



Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Biology End-of-Course Examination

April 2008 Administration

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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 who had completed or were completing Biology by the end of the spring semester participated in the *Biology End-of-Course Examination* in April 2008.

This Released Item Booklet for the *Biology End-of-Course Examination* contains test questions or items that were asked of students during the April 2008 operational administration. The test items included in Part II of this booklet are those items that contributed to the student performance results for that administration.

Students were given approximately two hours each day to complete assigned test sessions during the two days of testing in April 2008. All of the multiple-choice items within this booklet have the correct response marked with an asterisk (*). The open-response questions are listed with scoring guides (rubrics) immediately following. These rubrics provide information on the scoring model used for Biology.

The development of the *Biology End-of-Course Examination* 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, in many cases 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 Examination* 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 the *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.

The Arkansas Biology Rangefinding 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 pre-scored 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 pre-scored papers, and, in order to qualify, each reader must score in exact agreement on at least 80% of the responses and have no more than 5% non-adjacent agreement on 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.

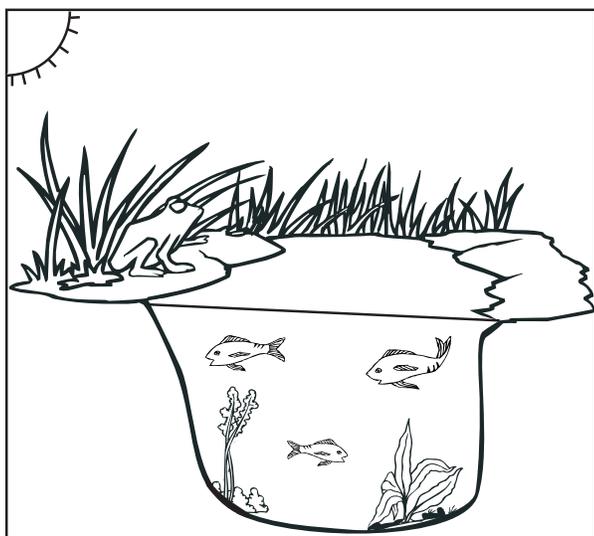
Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and Scoring Directors or Team Leaders reread selected responses scored by the 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 Released Biology Items

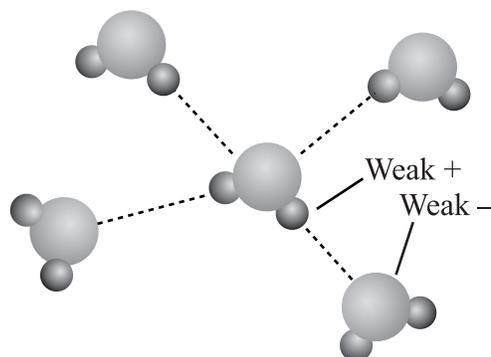
1. The presence of vertebrae is found in which kingdom?
 - A. Plantae
 - B. Protista
 - C. Archaea
 - * D. Animalia
2. An example of a biotic factor in the ecosystem shown below is



- A. the Sun.
 - B. the soil.
 - C. the water.
 - * D. the plants.
3. Gregor Mendel's work with garden peas led him to a crucial understanding of inheritance. Before Mendel started his experiments, he had to ensure the plants were
 - A. hybrids.
 - B. asexual.
 - * C. purebred.
 - D. cross-pollinated.

4. Which property of water is shown below?

Attraction between Water Molecules



- A. pH
 - * B. polarity
 - C. adhesion
 - D. solubility
5. The relationship between a tick and the dog it is biting is called
 - A. predation.
 - * B. parasitism.
 - C. mutualism.
 - D. commensalism.
 6. Relative dating of fossils is **different** from radioactive dating of fossils because relative dating
 - A. requires the use of modern technology.
 - B. can provide a rough estimation of the age of a fossil.
 - C. measures changes in fossils according to decaying isotopes.
 - * D. requires observing the location in which the fossil was found.

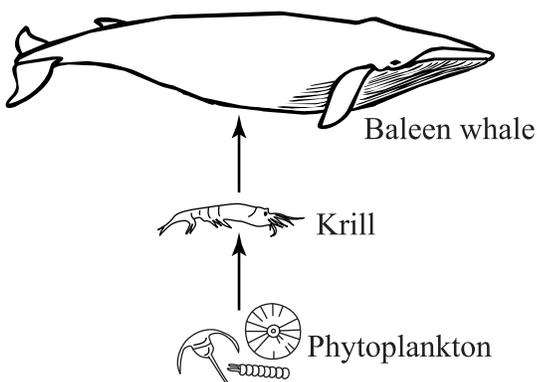
PART II Released Biology Items

7. Theory A is a well-established scientific theory. One hypothesis that could refute this theory is successfully tested over many experiments. What action must be taken for this hypothesis to pose a legitimate challenge to Theory A?
- A. collecting empirical data
 - * B. publishing data for peer review
 - C. forming a question for an investigation
 - D. turning the hypothesis into scientific law

8. As compared to bacteria and eukaryotes, species of archaea are considered to be the **most**

- * A. ancient.
- B. massive.
- C. complex.
- D. common.

9. Which organism in the aquatic food web below gets energy directly from the Sun?



- A. krill
- B. baleen whale
- * C. phytoplankton
- D. both krill and the baleen whale

10. Through his experiments with pea plants, Gregor Mendel concluded that inheritance of traits is determined by
- A. the presence of bees in the environment.
 - B. a factor that is passed down from just one parent.
 - C. the environmental conditions on the day of mating.
 - * D. a pair of factors, one passed down from each parent.

11. Which is the **correct** hierarchy of life from simple to complex?

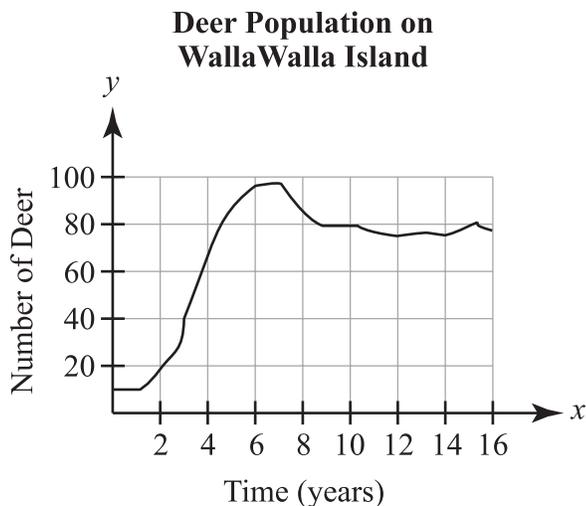
- * A. cell → tissue → organ → organ system → organism
- B. DNA → cell → organ → organ system → organism
- C. organism → organ system → organ → tissue → cell
- D. bacteria → cell → tissue → organ → organ system

12. A student came to class wanting to know if material from outer space was responsible for putting organisms on Earth. The teacher explained that this was **not** a scientific question because

- A. it was not true.
- * B. it could not be tested.
- C. it was the best explanation.
- D. it had already been proven to be wrong.

PART II Released Biology Items

13. Yeast, a common fungus, is economically important to the beverage industry because when placed in grape juice, it
- A. releases sugars that react with alcohol in the juice.
 - B. acts as an enzyme to break down juice into alcohol.
 - * C. ferments carbohydrates in the juice and releases alcohol.
 - D. produces starch that bonds with juice sugars to form alcohol.
14. Based on the graph below, what is the **best** explanation for the change in the deer population between years 2 and 6?



- * A. There was limited predation of the deer.
- B. Some deer left the area due to overcrowding.
- C. The competition within the population for the resources increased.
- D. The number of births equaled the number of deaths in the population.

15. A couple has two children, one with brown hair and blue eyes and one with brown hair and brown eyes. The fact that the children can have the same hair color but **different** eye color is explained by the
- A. law of segregation.
 - B. principle of probability.
 - C. principle of dominance.
 - * D. law of independent assortment.
16. What is the **primary** difference between diffusion and osmosis?
- A. Diffusion requires energy input but osmosis does not.
 - B. Diffusion does not require energy input but osmosis does.
 - C. Diffusion is the movement of water from high to low concentration, while osmosis is the movement of any substance from high to low concentration.
 - * D. Diffusion is the movement of any substance from high to low concentration, while osmosis is the movement of water from high to low concentration.
17. What aspect of the structure of viruses is similar to all living things?
- A. microscopic size
 - B. absence of nuclei
 - * C. presence of nucleic acid
 - D. requirement of a host cell or body

PART II Released Biology Items

18. A company that produces pesticides conducts an experiment to test the effectiveness of their newest product. The scientist involved in the development of the pesticide is the one who will interpret the results. Why is this a problem?
- A. The pesticide could be made better during the process.
 - B. The results could be shared with a competing company.
 - C. The scientist will not know how to make accurate observations.
 - * D. The scientist may misinterpret the results because he knows what should happen.
19. When an animal has to survive without food for a long time, it will eventually break down proteins for energy. However, this process occurs only after exhausting the animal's reserves of
- A. DNA and RNA.
 - * B. carbohydrates and lipids.
 - C. carbon dioxide and water.
 - D. enzymes and nucleic acids.
20. A hypothesis and a theory are related because
- A. a theory is always used to develop a hypothesis.
 - B. they are both developed in the absence of observations.
 - * C. the data collected when a hypothesis is tested can support a theory.
 - D. an experiment is done before the formation of both a hypothesis and a theory.
21. When referring to any taxonomically classified organism, scientists use only those categories that differentiate an organism from any other, such as *Ursus horribilis* (grizzly bear). Thus, scientists refer to an organism by its
- A. order and family.
 - B. family and genus.
 - C. species and order.
 - * D. genus and species.
22. A scientist is examining what happens to rodents and grasses when more hawks are allowed to hunt rodents in a field. What level of ecology is he observing?
- A. an organism
 - B. a population
 - * C. a community
 - D. an ecosystem
23. Complex molecules are broken down during cellular respiration and converted into smaller molecules containing energy. What are these complex molecules called?
- A. proteins
 - B. enzymes
 - C. nucleic acids
 - * D. carbohydrates

PART II Released Biology Items

24. A bacterium called *Rickettsia* lives only in living animal cells and causes diseases such as Rocky Mountain spotted fever. *Rickettsia* can be classified as

- * A. a parasite.
- B. a eukaryote.
- C. an autotroph.
- D. a decomposer.

25. What always occurs when converting wildlife habitats into farmland?

- A. spread of bacterial disease
- * B. reduction of ecosystem biodiversity
- C. increase in the populations of predators
- D. growth of insect resistance to pesticides

26. Which mode of inheritance explains why a mother with a particular recessive trait will **always** pass it on to her son?

- * A. sex-linkage
- B. codominance
- C. multiple alleles
- D. incomplete dominance

27. A person sweating on a hot day would **most** likely be an example of what biological process?

- A. digestion
- B. respiration
- * C. homeostasis
- D. gametogenesis

28. How do the functions of DNA and RNA differ?

- A. DNA directs protein transport, while RNA aids in energy production.
- B. DNA aids in energy production, while RNA directs protein transport.
- * C. DNA stores genetic information, while RNA relays genetic information for protein synthesis.
- D. DNA relays genetic information for protein synthesis, while RNA stores genetic information.

29. The data in the table below were collected for three plants that were fertilized at the beginning of an experiment.

Height of Fertilized Plants

Day	Height (cm)		
	Plant 1	Plant 2	Plant 3
1	10	12	10
5	20	20	15
9	29	33	31
13	39	41	41

What was the total growth of Plant 2 over the 13-day experiment?

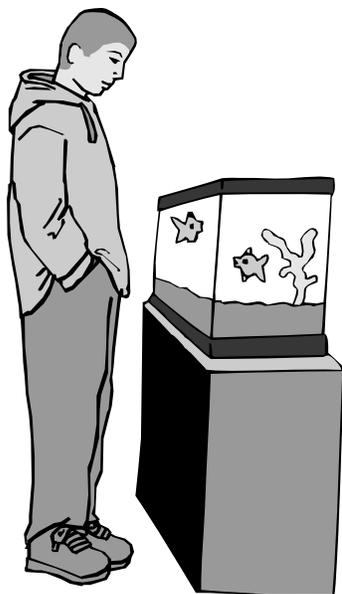
- A. 26 cm
- B. 27 cm
- * C. 29 cm
- D. 41 cm

PART II Released Biology Items

30. A biology class conducted an experiment using five plants. The first plant received only water. The remaining plants received varying amounts of a liquid fertilizer added to their water. The class wanted to know which plant would show the greatest amount of growth. What is the control in this experiment?

- A. using two plants
- * B. giving one plant water
- C. measuring plant growth
- D. giving one plant water with fertilizer

31. The student below is concerned with the survival of the plant in his aquarium.



Which level of ecology is his focus?

- * A. an organism
- B. a population
- C. a community
- D. an ecosystem

32. Which field of biology has the fewest educational requirements?

- * A. lab technician
- B. college professor
- C. genetics researcher
- D. biomedical engineer

33. In plants, stomata are tiny pores through which evaporated water escapes. To which plant tissue do stomata directly relate?

- A. vascular
- B. structural
- * C. epidermal
- D. reproductive

34. One way that pesticides have had a negative effect on ecosystems is by

- * A. building up toxins in animals that consume plants sprayed with pesticides.
- B. making plants that have been sprayed with pesticides unable to fix nitrogen in soil.
- C. preventing runoff from fields sprayed with pesticides from entering lakes and streams.
- D. allowing plants that have been sprayed with pesticides to build up resistance to the pesticides.

PART II Released Biology Items

35. The table below shows several periods in Earth's history.

Event	Estimated Time of Occurrence
earliest evidence of life	3.5 billion years ago
Paleozoic era begins	545.0 million years ago
first land plants	400.0 million years ago
Triassic period begins	248.0 million years ago
Mesozoic era begins	245.0 million years ago
first mammals and dinosaurs	225.0 million years ago
Jurassic period begins	208.0 million years ago
first birds	150.0 million years ago
Cretaceous period begins	144.0 million years ago
dinosaurs become extinct	65.0 million years ago
Cenozoic era begins	65.0 million years ago
primates appear	60.0 million years ago
humans appear	200.0 thousand years ago

At what point did a catastrophic environmental change **most** likely take place across the planet?

- * A. 65 million years ago
- B. 144 million years ago
- C. 225 million years ago
- D. 400 million years ago

36. Which lists the mitosis phases in the **correct** order?

- * A. prophase, metaphase, anaphase, telophase
- B. prophase, anaphase, metaphase, telophase
- C. telophase, metaphase, anaphase, prophase
- D. telophase, anaphase, metaphase, prophase

37. A certain microscopic single-celled organism is important to the dairy industry because when placed in milk, it consumes sugars in the milk and releases substances that react with the milk, adding flavor and thickening it. What kind of organism is this?

- A. virus
- B. fungus
- C. archaea
- * D. bacteria

PART II Released Biology Items

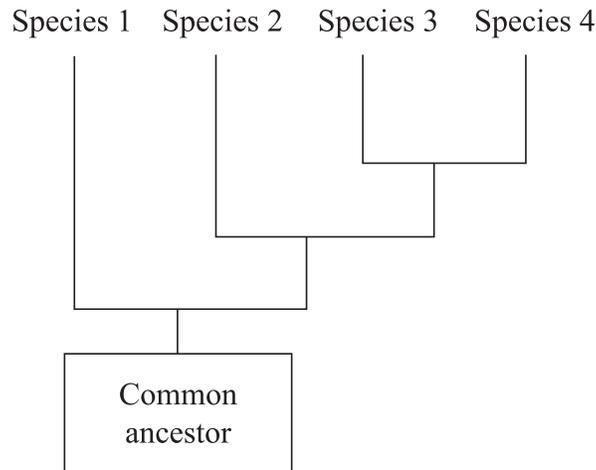
38. In pea plants, a smooth pea is dominant to a wrinkled pea. What is the genotypic ratio from a cross between a plant that has homozygous smooth-skin peas and a plant with wrinkled-skin peas?
- A. 4 RR : 0 Rr : 0 rr
 - * B. 0 RR : 4 Rr : 0 rr
 - C. 0 RR : 0 Rr : 4 rr
 - D. 1 RR : 2 Rr : 1 rr
39. A person fills a drinking glass with water until the water is bulging slightly over the glass rim. The property of water that prevents the water from spilling is
- A. pH.
 - B. osmosis.
 - * C. cohesion.
 - D. solubility.
40. One issue caused by ozone depletion is increased
- A. acid rain.
 - * B. skin cancer cases.
 - C. fossil fuel emissions.
 - D. number of infectious diseases.
41. Which are components of DNA and RNA?
- A. sugar, sulfate, and amino acid
 - B. sugar, sulfate, and nucleic acid
 - C. sugar, phosphate, and amino acid
 - * D. sugar, phosphate, and nitrogenous base
42. Ultrasound sonograms are used to provide images of unborn babies rather than x-ray photographs, because sonograms
- A. provide clearer skeletal images.
 - B. have the ability to record sound.
 - C. require much simpler technology.
 - * D. do not produce harmful radiation.
43. A certain kind of protist can digest wood. It lives in the intestines of insects that fly and reproduce rapidly. This can cause problems for the
- A. oil industry.
 - B. coal industry.
 - * C. construction industry.
 - D. transportation industry.
44. What is the difference in structure between RNA and DNA?
- A. RNA is double stranded while DNA is single stranded.
 - * B. RNA is single stranded while DNA is double stranded.
 - C. RNA has a 6-carbon sugar while DNA has a 5-carbon sugar.
 - D. RNA has a 5-carbon sugar while DNA has a 6-carbon sugar.

PART II Released Biology Items

45. Scientists originally classified certain kinds of fungi, such as mushrooms, into the plant kingdom. This was discovered to be a mistake because fungi
- * A. cannot make their own food.
 - B. do not contain nuclei in their cells.
 - C. are not considered to be living organisms.
 - D. do not survive in areas receiving much sunlight.
46. A civic leader wishes to limit the amount of pollution that is carried along runoff into rivers and streams. One plan that can help accomplish this is to limit the
- * A. use of fertilizers on farms.
 - B. use of nitrogen-fixing crops on farms.
 - C. amount of CO₂ entering the atmosphere.
 - D. amount of CFCs entering the atmosphere.
47. Why do leaves tend to be flat?
- A. so that water can easily be absorbed and carried to the rest of the plant
 - * B. so that sunlight can easily penetrate to the leaf's photosynthetic tissues
 - C. so that nutrients can easily enter the plant and be used for structure and support
 - D. so that plants can easily find balance due to the symmetrical nature of their branches
48. What question did both Lamarck and Darwin try to answer with their theories of evolution?
- A. What is the role of DNA in the inheritance of traits?
 - * B. What causes populations of organisms to change over time?
 - C. What are the patterns of heredity in sexually reproducing organisms?
 - D. What happens to beneficial traits when populations undergo natural selection?
49. What do glycolysis, the citric acid cycle, and the electron transport chain have in common?
- * A. the production of ATP
 - B. the process of trapping solar energy
 - C. the occurrence of each within mitochondria
 - D. the process of breaking down sugar molecules
50. Geneticists have learned that segments of a cell's DNA can be removed and replaced with different segments of DNA. What development can arise as a result of this knowledge?
- A. animals that can inherit acquired traits
 - * B. crops that have more desirable genetic traits
 - C. crops that can avoid passing genetic traits to offspring
 - D. animals that can convert acquired traits into genetic ones

PART II Released Biology Items

51. Based on the cladogram below, which statement must be true?



- A. Species 1 and 2 cannot have traits in common with Species 3 and 4.
- B. Species 3 and 4 are found in different ecosystems than Species 1 and 2.
- * C. Species 3 is more genetically similar to Species 4 than to the other species.
- D. Species 1 has a less direct relationship to the common ancestor than the other species.

52. What is formed during photosynthesis and broken down during cellular respiration?

- A. water
- * B. glucose
- C. lactic acid
- D. carbon dioxide

53. Some animals use large amounts of energy while performing normal activities. What organelles do these animals **most** likely have large numbers of in their muscle cells?

- A. nuclei
- B. chloroplasts
- C. Golgi bodies
- * D. mitochondria

54. An archeological dig site is **most** likely the working environment of which kind of biologist?

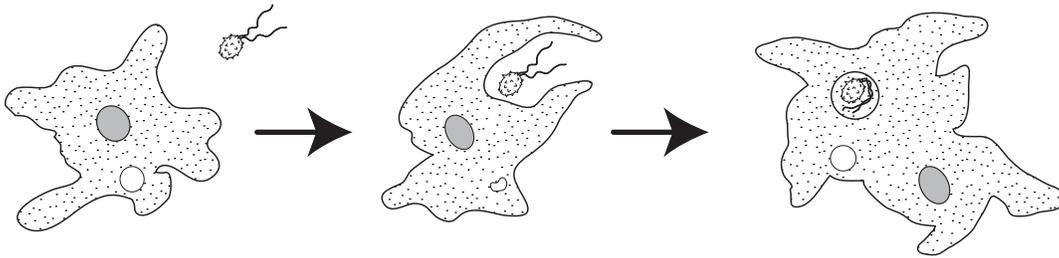
- A. ecologist
- B. geneticist
- * C. paleontologist
- D. molecular biologist

55. What technology provides the **best** way to show the appearance of viruses?

- A. radio telescope
- B. x-ray photography
- C. ultrasound imaging
- * D. electron microscope

PART II Released Biology Items

56. A protist eating food is shown below.



This protist can be described as acting like

- A. a virus.
- B. a plant.
- C. a fungus.
- * D. an animal.

57. Biologists have the technology to convert a tiny amount of DNA, such as that found in ancient fossils, into a large amount of DNA, which is more easily studied. What scientific discovery has resulted from this technology?

- A. the social interactions between many ancient species
- B. the traits that many ancient species learned and acquired
- * C. the evolutionary relationships between many ancient species
- D. the environmental factors that caused many ancient species to evolve

58. Which two transport mechanisms are considered to be passive?

- * A. diffusion and osmosis
- B. diffusion and exocytosis
- C. endocytosis and osmosis
- D. exocytosis and endocytosis

59. There is a current controversy involving whether the United States government should drill for oil on a national wildlife refuge in Alaska. The opposing sides of this controversy can be described as

- A. fossil-fuel power versus nuclear power.
- * B. economic benefit versus ecological benefit.
- C. renewable-resource use versus nonrenewable-resource use.
- D. cheap, but weak, energy source versus expensive, but powerful, energy source.

60. The higher the animal in a food chain for a particular ecosystem, the greater the concentrations of toxins found in the animal's body. This is often the result of

- * A. pesticide use.
- B. nitrogen fixing.
- C. nuclear radiation.
- D. shrinking of habitat.

PART II Released Biology Items

BIOLOGY OPEN-RESPONSE ITEM A

A. The four main parts of a flowering plant are given below.

- roots
- stem
- leaves
- flowers

Select two parts from the list. Identify and explain a reason why each is crucial for the survival of the plant.

RUBRIC FOR BIOLOGY OPEN-RESPONSE ITEM A

SCORE	DESCRIPTION
4	The student earns 4 points. The response contains no incorrect statements.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank – No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” assigned for the item.)

PART II Released Biology Items

Solution and Scoring

Part	Points
	<p>The student may answer any two of the following four parts. <u>No credit is given for a statement including the term “survival/survive,” as it is included in the prompt, or for indicating that “it won’t die/so it will live,” paraphrasing survival.</u></p>
1	<p>2 points possible</p> <p>2 points: Correct and complete answer: Roots take in water and/or nutrients needed for (the student must list at least one of the following): photosynthesis, making food, daily activities, or growth of the plant. Or The student must list at least one of the following: roots lock plants in place, or anchor plants in the ground to keep them in the best spot to take in water and/or nutrients. Or Roots store food for future use. Or Roots take in water to prevent dehydration.</p> <p>Or</p> <p>1 point: Incomplete answer: Roots take in water and/or nutrients. Or Roots keep plants anchored or in one spot. Or Roots store food.</p>
2	<p>2 points possible</p> <p>2 points: Correct and complete answer: Stems transport (the student must list at least one of the following): water, nutrients, or materials from the roots to the leaves for photosynthesis. Or Stems hold the leaves up toward the sun so they can absorb sunlight and/or energy. Or Stems contain (the student must list at least one of the following): xylem, phloem that transports water, sugar (food), or materials. Or Stems provide support for the plant to hold it upright.</p> <p>Or</p> <p>1 point: Incomplete answer: Stems transport (the student must list at least one of the following): water, nutrients, sugar, or food. Or The student must list at least one of the following: stems hold up the plant, or stems provide support. Or The student must list at least one of the following: stems contain xylem, or stems contain phloem. Or Stems store water.</p>

PART II Released Biology Items

Solution and Scoring (continued)

Part	Points
3	<p>2 points possible</p> <p>2 points: Correct and complete answer: Photosynthesis takes place in leaves to make food for the plant. Or Leaves absorb sunlight for photosynthesis to take place. Or Leaves give off water vapor during transpiration. Or Leaves take in CO₂ for photosynthesis.</p> <p>Or</p> <p>1 point: Incomplete answer: Leaves absorb sunlight and/or energy. Or Leaves make food. Or Leaves take in CO₂. Or Leaves give off water vapor. Or Leaves contain chloroplasts.</p>
4	<p>2 points possible</p> <p>2 points: Correct and complete answer: Flowers attract pollinators, which help with pollination. Or Flowers contain sexual organs which are needed for reproduction. Or Seeds are produced in flowers to make more plants. Or Flowers are pollinated and reproduce.</p> <p>Or</p> <p>1 point: Incomplete answer: Flowers make pollen. Or Flowers make seeds. Or Flowers are for reproduction.</p>

PART II Released Biology Items

BIOLOGY OPEN-RESPONSE ITEM B

- B.** In the 1980s, it was discovered that chlorofluorocarbons (CFCs), chemicals released from aerosol cans, reduce the amount of ozone gas in the upper atmosphere. Ozone is a greenhouse gas, and since the reduction of CFC emissions during the 1990s, ozone has increased dramatically in the atmosphere.
1. Identify and explain a positive aspect of the policy to limit CFC emissions.
 2. Identify and explain a negative aspect of the policy to limit CFC emissions.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

RUBRIC FOR BIOLOGY OPEN-RESPONSE ITEM B

SCORE	DESCRIPTION
4	The student earns 4 points. The response contains no incorrect statements.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank – No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” assigned for the item.)

PART II Released Biology Items

BIOLOGY OPEN-RESPONSE ITEM C

- C. A mammal that lived 70,000 years ago is found frozen in ice and is very well preserved. Scientists note that it is very similar to a mammal species that is alive today.
1. Identify and explain one easily observable, nonmicroscopic characteristic of the frozen mammal that can help determine how much the modern mammal has evolved in 70,000 years.
 2. Identify one molecular characteristic of the frozen mammal that can help determine how much the modern mammal has evolved in 70,000 years, and explain how this characteristic could be more important than the nonmicroscopic ones.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

RUBRIC FOR BIOLOGY OPEN-RESPONSE ITEM C

SCORE	DESCRIPTION
4	The student earns 4 points. The response contains no incorrect statements.
3	The student earns 3–3 ½ points.
2	The student earns 2–2 ½ points.
1	The student earns ½–1 ½ point, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank – No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” assigned for the item.)

PART II Released Biology Items

Solution and Scoring

Part	Points
1	<p>2 points possible</p> <p>1 point: Correct answer: The physical appearance has the same (the student must list at least one of the following): structure, body shape, tusks, claws, teeth, fur, skin, skeletal structure, bones, or organ systems.</p> <p>And</p> <p>1 point: Correct explanation: The closer the physical features are, the less evolution that has taken place. Or The greater the difference in the physical features, the more evolution that has taken place. Or Related animals have similar characteristics. Or Physical appearance shows how much mammals have changed and/or shows how much their structure has changed. Or The student compares the structures of old and new by citing example(s).</p> <p>Or</p> <p>½ point: Incomplete explanation: Shows how it functions. Or It looks similar. Or See some differences. Or Traits are the same. Or Shows they are related. Or Implies animal has changed.</p>

PART II Released Biology Items

Solution and Scoring (continued)

Part	Points
2	<p>2 points possible</p> <p>1 point: Correct answer: The student must list at least one of the following: DNA, genes, proteins, chromosomes, its genome, amino acid sequences, or allele frequency change.</p> <p>Or</p> <p>½ point: Incomplete answer: They contain the same kinds of molecules.</p> <p>And</p> <p>1 point: Correct explanation: Molecular characteristics show (the student must list at least one of the following): genetic makeup, genetic separation, molecular differences, differences in genome, and/or traits that have been passed on. Or The molecular characteristic is evidence of genotype. Or The molecular characteristic compares genetic structure. Or The molecular characteristic is a blue print of the body. Or The molecular characteristic determines characteristics, traits, and/or qualities.</p> <p>Or</p> <p>½ point: Incomplete explanation: The molecular characteristic is a better indicator of evolution. Or The molecular characteristic proves a relation. Or The molecular characteristic makes a bigger difference. Or The molecular characteristic tells you better. Or The molecular characteristic gives you all sorts of information. Or The molecular characteristic shows how similar they really are. Or The molecular characteristic is the best way. Or The molecular characteristic tells everything. Or The molecular characteristic is more accurate.</p>

PART II Released Biology Items

BIOLOGY OPEN-RESPONSE ITEM D

D. Active and passive transport are very important to cell homeostasis.

1. Identify one type of passive transport and explain in detail how it occurs.
2. Identify one type of active transport and explain in detail how it occurs.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

RUBRIC FOR BIOLOGY OPEN-RESPONSE ITEM D

SCORE	DESCRIPTION
4	The student earns 4 points. The response contains no incorrect statements.
3	The student earns 3–3 ½ points.
2	The student earns 2–2 ½ points.
1	The student earns ½–1 ½ point, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank – No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” assigned for the item.)

PART II Released Biology Items

Solution and Scoring

Part	Points
1	<p>2 points possible</p> <p>1 point: Correct answer: Diffusion or facilitated diffusion.</p> <p>And</p> <p>1 point: Correct and complete explanation: Substances moving from areas of higher concentration to areas of lower concentration. Or Substances moving with no input of energy needed.</p> <p>Or</p> <p>1 point: Correct and complete explanation with no type of passive transport identified: Substances moving from areas of higher concentration to areas of lower concentration. And Substances moving with no input of energy needed.</p> <p>Or</p> <p>½ point: Incomplete explanation with no type of passive transport identified: Substances moving from areas of higher concentration to areas of lower concentration. Or Substances moving with no input of energy needed.</p> <p>Or</p> <p>1 point: Correct answer: Osmosis</p> <p>And</p> <p>1 point: Correct and complete explanation: Water moves through a selectively permeable membrane (cell membrane) from higher to lower concentration. Or Water moves through a selectively permeable membrane (cell membrane) with no input of energy needed.</p> <p>Or</p> <p>1 point: Correct and complete explanation with no type of passive transport identified: Water moves through a selectively permeable membrane (cell membrane) from areas of higher concentration to areas of lower concentration, and water moves with no input of energy needed.</p> <p>Or</p> <p>½ point: Incomplete explanation with no type of passive transport identified: Water moves through a selectively permeable membrane (cell membrane). Or Water moves from areas of higher concentration to areas of lower concentration. Or Water moving with no input energy needed.</p>

PART II Released Biology Items

Solution and Scoring (continued)

Part	Points
2	<p>2 points possible</p> <p>1 point: Correct answer: The student must list one of the following: Endocytosis, Exocytosis, Phagocytosis, Pinocytosis, Ion Pump/Ion Transporter (or gives an example of an ion pump), or Carrier Protein.</p> <p>And</p> <p>1 point: Correct and complete explanation: <u>Endocytosis</u> – cell membrane forms a pocket around the substance it wants to take in, pinches off to form a vesicle within the cell, or (engulfs/surrounds it) with an input of energy needed to take place. Or <u>Exocytosis</u> – cell membrane forms a pocket around substance to be released from the cell, pinches off to form a vesicle on the outside of a cell (or forms a contractile vacuole) with an input of energy needed to take place. Or <u>Phagocytosis</u> – cell membrane forms a pocket around food particles it wants to take in, pinches off to form a vesicle within the cell (or engulfs/surrounds it) with an input of energy needed to take place. Or <u>Pinocytosis</u> – cell membrane forms a pocket around water it wants to take in, pinches off to form a vesicle within the cell, (or engulfs/surrounds it) with an input of energy needed to take place. Or <u>Ion pump/Ion transporter (or an example of an ion pump), carrier protein, or protein pump</u> – (the student must list two of the following three facts): protein that moves ions across cell membrane, protein that moves against their concentration gradient, or protein that moves with an input of energy needed to take place.</p> <p>Or</p> <p>½ point: Incomplete explanation: Student notes only one fact for any one type of active transport. Ex: The student lists one of the following: engulfs particle, uses energy, protein that moves ions, cell eating (for phagocytosis), or cell drinking (for pinocytosis)</p>

PART II Released Biology Items

BIOLOGY OPEN-RESPONSE ITEM E

- E. The modern evolution theory includes three concepts: natural selection, environment pressure, and DNA mutation.

Select two of these three concepts. Identify and explain why each supports the theory of evolution.

RUBRIC FOR BIOLOGY OPEN-RESPONSE ITEM E

SCORE	DESCRIPTION
4	The student earns 4 points. The response contains no incorrect statements.
3	The student earns 3 points.
2	The student earns 2 points.
1	The student earns 1 point, or some minimal understanding is shown.
0	The student earns 0 points. No understanding is shown.
B	Blank – No Response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” assigned for the item.)

PART II Released Biology Items

Solution and Scoring

Part	Points
	The student may answer any two of the following three parts
1	<p>2 points possible</p> <p>2 points: Correct answer for Natural Selection: Those with traits best suited for survival will pass the traits to their young, and the population will change over time. Or The strongest survive to have young, and the species will change over time.</p> <p>Or</p> <p>1 point: Incomplete answer for Natural Selection: Those with the best traits survive and pass traits on to their young. Or Good traits are passed on. Or Only the strong survive and/or breed.</p>
2	<p>2 points possible</p> <p>2 points: Correct answer for Environmental Pressure: Environmental pressure makes some traits beneficial, and those traits are passed on to the young more often, changing the species over time.</p> <p>Or</p> <p>1 point: Incomplete answer for Environmental Pressure: Environmental pressure makes some traits beneficial and/or some traits are passed on Or Environmental pressure forces adaption or change</p>
3	<p>2 points possible</p> <p>2 points: Correct answer for DNA Mutation: DNA mutation introduces traits (DNA changes) which if beneficial, are spread over time and change a population. Or DNA mutation changes the genetic structure that changes the species over time.</p> <p>Or</p> <p>1 point: Incomplete answer for DNA Mutation: DNA mutation introduces new traits into a population. Or DNA mutation introduces traits which may be beneficial. Or DNA mutation helps a species respond to environmental pressure. Or DNA mutation changes things in an organism so it can survive. Or DNA mutation changes a trait. Or DNA mutation passes mutation on to offspring. Or DNA mutation causes DNA to change.</p>

PART III Curriculum Framework

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
1. MOLECULES AND CELLS (MC)	1. Students shall demonstrate an understanding of the role of chemistry in life processes.	1. Describe the structure and function of the major organic molecules found in living systems. <ul style="list-style-type: none"> • carbohydrates • proteins • enzymes • lipids • nucleic acids 3. Investigate the properties and importance of water and its significance for life. <ul style="list-style-type: none"> • surface tension • adhesion • cohesion • polarity • pH
	2. Students shall demonstrate an understanding of the structure and function of cells.	1. Construct a hierarchy of life from cells to ecosystems. 3. Describe the role of sub-cellular structures in the life of a cell. <ul style="list-style-type: none"> • organelles • ribosomes • cytoskeleton 7. Compare and contrast active transport and passive transport mechanisms. <ul style="list-style-type: none"> • diffusion • osmosis • endocytosis • exocytosis • phagocytosis • pinocytosis 9. List in order and describe the stages of mitosis. <ul style="list-style-type: none"> • prophase • metaphase • anaphase • telophase 11. Discuss homeostasis using thermoregulation as an example.
	3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).	2. Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP). <ul style="list-style-type: none"> • glycolysis • citric acid cycle • electron transport chain 5. Compare and contrast cellular respiration and photosynthesis as energy conversion pathways.
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 laws and principles of inheritance. <ul style="list-style-type: none"> • dominance • segregation • independent assortment 3. Use the laws of probability and Punnett squares to predict genotypic and phenotypic ratios. 4. Examine different modes of inheritance. <ul style="list-style-type: none"> • sex linkage • codominance • crossing over • incomplete dominance • multiple alleles
	5. Students shall investigate the molecular basis of genetics.	1. Model the components of a DNA nucleotide and an RNA nucleotide. 3. Compare and contrast the structure and function of DNA and RNA.

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the released test items in this document.

PART III Curriculum Framework

The Arkansas Biology Science Curriculum Framework* (continued)

Strands	Content Standards	Student Learning Expectations
2. HEREDITY AND EVOLUTION (HE)	6. Students shall examine the development of the theory of biological evolution.	<ol style="list-style-type: none"> 1. Compare and contrast Lamarck's explanation of evolution with Darwin's theory of evolution by natural selection. 4. Illustrate mass extinction events using a timeline. 5. Evaluate evolution in terms of evidence as found in the following. <ul style="list-style-type: none"> • fossil record • DNA analysis • artificial selection • morphology • embryology • viral evolution • geographic distribution of related species • antibiotic and pesticide resistance in various organisms 6. Compare the processes of relative dating and radioactive dating to determine the age of fossils. 7. Interpret a cladogram.
3. CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.	<ol style="list-style-type: none"> 1. Differentiate among the different domains. <ul style="list-style-type: none"> • Bacteria • Archaea • Eukarya 2. Differentiate the characteristics of the six kingdoms. <ul style="list-style-type: none"> • Eubacteria • Archaea • Protista • Fungi • Plantae • Animalia 3. Identify the seven major taxonomic categories. <ul style="list-style-type: none"> • kingdom • phylum • class • order • family • genus • species 6. Compare and contrast the structures and characteristics of viruses (lytic and lysogenic cycles) with nonliving and living things. 9. Classify bacteria according to their characteristics and adaptations. 10. Evaluate the medical and economic importance of bacteria. 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. 13. Compare and contrast fungi with other eukaryotic organisms. 14. Evaluate the medical and economic importance of fungi. 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

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the released test items in this document.

PART III Curriculum Framework

The Arkansas Biology Science Curriculum Framework* (continued)

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 ecosystems. 4. Analyze an ecosystem's energy flow through food chains, food webs, and energy pyramids. 5. Identify and predict the factors that control population, including predation, competition, 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"> • commensalism • parasitism • mutualism 8. Identify the properties of each of the five levels of ecology. <ul style="list-style-type: none"> • organism • population • community • ecosystem • biosphere
	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 environment/biosphere. 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, epidemics, pandemics, ozone depletion, UV radiation, natural resources, use of technology, and public policy).
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 hypotheses, theories, and laws.
	11. Students shall design and safely conduct a scientific inquiry.	<ol style="list-style-type: none"> 1. Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation. 3. Identify sources of bias that could affect experimental outcome. 4. Gather and analyze data using appropriate summary statistics.
	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. 3. Summarize biological evolution.
	13. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life-science problems.	<ol style="list-style-type: none"> 2. Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware). 3. Utilize technology to communicate research findings.
	14. Students shall describe the connections between pure and applied science.	<ol style="list-style-type: none"> 4. Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology.
	15. Students shall describe various life-science careers and the training required for the selected career.	<ol style="list-style-type: none"> 1. Research and evaluate science careers using the following criteria. <ul style="list-style-type: none"> • educational requirements • salary • availability of jobs • working conditions

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the released test items in this document.

PART IV Item Correlation with Curriculum Framework

Released Items for Biology*

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 (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. 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. 13. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life-science problems. 14. Students shall describe the connections between pure and applied science. 15. Students shall describe various life-science careers and the training required for the selected career.

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

Item	Strand	Content Standard	Student Learning Expectation
34	EBR	9	1
35	HE	6	4
36	MC	2	9
37	CDL	7	10
38	HE	4	3
39	MC	1	3
40	EBR	9	3
41	HE	5	1
42	NS	13	2
43	CDL	7	12
44	HE	5	3
45	CDL	7	13
46	EBR	9	2
47	CDL	7	17
48	HE	6	1
49	MC	3	2
50	NS	14	4
51	HE	6	7
52	MC	3	5
53	MC	2	3
54	NS	15	1
55	NS	13	3
56	CDL	7	11
57	NS	14	4
58	MC	2	7
59	EBR	9	2
60	EBR	9	1
A	CDL	7	17
B	EBR	9	3
C	HE	6	5
D	MC	2	7
E	NS	12	3

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

ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

DEVELOPED FOR THE ARKANSAS DEPARTMENT OF EDUCATION, LITTLE ROCK, AR 72201