (min)	Radius (mm)
0	0
15	2
30	4
45	8
60	16

Which statement **best** explains the data in the table?

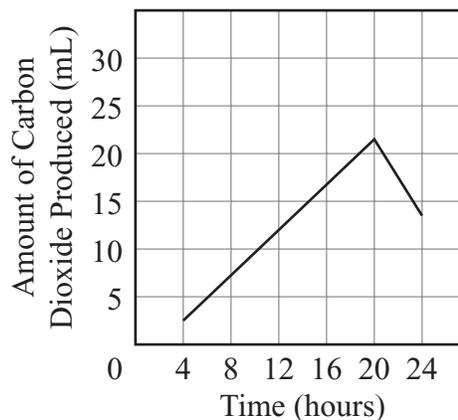
- * A. *E. coli* has a doubling time of 15 minutes.
- B. Under different conditions, *E. coli* would grow faster.
- C. The radius of the *E. coli* colony will be 32 mm at 85 minutes.
- D. It will take 30 additional minutes for the *E. coli* colony to reach 20 mm.

18. Which is a known effect of the thinning of the ozone layer of the atmosphere?

- A. decreased oxygen
- * B. increase in UV radiation
- C. decrease in UV radiation
- D. increased carbon dioxide

19. A glucose solution was added to a flask of yeast kept at 37 degrees Celsius. A balloon is placed over the mouth of the flask to collect CO₂ gas. The graph below shows the volume of gas collected over a 24-hour period.

CO₂ Production of Yeast over 24 Hours



Which is the **most** likely explanation for the decrease in CO₂ production?

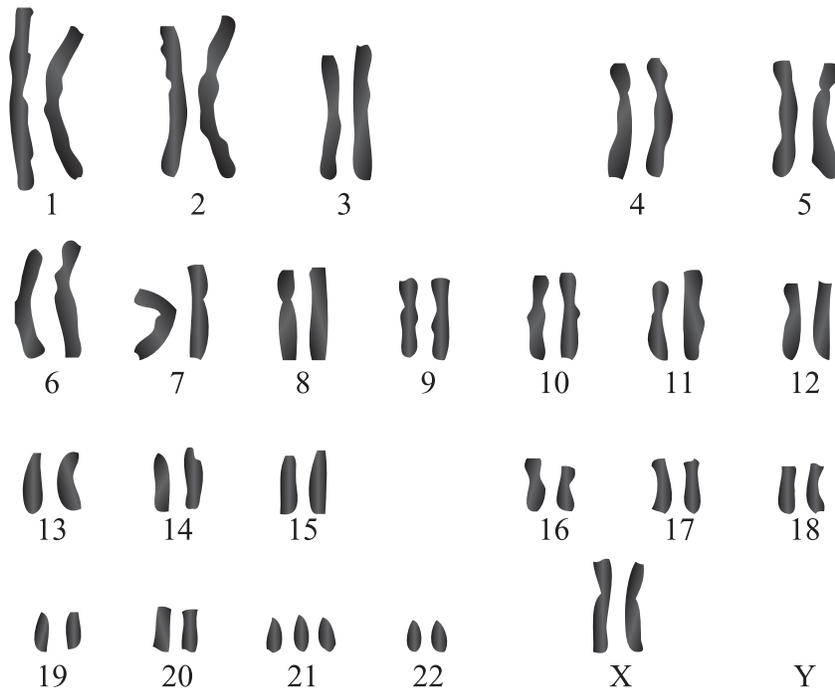
- A. The yeast had begun to die off from an increase in O₂ levels.
- B. The yeast growth reached equilibrium and produced less CO₂.
- C. The yeast converted to photosynthesis and started producing oxygen.
- * D. The yeast consumed all the available nutrients and could not perform cellular respiration.

20. Activation energy is the amount of energy required for which of the following?
- A. ending a chemical reaction
 - * B. starting a chemical reaction
 - C. moving water through a cell membrane
 - D. moving glucose through a cell membrane
21. Which piece of information would be **most** useful for classifying organisms as autotrophs or heterotrophs?
- A. presence of a cell wall
 - B. method of reproduction
 - C. presence of mitochondria
 - * D. method of obtaining energy

22. Which eukaryotic organisms account for the most ecological recycling of organic material?
- A. algae
 - * B. fungi
 - C. angiosperms
 - D. gymnosperms
23. Which cell structure contains pigment that absorbs light energy and converts the energy into stored chemical energy?
- A. ribosome
 - B. lysosome
 - * C. chloroplast
 - D. mitochondrion

PART II MID-YEAR RELEASED BIOLOGY ITEMS

24. Look at the the karyotype below.



Which term **best** describes the karyotype above?

- * A. trisomy
- B. monosomy
- C. duplication
- D. translocation

25. Which is **not** a nucleotide base found in RNA?

- A. adenine
- B. guanine
- * C. thymine
- D. cytosine

26. Which level of ecology **best** describes all humans living on Earth?

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

27. A scientist observes that each time a certain type of bird arrives at a bird feeder the bird gives a particular call. Shortly thereafter, more birds of the same species arrive. The scientist thinks that the call may signal that it is safe and food is present.

What has the scientist just done?

- A. proven a theory
 - B. established a law
 - * C. formed a hypothesis
 - D. performed an experiment
28. Recently, scientists have discovered a way to generate stem cells from skin cells. These stem cells can then develop into other types of mature tissues such as blood, muscle, and nerve.

Which part of the cell theory does this discovery directly involve?

- A. All living organisms are made of cells.
- B. Cells are the basic unit of living organisms.
- * C. New cells are produced from existing cells.
- D. Cells contain DNA which is passed from cell to cell.

29. What is the **greatest** benefit to humans from improvements in shelter?

- A. opening up land for agriculture
- B. reduction of competition for resources from non-human organisms
- C. economic improvements from the exploitation and selling of natural resources
- * D. protection against environmental extremes and biotic threats such as disease and predation

30. Scientists are expected to respect individuals and provide informed consent for subjects who participate in clinical trials.

Which is the reason for informed consent?

- A. It ensures that funding from the government is maintained.
- B. It ensures that test subjects will be compensated for their time.
- * C. It ensures that scientists are working within ethical parameters.
- D. It ensures that controlled experiments occur with human subjects.

PART II MID-YEAR RELEASED BIOLOGY ITEMS

- A. In pea plants, seed shape is controlled by a single gene with two alleles. The allele for round seeds (R) is dominant to the allele for wrinkled seeds (r).
- Predict the genotypic offspring ratios (or percentages) of a cross between two heterozygous plants.
 - Predict the phenotypic offspring ratios (or percentages) of a cross between two heterozygous plants.
 - A cross between a plant that produces round seeds and a plant that produces wrinkled seeds results in 303 round offspring and 296 wrinkled offspring. List the genotypes of both parents.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

Item A Scoring Rubric—2014 Biology

Part	Points
1	1 point possible: 1 point for the correct genotypic ratio
2	1 point possible: 1 point for the correct phenotypic ratio
3	2 points possible: Lists the genotypes of both parents

Score	Description
4	Response shows a <i>complete understanding</i> of using the laws of probability and Punnett squares to predict genotypic and phenotypic ratios. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of using the laws of probability and Punnett squares to predict genotypic and phenotypic ratios. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of using the laws of probability and Punnett squares to predict genotypic and phenotypic ratios. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of using the laws of probability and Punnett squares to predict genotypic and phenotypic ratios. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of using the laws of probability and Punnett squares to predict genotypic and phenotypic ratios. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

PART II MID-YEAR RELEASED BIOLOGY ITEMS

SOLUTION AND SCORING

4 points possible:

Part	Points
1	<p>1 point possible:</p> <p>1 point for the genotypic ratio:</p> <p>1:2:1</p> <p>OR</p> <p>25% RR, 50% Rr, and 25% rr</p>
2	<p>1 point possible:</p> <p>1 point for the phenotypic ratio:</p> <p>3:1</p> <p>OR</p> <p>75% round and 25% wrinkled</p>
3	<p>2 points possible:</p> <p>1 point for each parent genotype:</p> <p>Rr x rr</p>

PART II MID-YEAR RELEASED BIOLOGY ITEMS

B. Listed below are some important properties of water:

- **surface tension**
- **adhesion**
- **cohesion**
- **polarity**
- **pH**

1. Choose one of the properties listed above. Describe an example of how water demonstrates this property.
2. Explain how the property chosen in part 1 is significant for life.
3. Choose another one of the properties listed above. Describe an example of how water demonstrates this property.
4. Explain how the property chosen in part 3 is significant for life.

BE SURE TO LABEL YOUR RESPONSES 1, 2, 3, AND 4.

Item B Scoring Rubric—2014 Biology

Part	Points
1	1 point possible: Describes one example of one property of water.
2	1 point possible: Explains how this property is significant for life.
3	1 point possible: Describes one example of one property of water.
4	1 point possible: Explains how this property is significant for life.

Score	Description
4	Response shows a <i>complete understanding</i> of investigation of the properties and importance of water and its significance for life. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of investigation of the properties and importance of water and its significance for life. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of investigation of the properties and importance of water and its significance for life. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of investigation of the properties and importance of water and its significance for life. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of investigation of the properties and importance of water and its significance for life. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

PART II MID-YEAR RELEASED BIOLOGY ITEMS

SOLUTION AND SCORING

4 points possible:

Part	Points	
1 and 3	1 point possible for each part:	
	Property	Description
	Cohesion	The ability of water molecules to bond to each other. OR Water droplets are nearly spherical because of cohesion. OR Water exhibits this property through surface tension. OR Water droplets combine with each other.
	Surface tension	Allows water to resist an external force due to the cohesive nature of the water molecules. OR Allows certain organisms to glide over the surface of water. OR Allows a cup to be filled above its rim.
	Adhesion	The ability of water to adhere to other substances/surfaces. OR Capillary action — Water can climb up small tubes due to adhesion. OR Meniscus — The clinging of water to the sides of a test tube is due to adhesion.

PART II MID-YEAR RELEASED BIOLOGY ITEMS

Part	Points	
	Polarity	<p>Molecules having uneven distribution of charges (a labeled diagram will be accepted)</p> <p style="text-align: center;">OR</p> <p>Hydrogen bonds form between water molecules as a result of polarity.</p>
	pH	pH of pure water is 7 or neutral.
2 and 4	1 point possible for each correct explanation:	
	Property	Explanation of significance for life
	Cohesion	Cohesion contributes to the transport of water against the force of gravity in plants.
	Surface tension	Insects or certain lizards can travel on water to hunt or escape predators.
	Adhesion	Adhesion contributes to the transport of water against the force of gravity in plants.
	Polarity	<p>Water is the universal solvent because of its polarity, which is significant to life because metabolic reactions take place in solution in the cytoplasm of living cells.</p> <p style="text-align: center;">OR</p> <p>Water has a specific heat resulting in: bodies of water being more resistant to temperature change and the internal environment of organisms being able to resist changes in temperature that could result in damage.</p> <p style="text-align: center;">OR</p> <p>Ice is less dense than water as a result of the hydrogen bonds formed. Ice acts as an insulator which is important for the survival of aquatic organisms.</p>
	pH	<p>Water's neutral pH allows organisms to use water in metabolism.</p> <p style="text-align: center;">OR</p> <p>Water can become slightly acidic (acid rain) or slightly basic which may disrupt normal metabolism or prevent organisms from inhabiting affected bodies of water.</p>

PART II SPRING RELEASED BIOLOGY ITEMS

1. How does shivering help maintain homeostasis when a person is cold?

- A. synthesizes cellular ATP
- B. causes anaerobic respiration
- C. increases production of CO₂
- * D. expends energy to create heat

2. The table below shows the heights of different plants.

Plant Height Data

Height (cm)	Number of Plants
2	3
4	6
6	4
8	2

What is the range in this set of data?

- A. 2
 - B. 4
 - * C. 6
 - D. 8
3. Which **correctly** identifies the structure and its function?
- A. flower – storage
 - * B. root – anchorage
 - C. leaf – absorbs oxygen
 - D. stem – reproduction site

4. A student is studying the effect of different carbohydrates on bacterial growth. Equal amounts of *Escherichia coli* bacteria are placed in two test tubes. Tube A receives a 10% glucose solution. Tube B receives a 10% sucrose solution. After one hour, 1 ml of each solution is removed and analyzed. The solution from tube A has more bacteria.

Which conclusion is valid?

- A. All bacteria grow best in a solution of sucrose.
 - B. All bacteria grow best in a solution of glucose.
 - C. *E. coli* bacteria grow best in a solution of sucrose.
 - * D. *E. coli* bacteria grow best in a solution of glucose.
5. Which term describes a network of complex feeding relationships among the various organisms in an ecosystem?
- * A. food web
 - B. food chain
 - C. energy pyramid
 - D. biomass pyramid

6. Which is an example of a non-scientific theory?
- * A. the theory that astrology has caused natural disasters
 - B. the theory that a particular infectious agent causes a disease
 - C. the theory that all living things are made of cells, that cells are the basic units of organisms, and that cells come only from existing cells
 - D. the theory that genes are located on chromosomes and that each gene occupies a specific place on a chromosome
7. Why do investigators have both the experimental treatment group and control groups take “medication” during an investigation?
- A. They must group participants based on preexisting conditions.
 - B. They need to have at least two groups to get funding for their research.
 - * C. They do not want to introduce bias because some people are taking pills and others are not.
 - D. They require a minimum number of participants, but have only a limited amount of medication.

8. In fruit flies, white eyes are caused by a recessive allele on the X chromosome. Red eyes (or wild type) are achieved by a dominant allele.

Which cross would result in a white-eyed female fruit fly?

- A. red-eyed male crossed with a red-eyed carrier female
 - * B. white-eyed male crossed with a red-eyed carrier female
 - C. red-eyed male crossed with a red-eyed homozygous female
 - D. white-eyed male crossed with a red-eyed homozygous female
9. Which analogy **best** describes the relationship between an enzyme’s active site and its substrate?
- * A. a lock and a key
 - B. a bike and a wheel
 - C. a hammer and a nail
 - D. a car and a steering wheel

PART II SPRING RELEASED BIOLOGY ITEMS

10. Which is a nonvascular plant?

- A. fern
- * B. moss
- C. angiosperm
- D. gymnosperm

11. Which process is a major part of the nitrogen cycle?

- A. evaporation
- B. precipitation
- C. photosynthesis
- * D. ammonification

12. Which term describes resources that can be consumed while continuing to ensure environmental health?

- A. abiotic
- B. nonrenewable
- C. limiting factor
- * D. sustainable use

13. An experiment is conducted to measure the volume of bread dough as it rises. The data table below shows the results.

Time (in minutes)	Amount Dough Rose in Graduated Cylinder (in ml)
5	1
10	4
15	6
20	5
25	2

Which type of graph would best represent the data observed?

- A. pie chart
- B. histogram
- * C. line graph
- D. scatter plot

14. What could be the effect of increasing the number of mitochondria in a muscle cell?

- A. Lipid synthesis would decrease.
- * B. ATP production would increase.
- C. Protein synthesis would decrease.
- D. Glucose production would increase.

15. Cyanobacteria are autotrophic organisms that carry out photosynthesis.

Which must be present in cyanobacteria to allow photosynthesis to occur?

- A. ribosome
 - B. flagellum
 - C. endospore
 - * D. chlorophyll
16. How is a helpful mutation different from a harmful mutation?
- A. It reduces the number of alleles.
 - B. It can be passed down to offspring.
 - * C. It increases fitness in the population.
 - D. It decreases fitness in the population.

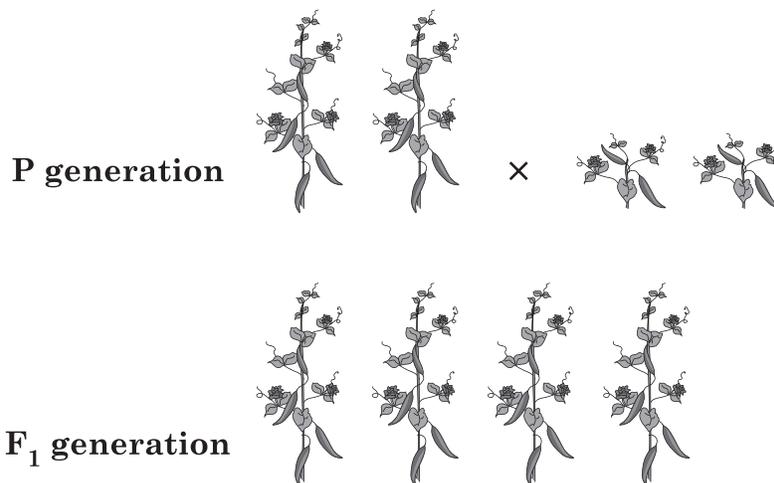
17. Lynx catch rabbits to eat. As the lynx population increases, the rabbit population decreases.

In this scenario, which type of factor controls the population?

- A. shelter
 - B. crowding
 - * C. predation
 - D. competition
18. Which is a product of respiration used by cells for energy?
- A. AMP
 - * B. ATP
 - C. DNA
 - D. RNA

PART II SPRING RELEASED BIOLOGY ITEMS

19. Look at the cross of pea plants below.



Which conclusion can be drawn from the cross shown above?

- * A. Tall is a dominant trait in peas.
- B. Pea plants produce fertile hybrids.
- C. Height is an incompletely dominant trait.
- D. All pea plants in the F₂ generation will be tall.

20. Which term describes a biological relationship in which both species benefit?

- A. parasitism
- * B. mutualism
- C. exploitation
- D. commensalism

21. Many medicines have been derived from plants.

Which is **most** important to maintain in order to discover new medicines from plants?

- * A. biodiversity
- B. greenhouses
- C. monoculture
- D. bioremediation

22. Look at the image below.



Which statement explains the image shown above?

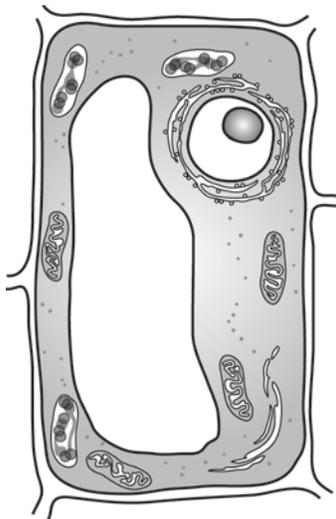
- A. It is RNA because it is single-stranded.
 - B. It is DNA because it is single-stranded.
 - * C. It is DNA because it is double-stranded.
 - D. It is RNA because it is double-stranded.
23. Which describes how the protist that causes malaria is transmitted from person to person?
- A. eating undercooked pork
 - B. drinking contaminated water
 - C. getting scratched by a feral cat
 - * D. being bitten by an infected mosquito

24. Which source would have the most reliable and most recent biological research?

- A. internet blogs
 - B. science fiction books
 - * C. online science journals
 - D. published encyclopedias
25. Which type of ecological succession would occur on a newly formed volcanic island?
- * A. primary
 - B. secondary
 - C. barrier island
 - D. eutrophication

PART II SPRING RELEASED BIOLOGY ITEMS

26. Examine the cell below.



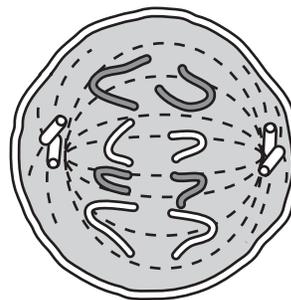
Which type of cell is pictured above?

- A. A plant cell because it has a flagellum and a cell wall.
- * B. A plant cell because it has a cell wall and chloroplasts.
- C. An animal cell because it has mitochondria and a cell membrane.
- D. An animal cell because it has a rough and a smooth endoplasmic reticulum.

27. Which **best** explains why polar bears appear white?

- A. Brown fur does not insulate polar bears as well as white fur.
- B. White fur allows polar bears to blend in with the vegetation in their environment.
- C. During the last ice age, their ancestors acquired this coloration to better enable them to blend in with the ice and snow.
- * D. In the ancestral population, some had a mutation that produced this coloration and they were better able to find prey and avoid predation in the ice and snow.

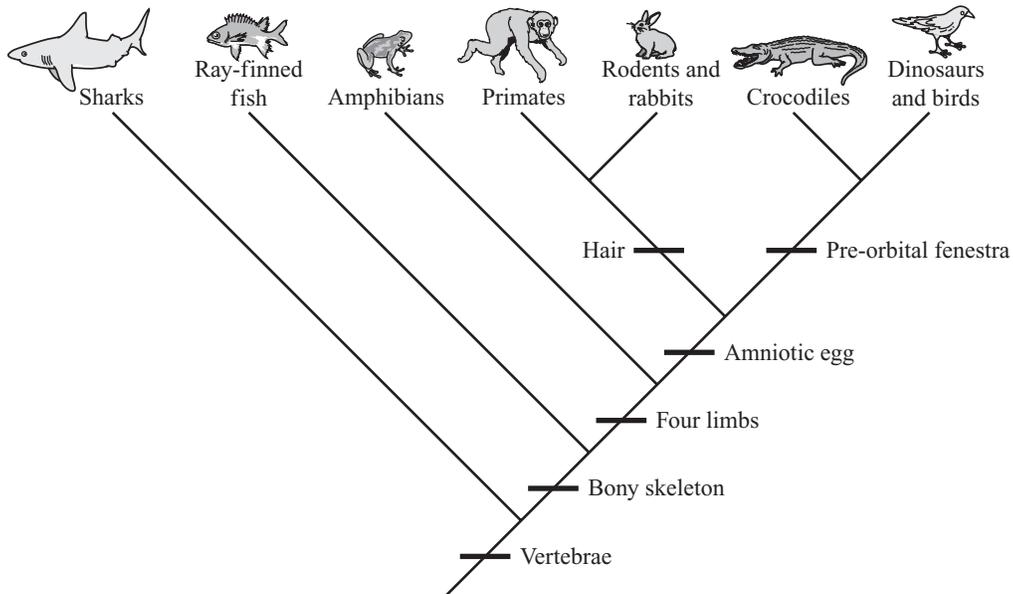
28. Look at the picture below.



Which event is occurring in the stage of mitosis shown above?

- A. DNA is dissolving into chromatin.
- B. New nuclei are forming at opposite poles.
- C. Cytoplasmic threads are cutting the cell in half.
- * D. Sister chromatids are being pulled to opposite poles.

29. This cladogram shows relationships among groups of animals.



Based on this cladogram, which of the following statements is true?

- * A. All of these animals have vertebrae.
- B. All these animals have bony skeletons.
- C. Amphibians, primates, rodents, and rabbits have amniotic eggs.
- D. Amphibians are more closely related to primates than rodents are.

30. Which is true regarding prokaryotes?

- A. Most known prokaryotes are fungi.
- B. Most known prokaryotes are plants.
- C. Most known prokaryotes are protists.
- * D. Most known prokaryotes are bacteria.

PART II SPRING RELEASED BIOLOGY ITEMS

- A. Field studies have shown that predator-prey relationships help to control populations within ecosystems. If coyotes were removed from the Ouachita National Forest in Arkansas, populations of other species would be affected.
1. Identify one population that could increase as a result of the removal of coyotes from Ouachita National Forest. Explain why this population would experience an increase in numbers.
 2. Identify one population that could decrease as a result of the removal of coyotes from Ouachita National Forest. Explain why this population would experience a decrease in numbers.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

Item A Scoring Rubric—2014 Biology

Part	Points
1	2 points possible: 1 point for the identification of one population that could increase as a result of the removal of coyotes from Ouachita National Forest. 1 point for the explanation why this population would experience an increase in numbers.
2	2 points possible: 1 point for the identification of one population that could decrease as a result of the removal of coyotes from Ouachita National Forest. 1 point for the explanation why this population would experience a decrease in numbers.

Score	Description
4	Response shows a <i>complete understanding</i> of factors that control population. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of factors that control population. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of factors that control population. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of factors that control population. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of factors that control population. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

PART II SPRING RELEASED BIOLOGY ITEMS

SOLUTION AND SCORING

4 points possible:

Part	Points																					
1	<p>2 points possible:</p> <p>1 point for identification:</p> <table><tr><td>Rabbit</td><td>Turkey</td><td>Beaver</td></tr><tr><td>Squirrel</td><td>Quail</td><td>Skunk</td></tr><tr><td>Woodchuck</td><td>Raccoon</td><td>Bobcat</td></tr><tr><td>Deer</td><td>Opossum</td><td>Otter</td></tr><tr><td>Mouse</td><td>Ground Hog</td><td>Lizard</td></tr><tr><td>Rat</td><td>Chipmunk</td><td>Vulture</td></tr><tr><td>Crow</td><td>Fox</td><td>Hawk</td></tr></table> <p>1 point for explanation:</p> <p>The coyote is a predator that eats (named prey). If the predator is gone the number of prey increases. They have an inverse relationship.</p>	Rabbit	Turkey	Beaver	Squirrel	Quail	Skunk	Woodchuck	Raccoon	Bobcat	Deer	Opossum	Otter	Mouse	Ground Hog	Lizard	Rat	Chipmunk	Vulture	Crow	Fox	Hawk
Rabbit	Turkey	Beaver																				
Squirrel	Quail	Skunk																				
Woodchuck	Raccoon	Bobcat																				
Deer	Opossum	Otter																				
Mouse	Ground Hog	Lizard																				
Rat	Chipmunk	Vulture																				
Crow	Fox	Hawk																				
2	<p>2 points possible:</p> <p>1 point for identification:</p> <p>Bear Cougar</p> <p>Note: Food sources of coyote prey will also decrease as their numbers increase.</p> <p>1 point for explanation:</p> <p>The coyote is a source of food. Less prey means fewer predators of the coyote.</p>																					

PART II SPRING RELEASED BIOLOGY ITEMS

- B.**
1. List two diseases that are caused by viruses.
 2. Describe one way viruses can be useful in the treatment or prevention of diseases in humans.
 3. Other than treating viral diseases in humans, describe one way the study of viruses can be economically important.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

Item B Scoring Rubric—2014 Biology

Part	Points
1	2 points possible: Lists two diseases caused by viruses.
2	1 point possible: Describes one way viruses can be useful in the treatment of disease in humans.
3	1 point possible: Describes one way the study of viruses can be economically beneficial.

Score	Description
4	Response shows a <i>complete understanding</i> of evaluating the medical and economic importance of viruses. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of evaluating the medical and economic importance of viruses. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of evaluating the medical and economic importance of viruses. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of evaluating the medical and economic importance of viruses. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of evaluating the medical and economic importance of viruses. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

SOLUTION AND SCORING

4 points possible:

Part	Points																																								
1	<p>2 points possible:</p> <p>1 point for each viral disease listed</p> <table border="1"> <tr> <td>Influenza</td> <td>AIDS</td> <td>West Nile</td> <td>Mononucleosis</td> </tr> <tr> <td>Common Cold</td> <td>Herpes</td> <td>Hanta</td> <td>Genital Warts</td> </tr> <tr> <td>Chicken Pox</td> <td>Adenovirus</td> <td>Ebola</td> <td>Plantar Warts</td> </tr> <tr> <td>Shingles</td> <td>Rhinovirus</td> <td>Encephalitis</td> <td>CMV</td> </tr> <tr> <td>Measles</td> <td>Rotavirus</td> <td>RSV</td> <td>Hand, Foot, and Mouth Or Coxsackie Disease</td> </tr> <tr> <td>Mumps</td> <td>Norwalk (Norovirus)</td> <td>Epstein Barr</td> <td></td> </tr> <tr> <td>Rubella</td> <td>Hepatitis A, B, C</td> <td>HSV</td> <td>Conjunctivitis</td> </tr> <tr> <td>Fifth Disease</td> <td>Meningitis</td> <td>HTLV I, II, or III</td> <td>Herpangia</td> </tr> <tr> <td>Polio</td> <td>Pneumonia</td> <td>Yellow Fever</td> <td>Hunt Syndrome</td> </tr> <tr> <td>Smallpox</td> <td>SARS</td> <td>Dengue Fever</td> <td></td> </tr> </table>	Influenza	AIDS	West Nile	Mononucleosis	Common Cold	Herpes	Hanta	Genital Warts	Chicken Pox	Adenovirus	Ebola	Plantar Warts	Shingles	Rhinovirus	Encephalitis	CMV	Measles	Rotavirus	RSV	Hand, Foot, and Mouth Or Coxsackie Disease	Mumps	Norwalk (Norovirus)	Epstein Barr		Rubella	Hepatitis A, B, C	HSV	Conjunctivitis	Fifth Disease	Meningitis	HTLV I, II, or III	Herpangia	Polio	Pneumonia	Yellow Fever	Hunt Syndrome	Smallpox	SARS	Dengue Fever	
Influenza	AIDS	West Nile	Mononucleosis																																						
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Smallpox	SARS	Dengue Fever																																							
2	<p>1 point possible:</p> <p>Develop vaccines to prevent viral disease</p> <p>OR</p> <p>Prevent cancer (HPV)</p> <p>OR</p> <p>Gene Therapy — replace “defective” genes with normal genes.</p> <p>OR</p> <p>Target, infect, and destroy pathogenic bacteria.</p> <p>OR</p> <p>VDEPT –Virus directed enzyme prodrug therapy/Drugs are delivered via a virus to help kill cancer cells.</p>																																								

PART II SPRING RELEASED BIOLOGY ITEMS

Part	Points
3	<p data-bbox="310 296 532 321">1 point possible:</p> <p data-bbox="310 352 1328 411">Biological pest control for better crop yield means more money for farmers. (used to control insects and rabbits)</p> <p data-bbox="310 447 354 472">OR</p> <p data-bbox="310 510 1214 535">Prevention of disease by vaccination, saves money on future medical bills.</p> <p data-bbox="310 573 354 598">OR</p> <p data-bbox="310 636 1344 695">Crops or livestock may be infected by viruses. Healthier crops and livestock increase profits for the farmer.</p> <p data-bbox="310 730 354 756">OR</p> <p data-bbox="310 793 1214 819">Prevent certain types of cancer (HPV), saving money on health care costs.</p> <p data-bbox="310 856 354 882">OR</p> <p data-bbox="310 919 1352 945">Gene Therapy, economically important to the companies that develop these methods.</p> <p data-bbox="310 982 354 1008">OR</p> <p data-bbox="310 1045 792 1071">VDEPT- Therapy can be sold for profit.</p> <p data-bbox="310 1108 354 1134">OR</p> <p data-bbox="310 1171 1279 1197">Viruses are used in research to study how genes work. Discoveries may be sold.</p> <p data-bbox="310 1234 354 1260">OR</p> <p data-bbox="310 1297 1409 1356">Studying how viruses are transmitted from person to person or animal to person can keep less people from getting sick allowing them to be more productive and use less sick time.</p>

- C. 1. Describe the conditions under which a scientific theory may be modified.
2. Describe peer review as a guideline for science.
3. Describe two benefits that peer review of scientific investigations provide for the advancement of scientific knowledge.

BE SURE TO LABEL YOUR RESPONSES 1, 2, AND 3.

Item C Scoring Rubric—2014 Biology

Part	Points
1	1 point possible: Describes the conditions under which a scientific theory may be modified.
2	1 point possible: Describes peer review as a guideline for science.
3	2 points possible: Describes two benefits that peer review of scientific investigations provides for the advancement of scientific knowledge.

Score	Description
4	Response shows a <i>complete understanding</i> of the guidelines of science. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of the guidelines of science. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of the guidelines of science. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of the guidelines of science. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of the guidelines of science. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

PART II SPRING RELEASED BIOLOGY ITEMS

SOLUTION AND SCORING

4 points possible:

Part	Points
1	<p>1 point possible:</p> <p>A scientific theory may be modified when new data is discovered through research and/or new technology.</p>
2	<p>1 point possible:</p> <p>Scientists present their work (includes hypothesis, experiments, results, and conclusions) to their peers in a presentation or in a written article. Their peers have a chance to evaluate the work of the scientists (replicate their findings through experimentation) and then make a recommendation to accept, modify, or reject the scientist's work.</p>
3	<p>2 points possible:</p> <p>1 point each for benefit of peer review:</p> <p>Peer review can identify any bias or conflict of interest.</p> <p>OR</p> <p>Peer review can identify errors in the experimentation (process).</p> <p>OR</p> <p>Peer review can identify errors on the conclusion(s) made by the scientists.</p> <p>OR</p> <p>Peer review can validate the data presented by the scientist(s).</p> <p>OR</p> <p>Peer review can confirm that enough information has been provided by the publishing scientist to replicate his/her experiments.</p>

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
<p>1. MOLECULES AND CELLS (MC)</p>	<p>1. Students shall demonstrate an understanding of the role of chemistry in life processes.</p>	<p>2. Describe the relationship between an enzyme and its substrate molecule(s).</p> <p>3. Investigate the properties and importance of water and its significance for life:</p> <ul style="list-style-type: none"> • <i>surface tension</i> • <i>adhesion</i> • <i>cohesion</i> • <i>polarity</i> • <i>pH</i> <p>4. Explain the role of energy in chemical reactions of living systems:</p> <ul style="list-style-type: none"> • <i>activation energy</i> • <i>exergonic reactions</i> • <i>endergonic reactions</i>
	<p>2. Students shall demonstrate an understanding of the structure and function of cells.</p>	<p>1. Construct a hierarchy of life from cells to <i>ecosystems</i>.</p> <p>2. Compare and contrast <i>prokaryotes</i> and <i>eukaryotes</i>.</p> <p>3. Describe the role of sub-cellular structures in the life of a cell:</p> <ul style="list-style-type: none"> • <i>organelles</i> • <i>ribosomes</i> • <i>cytoskeleton</i> <p>4. Relate the function of the <i>plasma (cell) membrane</i> to its structure.</p> <p>5. Compare and contrast the structures of an animal cell to a plant cell.</p> <p>6. Compare and contrast the functions of <i>autotrophs</i> and <i>heterotrophs</i>.</p> <p>8. Describe the main events in the <i>cell cycle</i>, including the differences in plant and animal cell division:</p> <ul style="list-style-type: none"> • <i>interphase</i> • <i>mitosis</i> • <i>cytokinesis</i> <p>9. List in order and describe the stages of <i>mitosis</i>:</p> <ul style="list-style-type: none"> • <i>prophase</i> • <i>metaphase</i> • <i>anaphase</i> • <i>telophase</i> <p>10. Analyze the meiotic maintenance of a constant <i>chromosome</i> number from one generation to the next.</p> <p>11. Discuss <i>homeostasis</i> using <i>thermoregulation</i> as an example.</p>
	<p>3. Students shall demonstrate an understanding of how cells obtain and use energy (<i>energetics</i>).</p>	<p>1. Compare and contrast the structure and function of <i>mitochondria</i> and <i>chloroplasts</i>.</p> <p>2. Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP):</p> <ul style="list-style-type: none"> • <i>glycolysis</i> • <i>citric acid cycle</i> • <i>electron transport chain</i> <p>3. Compare and contrast aerobic and anaerobic respiration:</p> <ul style="list-style-type: none"> • <i>lactic acid fermentation</i> • <i>alcoholic fermentation</i> <p>5. Compare and contrast <i>cellular respiration</i> and <i>photosynthesis</i> as energy conversion pathways.</p>

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2014 Mid-Year and Spring End-of-Course Biology Examinations.

PART III CURRICULUM FRAMEWORK

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
2. HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of heredity.	1. Summarize the outcomes of Gregor Mendel's experimental procedures. 2. Differentiate among the <i>laws and principles of inheritance</i> : <ul style="list-style-type: none"> • <i>dominance</i> • <i>segregation</i> • <i>independent assortment</i> 3. Use the <i>laws of probability</i> and <i>Punnett squares</i> to predict <i>genotypic</i> and <i>phenotypic ratios</i> . 4. Examine different modes of inheritance: <ul style="list-style-type: none"> • <i>sex linkage</i> • <i>codominance</i> • <i>crossing over</i> • <i>incomplete dominance</i> • <i>multiple alleles</i> 5. Analyze the historically significant work of prominent geneticists. 6. Evaluate <i>karyotypes</i> for abnormalities: <ul style="list-style-type: none"> • monosomy • trisomy
	5. Students shall investigate the molecular basis of genetics.	1. Model the components of a <i>DNA nucleotide</i> and an <i>RNA nucleotide</i> . 3. Compare and contrast the structure and function of <i>DNA</i> and <i>RNA</i> . 4. Describe and model the processes of <i>replication</i> , <i>transcription</i> , and <i>translation</i> . 5. Compare and contrast the different types of mutation events, including <i>point mutation</i> , <i>frameshift mutation</i> , <i>deletion</i> , and <i>inversion</i> . 6. Identify effects of changes brought about by <i>mutations</i> : <ul style="list-style-type: none"> • beneficial • harmful • neutral
	6. Students shall examine the development of the <i>theory of biological evolution</i> .	1. Compare and contrast Lamarck's explanation of <i>evolution</i> with Darwin's <i>theory of evolution by natural selection</i> . 2. Recognize that <i>evolution</i> involves a change in allele frequencies in a <i>population</i> across successive generations. 3. Analyze the effects of mutations and the resulting variations within a <i>population</i> in terms of <i>natural selection</i> . 5. Evaluate <i>evolution</i> in terms of evidence as found in the following: <ul style="list-style-type: none"> • fossil record • <i>DNA</i> analysis • <i>artificial selection</i> • morphology • embryology • viral <i>evolution</i> • geographic distribution of related <i>species</i> • <i>antibiotic</i> and <i>pesticide resistance</i> in various organisms 6. Compare the processes of <i>relative dating</i> and <i>radioactive dating</i> to determine the age of fossils. 7. Interpret a <i>Cladogram</i> .

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2014 Mid-Year and Spring End-of-Course Biology Examinations.

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
<p>3. CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)</p>	<p>7. Students shall demonstrate an understanding that organisms are diverse.</p>	<ol style="list-style-type: none"> 1. Differentiate among the different domains: <ul style="list-style-type: none"> • Bacteria • Archaea • Eukarya 4. Classify and name organisms based on their similarities and differences applying <i>taxonomic nomenclature</i> using <i>dichotomous keys</i>. 7. Evaluate the medical and economic importance of <i>viruses</i>. 8. Compare and contrast life cycles of familiar organisms: <ul style="list-style-type: none"> • sexual reproduction • asexual reproduction • metamorphosis • <i>alternation of generations</i> 9. Classify <i>bacteria</i> according to their characteristics and adaptations: 11. Describe the characteristics used to classify protists: <ul style="list-style-type: none"> • plant-like • animal-like • fungal-like 12. Evaluate the medical and economic importance of protists. 14. Evaluate the medical and economic importance of <i>fungi</i>. 15. Differentiate between <i>vascular</i> and <i>nonvascular</i> plants. 16. Differentiate among cycads, gymnosperms, and angiosperms. 17. Describe the structure and function of the major parts of a plant: <ul style="list-style-type: none"> • roots • stems • leaves • flowers 18. Relate the structure of plant tissue to its function: <ul style="list-style-type: none"> • epidermal • ground • vascular 19. Evaluate the medical and economic importance of plants. 20. Identify the symmetry of organisms: <ul style="list-style-type: none"> • radial • bilateral • asymmetrical 21. Compare and contrast the major invertebrate classes according to their nervous, respiratory, excretory, circulatory, and digestive systems. 22. Compare and contrast the major vertebrate classes according to their nervous, respiratory, excretory, circulatory, digestive, reproductive and integumentary systems.

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2014 Mid-Year and Spring End-of-Course Biology Examinations.

PART III CURRICULUM FRAMEWORK

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
4. ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms.	<ol style="list-style-type: none"> 1. Cite examples of abiotic and biotic factors of <i>ecosystems</i>. 2. Compare and contrast the characteristics of biomes. 3. Diagram the carbon, nitrogen, phosphate, and water cycles in an <i>ecosystem</i>. 4. Analyze an <i>ecosystem's</i> energy flow through food chains, food webs, and <i>energy pyramids</i>. 5. Identify and predict the factors that control <i>population</i>, including <i>predation</i>, <i>competition</i>, crowding, water, nutrients, and shelter. 6. Summarize the symbiotic ways in which individuals within a community interact with each other: <ul style="list-style-type: none"> • <i>commensalism</i> • <i>parasitism</i> • <i>mutualism</i> 7. Compare and contrast <i>primary succession</i> with <i>secondary succession</i>. 8. Identify the properties of each of the five levels of <i>ecology</i>: <ul style="list-style-type: none"> • organism • <i>population</i> • <i>community</i> • <i>ecosystem</i> • <i>biosphere</i>
	9. Students shall demonstrate an understanding of the ecological impact of global issues.	<ol style="list-style-type: none"> 1. Analyze the effects of human population growth and technology on the <i>environment/biosphere</i>. 2. Evaluate long range plans concerning resource use and by-product disposal in terms of their environmental, economic, and political impact. 3. Assess current world issues applying scientific themes (e.g., global changes in climate, <i>epidemics</i>, <i>pandemics</i>, ozone depletion, UV radiation, natural resources, use of <i>technology</i>, and public policy).

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2014 Mid-Year and Spring End-of-Course Biology Examinations.

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
5. NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing.	<ol style="list-style-type: none"> 1. Explain why science is limited to natural explanations of how the world works. 2. Compare and contrast <i>hypotheses</i>, <i>theories</i>, and <i>laws</i>. 3. Distinguish between a scientific <i>theory</i> and the term “<i>theory</i>” used in general conversation. 4. Summarize the guidelines of science: <ul style="list-style-type: none"> • <i>explanations</i> are based on observations, evidence, and testing • <i>hypotheses</i> must be testable • understandings and/or conclusions may change with additional empirical data • scientific knowledge must have peer review and verification before acceptance
	11. Students shall design and safely conduct a scientific inquiry.	<ol style="list-style-type: none"> 3. Identify sources of bias that could affect experimental outcome. 4. Gather and analyze data using appropriate summary statistics. 5. Formulate valid conclusions without bias. 6. Communicate experimental results using appropriate reports, figures, and tables.
	12. Students shall demonstrate an understanding of current life science theories.	<ol style="list-style-type: none"> 1. Recognize that theories are scientific explanations that require empirical data, verification, and peer review. 4. Relate the development of the <i>cell theory</i> to current trends in cellular biology. 5. Describe the relationship between the <i>germ theory of disease</i> and our current knowledge of immunology and control of infectious diseases. 6. Relate the <i>chromosome theory of heredity</i> to recent findings in genetic research (e.g., <i>Human Genome Project-HGP</i>, <i>chromosome therapy</i>). 7. Research current events and topics in biology.
	13. Students shall use mathematics, science equipment, and <i>technology</i> as tools to communicate and solve life science problems.	<ol style="list-style-type: none"> 1. Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables. 3. Utilize <i>technology</i> to communicate research findings.
	14. Students shall describe the connections between <i>pure</i> and <i>applied science</i> .	<ol style="list-style-type: none"> 2. Discuss why scientists should work within ethical parameters. 3. Evaluate long-range plans concerning resource use and by-product disposal for environmental, economic, and political impact.

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2014 Mid-Year and Spring End-of-Course Biology Examinations.

PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

Mid-Year Released Biology Items*

Strands	Content Standards
1— MOLECULES AND CELLS (MC)	1. Students shall demonstrate an understanding of the role of chemistry in life processes. 2. Students shall demonstrate an understanding of the structure and function of cells. 3. Students shall demonstrate an understanding of how cells obtain and use energy (<i>energetics</i>).
2— HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of <i>heredity</i> . 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the theory of biological evolution.
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing. 11. Students shall design and safely conduct a scientific inquiry. 12. Students shall demonstrate an understanding of current life science theories. 13. Students shall use mathematics, science equipment, and <i>technology</i> as tools to communicate and solve life science problems. 14. Students shall describe the connections between pure and applied science.

Item	Strand	Content Standard	Student Learning Expectation
1	CDL	7	4
2	NS	10	1
3	MC	2	4
4	MC	2	10
5	MC	2	2
6	HE	6	2
7	HE	5	5
8	HE	6	1
9	CDL	7	11
10	CDL	7	22
11	HE	6	5
12	CDL	7	18
13	CDL	7	16
14	EBR	8	5
15	EBR	8	4
16	EBR	8	1
17	NS	13	1
18	EBR	9	3
19	NS	11	6
20	MC	1	4
21	MC	2	6
22	CDL	7	14
23	MC	3	1
24	HE	4	6
25	HE	5	1
26	EBR	8	8
27	NS	10	2
28	NS	12	4
29	EBR	9	1
30	NS	14	2
A	HE	4	3
B	MC	1	3

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Biology items.

PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

Spring Released Biology Items*

Strands	Content Standards
1— MOLECULES AND CELLS (MC)	1. Students shall demonstrate an understanding of the role of chemistry in life processes. 2. Students shall demonstrate an understanding of the structure and function of cells. 3. Students shall demonstrate an understanding of how cells obtain and use energy (<i>energetics</i>).
2— HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of <i>heredity</i> . 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the <i>theory of biological evolution</i> .
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing. 11. Students shall design and safely conduct a scientific inquiry to solve valid problems. 12. Students shall demonstrate an understanding of current life science theories.

Item	Strand	Content Standard	Student Learning Expectation
1	MC	2	11
2	NS	11	4
3	CDL	7	17
4	NS	11	5
5	EBR	8	4
6	NS	10	3
7	NS	11	3
8	HE	4	4
9	MC	1	2
10	CDL	7	15
11	EBR	8	3
12	EBR	9	2
13	NS	11	4
14	MC	2	3
15	CDL	7	9
16	HE	5	6
17	EBR	8	5
18	MC	3	2
19	HE	4	1
20	EBR	8	6
21	CDL	7	19
22	HE	5	3
23	CDL	7	12
24	NS	12	7
25	EBR	8	7
26	MC	2	5
27	HE	6	3
28	MC	2	9
29	HE	6	7
30	CDL	7	1
31	EBR	8	5
32	CDL	7	7
33	NS	10	4

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Biology items.

PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

Mid-Year Non-Released Biology Items*

Strands	Content Standards
1— MOLECULES AND CELLS (MC)	<ol style="list-style-type: none"> Students shall demonstrate an understanding of the role of chemistry in life processes. Students shall demonstrate an understanding of the structure and function of cells. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
2— HEREDITY AND EVOLUTION (HE)	<ol style="list-style-type: none"> Students shall demonstrate an understanding of heredity. Students shall investigate the molecular basis of genetics. Students shall examine the development of the theory of biological evolution.
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	<ol style="list-style-type: none"> Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	<ol style="list-style-type: none"> Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	<ol style="list-style-type: none"> Students shall demonstrate an understanding that science is a way of knowing. Students shall design and safely conduct a scientific inquiry. Students shall demonstrate an understanding of current life science theories. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems. Students shall describe the connections between pure and applied science.

Strand	Content Standard	Student Learning Expectation
MC	1	2
HE	6	3
MC	3	5
MC	2	11
CDL	7	17
HE	4	3
CDL	7	7
EBR	8	3
EBR	8	5
NS	11	3
NS	13	3
EBR	8	4
NS	14	3
HE	6	6
MC	2	9
EBR	9	2
HE	4	1
CDL	7	19
CDL	7	20
CDL	7	8
HE	5	6
EBR	8	6
CDL	7	15
NS	10	3
EBR	8	2
NS	12	1
EBR	8	7
NS	12	7
NS	11	4
MC	2	5
MC	2	8
HE	5	3
CDL	7	7

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Biology items.

PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

Spring Non-Released Biology Items*

Strands	Content Standards
1— MOLECULES AND CELLS (MC)	2. Students shall demonstrate an understanding of the structure and function of cells. 3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
2— HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of heredity. 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the theory of biological evolution.
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing. 12. Students shall demonstrate an understanding of current life science theories. 14. Students shall describe the connections between pure and applied science.

Strand	Content Standard	Student Learning Expectation
CDL	7	7
NS	12	1
MC	3	5
HE	4	3
EBR	8	1
HE	4	6
CDL	7	16
CDL	7	20
EBR	8	2
NS	14	3
MC	2	1
CDL	7	21
EBR	8	1
HE	4	2
EBR	9	3
CDL	7	8
MC	3	1
EBR	9	1
NS	14	2
EBR	8	8
HE	5	4
MC	2	6
MC	2	8
NS	10	2
CDL	7	18
NS	12	6
HE	4	5
MC	3	3
NS	12	5
HE	6	1
HE	4	3
MC	2	2

*Only the predominant Strand, Content Standard, and Student Learning Expectation are listed for the Biology items.

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