ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Biology
End-of-Course Examinations

January and April 2009 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 who had completed or were completing Biology by the end of the first semester participated in the *Biology Mid-Year End-of-Course Examination* in January 2009, and students who had completed or were completing Biology by the end of spring semester participated in the *Biology End-of-Course Examination* in April 2009.

This Released Item Booklet for the *Biology End-of-Course Examinations* contains test questions or items that were asked of students during the operational administrations in January 2009 and April 2009. The test items included in Parts II and III of this booklet are those items that contributed to the student performance results for that administration.

Students were given approximately an hour and a half each day of testing during the January 2009 administration and approximately two hours each day of testing during the April 2009 administration to complete assigned test sessions during the two days of 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 IV 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.

Parts V and VI of the Released Item Booklet contain 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. Parts V and VI of the Released Item Booklet provide Arkansas educators with specific information on how the *Biology End-of-Course Examinations* 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 Examinations* 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 Examinations* 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 End-of-Course Released Biology Items

1. Which is the **best** way to describe the fit between an enzyme and its substrate?

A. The fit between them varies with the cell.

* B. The enzyme fits tightly with the substrate.

C. The enzyme loosely fits inside the substrate.

D. The substrate loosely fits inside the enzyme.

2. Which is a **correct** guideline of science?

A. Hypotheses may or may not be testable.

* B. Explanations are based on observations, evidence, and testing.

C. Scientific knowledge does not need peer review and verification before acceptance.

D. Understandings and/or conclusions will never change with additional empirical data.

3. A species of flower lives in an environment that has always had an abundance of rain but is now experiencing less rainfall each year. Which variation within the flower population would be beneficial in terms of natural selection?

A. a difference in pollen production

B. a difference in the color of petals

* C. a difference in the length of the roots

D. a difference in the length of the stems

4. Which is an example of a biotic factor found in ecosystems?

* A. plants

B. moisture

C. air currents

D. temperature

5. When water dissolves a substance, weak charges carried by water molecules attract the substance's oppositely charged atoms and pull them away from their molecules. This is a function of which property of water?

A. pH

* B. polarity

C. cohesion

D. surface tension

6. The Chinquapin, a tree native to northwest Arkansas, was plentiful until it was devastated by a fungal disease carried by the Asian chestnut tree. To restore the Chinquapin to its former numbers and maintain biodiversity, scientists should try to

A. remove all Asian chestnut trees from Arkansas.

B. plant many Chinquapin trees near Asian chestnut trees.

C. develop a vaccine for the fungal disease which harms the Chinquapin.

* D. breed the surviving Chinquapin trees that demonstrated resistance to the disease.

7. In classifying life-forms from cells to ecosystems, what form would follow animal cells?

* A. tissues

B. societies

C. organisms

D. populations

8. A scientific study concluded that plants with red flowers are less likely to die in drought situations. Which statement about the study would be a reason for this conclusion to be biased?

A. All plants received the same amount of rain water.

B. Many different types of plants were tested in the study.

C. Each plant's growth was recorded at the same time every day.

* D. Plants with red flowers were given more fertilizer than plants with other color flowers.

9. One problem with imposing heavy fines on businesses that do **not** meet legal or environmental standards with their waste emissions, is that such actions may result in

* A. political opposition from the business' supporters.

B. the businesses increasing their need for fossil fuels.

C. the businesses increasing their number of employees.

D. prices of the services offered by the businesses going down.

10. The epidermis of plants often has tiny holes called stomata. The holes are bordered by guard cells that control the size of each stoma's opening. Stomata are crucial for

A. absorbing water that exists underground.

B. transporting nutrients throughout the plant.

C. trapping sunlight in the chloroplasts of cells.

* D. providing carbon dioxide for photosynthesis.

11. During aerobic exercise, muscles may not receive enough oxygen and therefore switch to lactic acid fermentation. What is a reason for the cells to use lactic acid fermentation instead of waiting for more oxygen?

A. The cells still need to produce water.

B. The cells no longer need to use oxygen.

* C. The cells still need to generate usable energy.

D. The cells need to build up lactic acid in order to slow the muscles.

12. What occurs during the life-cycle stage known as metamorphosis?

A. Male and female haploid cells join to form a zygote.

* B. An immature organism undergoes distinct anatomical changes.

C. Hormones are released, causing a mammal to undergo growth spurts.

D. Sexual reproduction is followed by a period of asexual reproduction.

13. Which figure shows an organism with radial symmetry?

A.

* B.

C.

D.

14. Crucial to the idea of global warming is that global temperatures are raised when heat is

A. emitted from active volcanoes.

B. produced by fossil-fuel emissions.

C. generated within Earth's mantle and core.

* D. trapped by atmospheric greenhouse gases.

15. Which is part of the process of radioactive dating for determining the age of fossils?

* A. using the carbon 14 isotope

B. studying stratified bands of rocks

C. observing the biozones of different species

D. studying the different types of inclusions found in rock formations

16. Which theory was **most** influential in the completion of the Human Genome Project?

A. cell theory

B. theory of evolution

C. germ theory of disease

* D. chromosome theory of heredity

17. Plant cells have an additional structure beyond their plasma membranes that animal cells lack. One function of this additional structure is to

A. perform active transport.

* B. provide structure and protection.

C. enable the cell to undergo phagocytosis.

D. trap sunlight in order to convert it to energy.

18. What is one way in which all eukaryotic cells and all prokaryotic cells are similar?

A. They reproduce sexually.
B. They are roughly the same size.
* C. They are contained in a cell membrane.
D. They share the same kinds of organelles.

19. What is one evolutionary advantage angiosperms have over gymnosperms?

A. less genetic variation
B. more nonvascular tissue
* C. greater protection of seeds
D. decreased need to photosynthesize

20. Which nitrogen base is only found in an RNA nucleotide?

A. adenine
B. guanine
C. thymine
* D. uracil

21. A cell nucleus sends out molecules that carry instructions for protein synthesis. What is the destination of these molecules?

A. enzymes
* B. ribosomes
C. cytoskeleton
D. cell membrane

22. Biological evolution can be summarized as the change in

* A. allele frequency of a population over time.
B. chromosome frequency of a population over time.
C. allele frequency of a population in one generation.
D. chromosome frequency of a population in one generation.

23. A widely accepted scientific theory needs to be thoroughly revised when it is

A. refuted by a hypothesis.
B. supported by peer review.
* C. challenged by scientific data.
D. converted into a scientific law.

24. What is a main difference between primary succession and secondary succession?

A. Primary succession happens slowly, and secondary succession happens rapidly.
B. Small plants grow first during primary succession, while large trees grow first during secondary succession.
C. Primary succession occurs after a natural disaster, and secondary succession occurs before a natural disaster.
* D. Primary succession is the colonization of new sites, and secondary succession is colonization of previously inhabited sites.

25. In the late 1890s, scientists discovered that a certain disease in plants was caused by infective agents that were smaller than any known bacteria. This was the beginning of the discovery of

A. fungi.
* B. viruses.
C. protists.
D. eukaryotes.

26. According to the laws of genetics as determined by Gregor Mendel, the allele that expresses itself in the phenotype of an organism is called the

A. mutated allele.
B. inherited allele.
C. recessive allele.
* D. dominant allele.

27. The germ theory of disease has been used to develop vaccines. Which statement **best** supports this idea?

A. Vaccines are rarely effective against the target pathogen.
* B. The flu vaccine is created using material from the virus that causes the flu.
C. A vaccine can be made from compounds unrelated to the pathogen it is controlling.
D. The vaccine for chicken pox is designed to protect an individual from related diseases.

28. Which data set would be **most** appropriately represented by a line graph?

A. data showing all the different uses of timber
* B. data detailing the temperature of a certain region over a three-month period
C. data showing the number of students in biology class with red, blonde, and brown hair
D. data showing the number of students who visited the doctor in the past month, broken down by age

29. Which structural component do DNA and RNA have in common?

A. uracil
B. deoxyribose sugar
* C. phosphate molecule
D. double-stranded backbone

30. A certain light-producing microbe finds shelter and food in the skin of a fish. This relationship would be considered mutualism if the light from the microbe

* A. helps the fish find suitable mates.
B. causes harmful mutations in the fish.
C. makes the fish more easily preyed upon.
D. makes no difference in the life of the fish.

31. One way in which a point mutation and a deletion mutation are **different** is that

A. a point mutation is always harmful, and a deletion mutation is never harmful.

B. a point mutation is a physical change, and a deletion mutation is a chemical change.

C. a point mutation always results in a frameshift mutation, while a deletion mutation never results in a frameshift mutation.

* D. a point mutation only results in a change in a single nucleotide base, while a deletion mutation can result in a change in multiple nucleotide bases.

32. In what way are bacteria extremely important to agriculture?

* A. They fix nitrogen in the soil.

B. They provide oxygen for plants.

C. They release water that is taken through plant roots.

D. They cause chemical change during photosynthesis.

33. A land developer wants to control a population of hawks. He decides to solve the problem by clearing out the land's fields. How will this action **most** likely control the population?

A. The population of hawks will increase due to decreased competition.

B. The hawks will experience more crowding and the population will decline.

C. There will be fewer predators of the hawks, so their population will increase.

* D. The food supply of the hawks will decrease, causing the population of hawks to decrease.

PART III End-of-Course Released Biology Items

1. Gregor Mendel's experiments showed that an understanding of probability could be used to

A. find the molecular basis of genes.

B. discover where genes exist in the cell.

* C. predict patterns of genetic inheritance.

D. determine the structure of the DNA molecule.

2. Which statement is an example of a hypothesis?

A. All living things are composed of cells.

* B. If fertilizer is given to plants, then those plants will grow faster than plants not given fertilizer.

C. Based on this study, children who attend daycare have better test scores in elementary school.

D. Because plants have two different alleles, they can produce two different types of gametes.

3. When a cell with half the normal number of chromosomes is generated during meiosis, how can it eventually produce cells with the normal number of chromosomes?

A. by undergoing the six phases of mitosis

B. by forming two nuclei during cell division

C. by releasing young normal cells through exocytosis

* D. by combining with a gamete from another organism

4. Which organic molecule is part of an enzyme?

A. fatty acid

B. nucleotide

* C. amino acid

D. monosaccharide

5. What structural change makes the heart of a mammal more efficient than the heart of an amphibian?

A. The mammalian heart has a single atrium, and the amphibian heart has two atria.

B. The mammalian heart has three chambers, and the amphibian heart has two chambers.

* C. The mammalian heart has four chambers, and the amphibian heart has three chambers.

D. The mammalian heart has a single ventricle, and the amphibian heart has two ventricles.

6. A plan to convert and burn unsold food as biological fuel can be environmentally beneficial because it

A. restores wetlands.

* B. limits landfill use.

C. reduces air pollution.

D. decreases biodiversity.

7. In Calhoun County, Arkansas, a local timber company is now required to grow pine trees for 45 years before harvesting instead of the normal 20 years. This would increase biodiversity in Calhoun County through the

A. reduction of pollution.
* B. preservation of habitats.
C. elimination of extinction.
D. simplification of food webs.

8. Moss often grows on trees. The tree is not affected, while the moss has the nutrients it needs to grow. What type of relationship is this?

A. predatory
B. parasitism
C. mutualism
* D. commensalism

9. Which **best** describes the interaction between autotrophs and heterotrophs?

A. One competes with the other for access to sunlight and soil.
B. One decomposes the other to release nutrients back into the soil.
C. One helps produce the other in a mutually beneficial relationship.
* D. One consumes the other to use energy that originally came from the Sun.

10. Which is a **correct** example of the base-pairing rule within the Watson-Crick double-helix model of DNA?

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

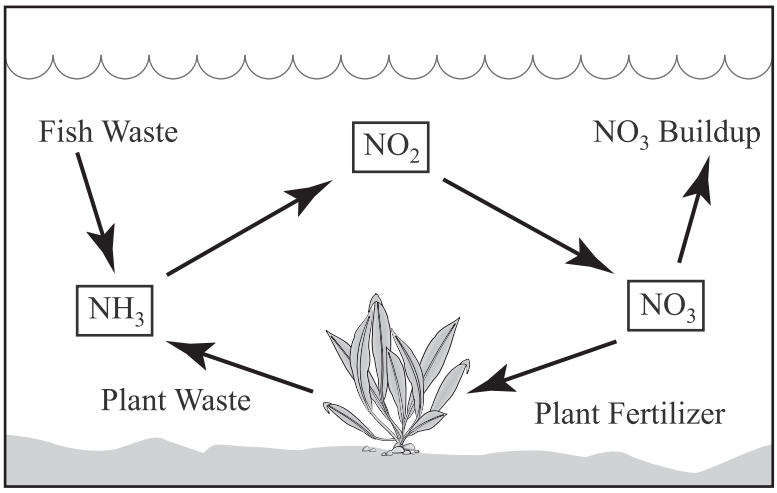
11. Skeptics of the idea that humans play a prominent role in global warming point to the fact that global temperatures were higher a thousand years ago than now. This could be relevant to the current global warming debate because a thousand years ago there were fewer

A. oceans.
B. polar icecaps.
* C. greenhouse gas emissions.
D. animal and plant species living in existence.

12. What is the smallest biological unit?

* A. cell
B. organ
C. molecule
D. organism

13. The diagram below of an aquatic ecosystem represents what elemental cycle on Earth?



A. water

B. carbon

* C. nitrogen

D. phosphorus

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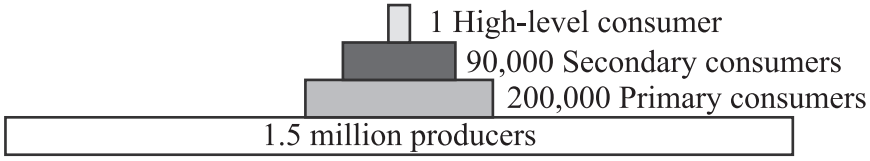
14. The figure below shows the number of plants and animals necessary to support the life of one high-level consumer in a temperate grassland biome.



The figure represents the flow of energy through

* A. different trophic levels in most ecosystems.

B. soil, plants, and animals during the nitrogen cycle.

C. different organisms within a single level of most food webs.

D. the atmosphere, land, and bodies of water during the water cycle.

15. Which statement about theories is true when the theory is being discussed in general conversation as compared to one that is considered a scientific theory?

* A. A general conversation theory is a guess or a hunch.

B. A general conversation theory is held with a high degree of confidence.

C. A general conversation theory is a set of universal statements that explains some aspect of the natural world.

D. A general conversation theory is supported by enough physical evidence to make its abandonment unlikely.

16. Which illustrates Lamarck's explanation of evolution?

A. A female peacock has brightly colored feathers, therefore attracting a mate more easily.

B. A population of humans develops a darker skin tone after moving to a sunnier and warmer environment.

C. A species of fish develops fins that allow it to swim faster after a bigger, predatory fish is introduced into its environment.

* D. A blacksmith, through his work, strengthens the muscles in his arms, and therefore, his sons will have similar muscular development when they mature.

17. One difference between reptiles and amphibians is that reptiles

A. can live on land.

B. are cold-blooded.

* C. lay eggs with shells.

D. prey on other animals.

18. In the 19th century, scientists observed that plants and animals were composed of cells, and from this derived the cell theory. Today, cell biologists are making many new discoveries about cells at the molecular level. What technology do both groups have in common?

A. the telescope

B. sonic imaging

* C. the microscope

D. x-ray photography

19. The alcohol in champagne and beer is the result of

* A. fermentation performed by fungi.

B. photosynthesis performed by algae.

C. protein synthesis performed in ribosomes.

D. cellular respiration performed in mitochondria.

20. During photosynthesis, low-energy electrons from water molecules are converted to high-energy electrons that are used to produce ATP. What causes this energy conversion?

A. oxygen
* B. sunlight
C. simple sugars
D. carbon dioxide

21. What body type is represented by the organism below?

A. asymmetry
B. radial symmetry
* C. bilateral symmetry
D. trilateral symmetry

22. Which presents the correct order of biomes from **least** biodiversity to **most** biodiversity?

* A. tundra, taiga, temperate grassland, rainforest
B. taiga, tundra, temperate grassland, rainforest
C. tundra, taiga, rainforest, temperate grassland
D. taiga, tundra, rainforest, temperate grassland

23. A normal strand of DNA is shown below, followed by the same strand of DNA after mutations have occurred.

Normal strand: GTCCATCTGATTACGGCA

Mutated strand: GTCCATCGATTACGGCA

Which mutations have taken place?

A. point and inversion mutations
B. point and frameshift mutations
C. inversion and deletion mutations
* D. deletion and frameshift mutations

24. What do the cell wall of a plant cell and the plasma membrane of an animal cell have in common?

A. They both are strong and rigid.
B. They both perform active transport.
C. They both consist of double layers of lipids.
* D. They both allow particles to enter and exit the cell.

25. Scientists who research ways to make more effective fertilizer are applying knowledge from what pure-science concept?

* A. nitrogen cycle
B. trait inheritance
C. natural selection
D. ecological competition

26. When a chromosome appears by itself within a karyotype and not as part of a pair, it is known as

A. trisomy.
* B. monosomy.
C. codominance.
D. incomplete dominance.

27. Which must be in place within a population in order for the theory of evolution to hold true?

A. changes in allele frequencies in random generations
* B. changes in allele frequencies in successive generations
C. changes in chromosomal frequencies in random generations
D. changes in chromosomal frequencies in successive generations

28. A farmer stops cultivating a large tract of farmland and abandons it. The natural changes taking place soon afterwards, such as the growth of wild grasses and weeds, can be considered secondary succession and **not** primary succession because

A. a new ecosystem develops.
* B. there is already soil present.
C. the land is not controlled by humans.
D. wild grasses and weeds make soil from rocks.

29. A scientific experiment is conducted to determine the effects of different levels of caffeine on exercise performance. In this experiment, what are the levels of caffeine?

A. the control
B. the summary statistic
C. the dependent variable
* D. the independent variable

30. Why is it important for a research company to evaluate its long-range plans concerning resource use and waste disposal?

A. so that others will be able to repeat the company's experiments
B. so that any related research is guaranteed to be published
C. so that the company is assured of its technologies being wise investments
* D. so that the technologies used will have a minimum environmental impact

31. A plant that can be either male or female, lives mostly in the tropics, and bears large cones can be described as being both

A. a cycad and an angiosperm.
* B. a gymnosperm and a cycad.
C. a nonvascular plant and a gymnosperm.
D. an angiosperm and a nonvascular plant.

32. In a fibrous root system, a plant produces a network of short and thin roots. Such a plant has adapted to

* A. absorb water that is close to the ground's surface.

B. take in hard-to-reach nutrients that are deep underground.

C. store large amounts of food made during photosynthesis in its roots.

D. repel nitrogen-fixing bacteria that live near the ground's surface.

33. What type of mutation occurs when a nucleotide base is replaced with a chemically similar nucleotide base and, therefore, there are no recognizable effects upon the organism?

* A. neutral mutation

B. harmful mutation

C. structural mutation

D. beneficial mutation

PART IV 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. • carbohydrates • proteins • enzymes • lipids • nucleic acids 2. Describe the relationship between an enzyme and its substrate molecule(s). 3. Investigate the properties and importance of water and its significance for life. • surface tension • adhesion • cohesion • polarity • pH 4. Explain the role of energy in chemical reactions of living systems. • activation energy • exergonic reactions • endergonic reactions
	2. Students shall demonstrate an understanding of the structure and function of cells.	1. Construct a hierarchy of life from cells to ecosystems. 2. Compare and contrast prokaryotes and eukaryotes. 3. Describe the role of sub-cellular structures in the life of a cell. • organelles • ribosomes • cytoskeleton 4. Relate the function of the plasma (cell) membrane to its structure. 5. Compare and contrast the structures of an animal cell to a plant cell. 6. Compare and contrast the functions of autotrophs and heterotrophs. 8. Describe the main events in the cell cycle, including the differences in plant and animal cell division. • interphase • mitosis • cytokinesis 9. List in order and describe the stages of mitosis. • prophase • metaphase • anaphase • telophase 10. Analyze the meiotic maintenance of a constant chromosome number from one generation to the next. 11. Discuss homeostasis using thermoregulation as an example.
	3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).	1. Compare and contrast the structure and function of mitochondria and chloroplasts. 3. Compare and contrast aerobic and anaerobic respiration. • lactic acid fermentation • alcoholic fermentation 4. Describe and model the conversion of light energy to chemical energy by photosynthetic organisms. • light dependent reactions • light independent reactions 5. Compare and contrast cellular respiration and photosynthesis as energy conversion pathways.

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

The Arkansas Biology Science Curriculum Framework* (continued)

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 laws and principles of inheritance. • 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. • sex linkage • codominance • crossing over • incomplete dominance • multiple alleles 5. Analyze the historically significant work of prominent geneticists. 6. Evaluate karyotypes for abnormalities. • monosomy • trisomy
	5. Students shall investigate the molecular basis of genetics.	1. Model the components of a DNA nucleotide and an RNA nucleotide. 2. Describe the Watson-Crick double-helix model of DNA, using the base-pairing rule (adenine-thymine, cytosine-guanine). 3. Compare and contrast the structure and function of DNA and RNA. 4. Describe and model the processes of replication, transcription, and translation. 5. Compare and contrast the different types of mutation events, including point mutation, frameshift mutation, deletion, and inversion. 6. Identify effects of changes brought about by mutations. • beneficial • harmful • neutral
	6. Students shall examine the development of the theory of biological evolution.	1. Compare and contrast Lamarck's explanation of evolution with Darwin's theory of evolution by natural selection. 2. Recognize that evolution involves a change in allele frequencies in a population across successive generations. 3. Analyze the effects of mutations and the resulting variations within a population in terms of natural selection. 4. Illustrate mass extinction events using a timeline. 5. Evaluate evolution in terms of evidence as found in the following. • 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.	1. Differentiate among the different domains. • Bacteria • Archaea • Eukarya 2. Differentiate the characteristics of the six kingdoms. • Eubacteria • Archaea • Protista • Fungi • Plantae • Animalia

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

The Arkansas Biology Science Curriculum Framework* (continued)

Strands	Content Standards	Student Learning Expectations
3. CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.	3. Identify the seven major taxonomic categories. • kingdom • phylum • class • order • family • genus • species 5. Investigate Arkansas' biodiversity using appropriate tools and technology. 6. Compare and contrast the structures and characteristics of viruses (lytic and lysogenic cycles) with non-living and living things. 7. Evaluate the medical and economic importance of viruses. 8. Compare and contrast life cycles of familiar organisms. • sexual reproduction • asexual reproduction • metamorphosis • alternation of generations 10. Evaluate the medical and economic importance of bacteria. 13. Compare and contrast fungi with other eukaryotic organisms. 14. Evaluate the medical and economic importance of fungi. 15. Differentiate between vascular and nonvascular plants. 16. Differentiate among cycads, gymnosperms, and angiosperms. 17. Describe the structure and function of the major parts of a plant. • roots • stems • leaves • flowers 18. Relate the structure of plant tissue to its function. • epidermal • ground • vascular 19. Evaluate the medical and economic importance of plants. 20. Identify the symmetry of organisms. • 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.
4. ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms.	1. Cite examples of abiotic and biotic factors of ecosystems. 2. Compare and contrast the characteristics of biomes. 3. Diagram the carbon, nitrogen, phosphate, and water cycles in an ecosystem. 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. • commensalism • parasitism • mutualism 7. Compare and contrast primary succession with secondary succession. 8. Identify the properties of each of the five levels of ecology. • organism • population • community • ecosystem • biosphere

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

The Arkansas Biology Science Curriculum Framework* (continued)

Strands	Content Standards	Student Learning Expectations
4. ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	9. Students shall demonstrate an understanding of the ecological impact of global issues.	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.	1. Explain why science is limited to natural explanations of how the world works. 2. Compare and contrast hypotheses, theories, and laws. 3. Distinguish between a scientific theory and the term "theory" used in general discussion. 4. Summarize the guidelines of science: • explanations are based on observations, evidence, and testing • hypotheses 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.	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. 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.	1. Recognize that theories are scientific explanations that require empirical data, verification, and peer review. 2. Understand that scientific theories may be modified or expanded based on additional empirical data, verification, and peer review. 3. Summarize biological evolution. 4. Relate the development of the cell theory to current trends in cellular biology. 5. Describe the relationship between the germ theory of disease and our current knowledge of immunology and control of infectious diseases. 6. Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project—HGP, chromosome therapy).
	13. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life-science problems.	1. Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables.
	14. Students shall describe the connections between pure and applied science.	1. Compare and contrast biological concepts in pure science and applied science. 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. 4. Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology.

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

PART V Mid-Year End-of-Course Item Correlation with Curriculum Framework

Released Items for Mid-Year End-of-Course 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. 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	MC	1	2
2	NS	10	4
3	HE	6	3
4	EBR	8	1
5	MC	1	3
6	CDL	7	5
7	MC	2	1
8	NS	11	5
9	EBR	9	2
10	CDL	7	18
11	MC	3	3
12	CDL	7	8
13	CDL	7	20
14	EBR	9	3
15	HE	6	6
16	NS	12	6
17	MC	2	5
18	MC	2	2
19	CDL	7	16
20	HE	5	1
21	MC	2	3
22	NS	12	3
23	NS	12	2
24	EBR	8	7
25	CDL	7	6
26	HE	4	2
27	NS	12	5
28	NS	13	1
29	HE	5	3
30	EBR	8	6
31	HE	5	5
32	CDL	7	10
33	EBR	8	5

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

PART V Mid-Year End-of-Course Item Correlation with Curriculum Framework

Non-Released Items for Mid-Year End-of-Course 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. 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	1
2	NS	11	1
3	HE	4	1
4	CDL	7	2
5	EBR	8	2
6	HE	4	3
7	EBR	8	8
8	MC	2	6
9	NS	10	1
10	EBR	8	3
11	HE	4	5
12	MC	3	5
13	HE	6	7
14	NS	11	4
15	CDL	7	7
16	EBR	8	1
17	HE	5	2
18	EBR	8	4
19	MC	2	4
20	NS	11	6
21	HE	4	6
22	CDL	7	13
23	CDL	7	15
24	MC	2	11
25	EBR	9	1
26	MC	3	1
27	NS	14	4
A	CDL	7	10
B	EBR	9	1
C	HE	5	3
D	NS	11	3
E	MC	1	3

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

PART VI End-of-Course Item Correlation with Curriculum Framework

Released Items for End-of-Course 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. 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	HE	4	1
2	NS	10	2
3	MC	2	10
4	MC	1	1
5	CDL	7	22
6	EBR	9	2
7	CDL	7	5
8	EBR	8	6
9	MC	2	6
10	HE	5	2
11	EBR	9	3
12	MC	2	1
13	EBR	8	3
14	EBR	8	4
15	NS	10	3
16	HE	6	1
17	CDL	7	21
18	NS	12	4
19	CDL	7	14
20	MC	3	4
21	CDL	7	20
22	EBR	8	2
23	HE	5	5
24	MC	2	5
25	NS	14	1
26	HE	4	6
27	HE	6	2
28	EBR	8	7
29	NS	11	1
30	NS	14	3
31	CDL	7	16
32	CDL	7	18
33	HE	5	6

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

PART VI End-of-Course Item Correlation with Curriculum Framework

Non-Released Items for End-of-Course 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. 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	1
2	EBR	8	1
3	HE	6	5
4	NS	14	2
5	EBR	8	5
6	NS	11	4
7	HE	4	5
8	MC	1	4
9	NS	12	1
10	CDL	7	19
11	CDL	7	2
12	HE	4	3
13	HE	5	4
14	MC	2	9
15	EBR	8	8
16	NS	12	6
17	CDL	7	3
18	HE	4	4
19	MC	2	2
20	EBR	8	6
21	NS	10	4
22	CDL	7	10
23	MC	1	2
24	MC	3	3
25	EBR	9	1
26	MC	2	8
27	NS	13	1
A	CDL	7	17
B	EBR	8	6
C	HE	6	4
D	MC	2	9
E	NS	14	1

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

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