ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Biology Mid-Year End-of-Course Examination

January 2010 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 first semester participated in the *Biology Mid-Year End-of-Course Examination* in January 2010.

This Released Item Booklet for the *Biology Mid-Year End-of-Course Examination* contains test questions or items that were asked of students during the January 2010 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 an hour and a half each day to complete assigned test sessions during the two days of testing in January 2010. All of the multiple-choice items within this booklet have the correct response marked with an asterisk (*).

The development of the *Biology Mid-Year 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 Mid-Year 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 Mid-Year 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 Mid-Year 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 Mid-Year 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

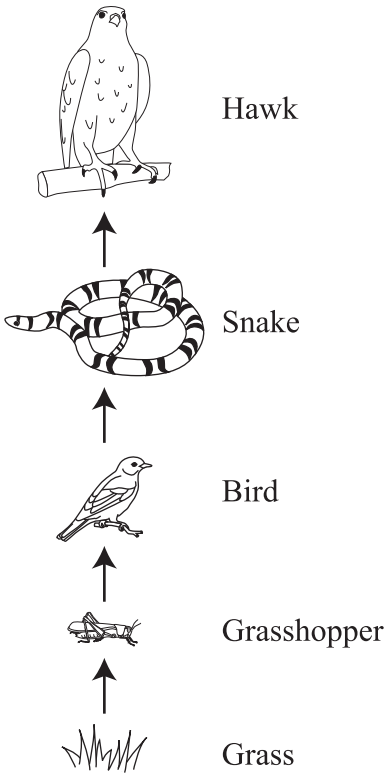
1. Which organisms can live in extreme conditions, such as hot springs that have high concentrations of acid or salt?

A. Fungi
B. Protista
*C. Archaea
D. Bacteria

2. Which action is an application of the work of Watson and Crick?

A. blood typing
*B. DNA fingerprinting
C. arthroscopic surgery
D. magnetic resonance imaging

3. The diagram below shows a simplified food chain.



Which level of the food chain has the **greatest** amount of biomass?

A. hawk
B. bird
C. grasshopper
*D. grass

4. Increased reliance on which energy source would likely have the **most** negative effects on global climate change?

*A. coal
B. wind
C. nuclear
D. hydroelectric

5. Which statement is an example of one of Gregor Mendel's experimental outcomes?

A. Genes are not inherited independently of each other.
B. Two true-breeding, tall (dominant) plants are crossed, and some of the offspring are short (recessive).
*C. A true-breeding, tall (dominant) plant is crossed with a true-breeding, short (recessive) plant, and all the offspring are tall.
D. Some organisms inherit one allele per parent for each genetic trait, while others inherit two alleles per parent for each genetic trait.

6. To which kingdom does one type of common bread mold belong if it has cell walls, membrane-bound organelles, and obtains its energy from decomposing bread?

*A. Fungi
B. Plantae
C. Archaea
D. Animalia

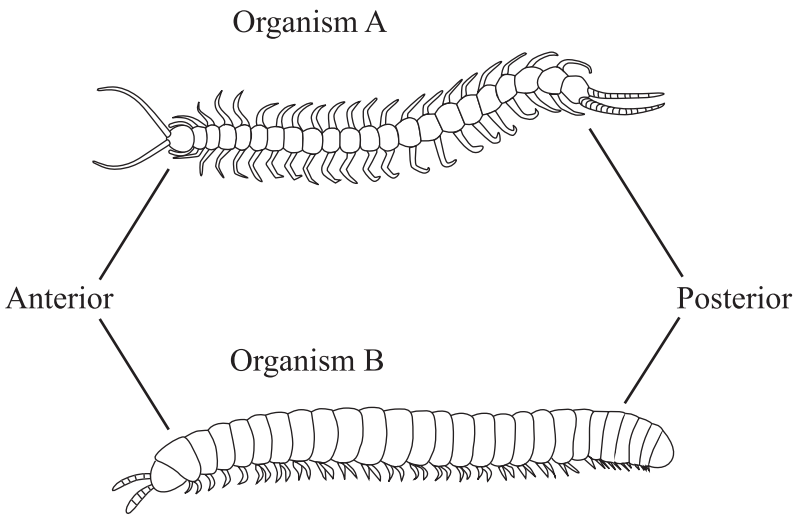
7. What is one way viruses are similar to all nonliving things?

A. They are microscopic.
B. They are not contagious.
*C. They do not reproduce on their own.
D. They do not contain genetic material.

8. A biology class learns that a larger local highway system is planned, and it wants to predict the effect on local wildflowers along the planned route. When should the flower samples be counted?

A. just after construction
B. during the construction
C. one year before construction
*D. before and after construction

9. Based on the figure and key below, what sequence of steps is needed to identify Organism A?



KEY:

1. Unsegmented antennae ..... go to 2
1. Segmented antennae ..... go to 3

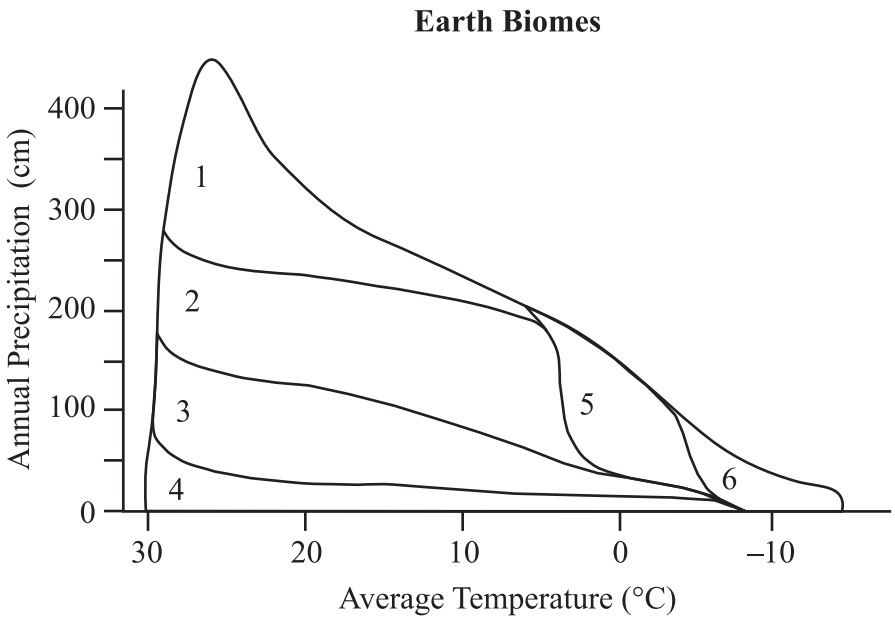
2. Rear appendage absent..... go to 3
2. Rear appendage present ..... go to 4

3. Pair of legs per body segment..... go to 4
3. Pair of legs on few body segments ..... go to 4

4a. Rear appendage segmented.....done
4b. Rear appendage unsegmented.....done

*A. 1 - 2 - 4a
B. 1 - 2 - 4b
C. 1 - 3 - 4a
D. 1 - 3 - 4b

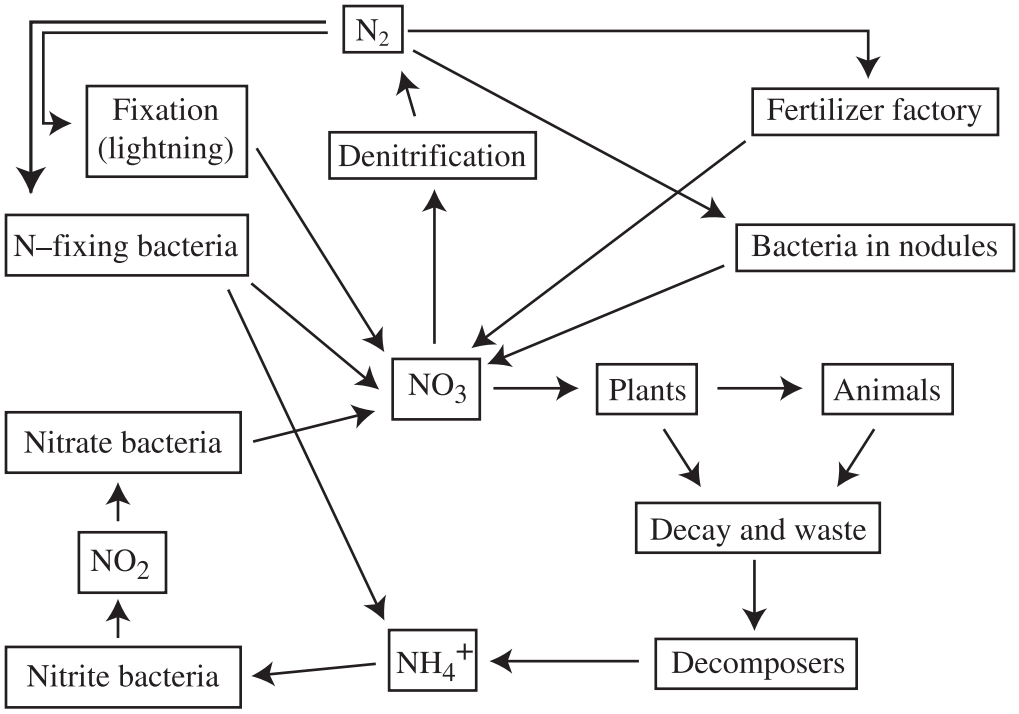
10. The graph below compares and contrasts the annual rainfall and temperature of several biomes.



Which biome is represented in section 4 of the graph?

A. taiga
*B. desert
C. rainforest
D. temperate forest

11. The diagram below shows a biogeochemical cycle.



Which cycle is shown?

A. water
B. carbon
*C. nitrogen
D. phosphate

12. Which taxonomic category is **most** appropriately described as a group of individuals that can successfully interbreed?

A. class
B. order
C. family
*D. species

13. A horse eats an apple from a tree. Which statement **best** explains this relationship?

A. Both the horse and the tree are heterotrophs.
*B. The horse, a heterotroph, is consuming food from an autotroph.
C. Both the horse and the tree are neither autotrophs nor heterotrophs.
D. The horse, an autotroph, is consuming food from another autotroph.

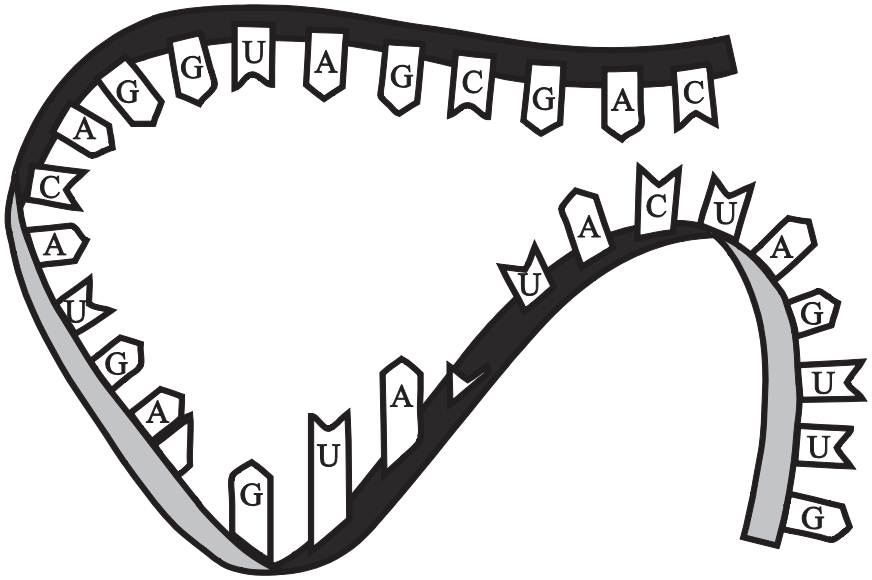
14. What **most** likely resulted from advancements in DNA technology?

*A. genetic screening for disease
B. discovery of different blood types
C. relating structural similarities between organisms
D. studying phenotypic traits between related organisms

15. Which statement **best** describes how cell theory relates to a stem cell's ability to change into specialized cell types?

A. Metabolism occurs in cells.
B. Some organisms are unicellular.
C. Stem cells result from viral infections of healthy cells.
*D. All cells in an organism have the same hereditary material.

16. The figure below shows genetic material.



What information confirms that this is an RNA molecule?

A. The molecule contains adenine.
*B. The molecule is single-stranded.
C. The molecule has hydrogen bonds.
D. The molecule has a sugar-phosphate backbone.

17. The body cells of one plant contain 40 chromosomes. How many chromosomes are found in the gametes of this plant?

*A. 20
B. 40
C. 60
D. 80

18. Which would one examine in order to find organic molecules that speed up or slow down certain chemical reactions?

A. lipids
*B. enzymes
C. nucleic acids
D. carbohydrates

19. MRSA, an antibiotic-resistant strain of bacteria, has recently become a problem in some schools. How can the germ theory of disease **best** help schools contain an outbreak?

A. by giving all students preventative antibiotics
B. by keeping all students home until the bacteria disappear
C. by informing the public about the symptoms of the infection
*D. by disinfecting all surfaces daily and having students wash hands regularly

20. Which of Gregor Mendel's discoveries is represented when a black dog and a white dog mate, and all the resulting puppies are black?

*A. dominance
B. sex-linkage
C. segregation
D. independent assortment

21. Which is an example of parasitism?

A. a harmless frog looking identical to a poisonous one
*B. a vampire bat sucking blood from the ankle of a cow
C. a bacterium breaking down wastes in a human intestine
D. a pilot fish cleaning food particles from the gill slits of a shark

22. Based on the table below, which cross of parents could produce a child with type O blood?

Genotype	Blood Type
I^AI^A	A
I^Ai	A
I^BI^B	B
I^Bi	B
I^AI^B	AB
ii	O

A. $I^AI^B \times ii$
B. $I^AI^A \times ii$
C. $I^BI^B \times ii$
*D. $I^Ai \times I^Bi$

23. Yeasts ferment when they undergo anaerobic respiration. Which industry relies **most** on a by-product of yeast metabolism?

A. dairy
*B. bread
C. soft drink
D. biomedical

24. What is the **correct** sequence of bases if the segment of DNA shown below is transcribed by mRNA?

TAGCTAAAG

A. UTCGUTTTC
B. ATCGATTTC
*C. AUCGAUUUC
D. TAGCTAAAG

25. How is the respiratory system of most frogs **different** from that of a mammal?

A. Most frogs have gills during their entire lifetime.
B. Most frogs breathe only through their skin covering.
*C. Most frogs have gills when they hatch and develop lungs as they get older.
D. Most frogs have lungs when they hatch and develop gills to live in the water.

26. Which is the **most** likely order of plant life succession around a volcano that erupted and destroyed most life forms?

*A. lichens → grasses → shrubs → trees
B. shrubs → grasses → trees → lichens
C. mosses → grasses → lichens → trees
D. grasses → trees → mosses → lichens

27. A centrifuge is an effective tool for accomplishing which goal in the lab?

*A. separating blood plasma from blood cells
B. determining the molecular mass of a substance
C. isolating a soluble impurity in a sample of drinking water
D. measuring the heat released during a biochemical reaction

28. A strain of bacteria has been effectively treated by penicillin for many years. Lately, the drug has not been completely able to destroy it. What has been the result of evolution that has taken place with the bacteria?

A. DNA analysis
B. viral evolution
C. pesticide resistance
*D. antibiotic resistance

29. What happens to chromatids when they separate during mitosis?

*A. They become chromosomes.
B. They reattach quickly.
C. They are destroyed.
D. They leave the cell.

30. Which is a true statement about mitochondria and chloroplasts?

A. They contain chlorophyll.
B. They capture light energy.
C. They are found in animal cells.
*D. They have a double membrane.

31. The Internet offers many possibilities for science. What is the **most** effective way for scientists to use the Internet?

A. allowing students to give them feedback on their research
B. allowing the public to alter research results to suit their needs
*C. staying current with new findings in the scientific community
D. using other scientists' findings to fill in the weak points to their research

32. A developer purchases a piece of land where a deer population lives. How will the deer population **most** likely be affected once the houses are built?

A. Birth rate will increase.
B. Death rate will decrease.
*C. Population size will decrease.
D. Food availability will increase.

33. What do the structure and function of a cell membrane **most** resemble?

A. water permeating a tea bag
B. a tea bag that does not allow water to permeate
C. grains of tea that break through a tea bag and float into the cup of water
*D. a tea bag that is permeated by water but does not allow grains of tea to be released

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: • 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.	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. 7. Compare and contrast active transport and passive transport mechanisms: • diffusion • osmosis • endocytosis • exocytosis • phagocytosis • pinocytosis 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.
	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. 2. Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP): • glycolysis • citric acid cycle • electron transport chain 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 items in the January 2010 Mid-Year End-of-Course Biology Examination.

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
2. Heredity and Evolution (HE)	4. Students shall demonstrate an understanding of heredity.	1. Summarize the outcomes of Gregor Mendel's experimental procedures. 2. Differentiate among the 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. 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. Students shall examine the development of the theory of biological evolution.	3. Analyze the effects of mutations and the resulting variations within a population in terms of natural selection. 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

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the January 2010 Mid-Year End-of-Course Biology Examination.

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
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 3. Identify the seven major taxonomic categories: • kingdom • phylum • class • order • family • genus • species 4. Classify and name organisms based on their similarities and differences applying taxonomic nomenclature using dichotomous keys. 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. 8. Compare and contrast life cycles of familiar organisms: • sexual reproduction • asexual reproduction • metamorphosis • alternation of generations 11. Describe the characteristics used to classify protists: • plant-like • animal-like • fungal-like 14. Evaluate the medical and economic importance of fungi. 17. Describe the structure and function of the major parts of a plant: • roots • stems • leaves • flowers 20. Identify the symmetry of organisms: • radial • bilateral • asymmetrical 22. Compare and contrast the major vertebrate classes according to their nervous, respiratory, excretory, circulatory, digestive, reproductive, and integumentary systems.

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the January 2010 Mid-Year End-of-Course Biology Examination.

PART III Curriculum Framework

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
4. Ecology and Behavioral Relationships (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms.	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
	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).

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the January 2010 Mid-Year End-of-Course Biology Examination.

PART III Curriculum Framework

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
5. Nature of Science (NS)	10. Students shall demonstrate an understanding that science is a way of knowing.	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. 2. Research and apply appropriate safety precautions (refer to ADE Guidelines) when designing and/or conducting scientific investigations. 5. Formulate valid conclusions without bias.
	12. Students shall demonstrate an understanding of current life science theories.	2. Understand that scientific theories may be modified or expanded based on additional empirical data, verification, and peer review. 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.
	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. 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.	1. Compare and contrast biological concepts in pure science and applied science. 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 items in the January 2010 Mid-Year End-of-Course Biology Examination.

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)	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.

Item	Strand	Content Standard	Student Learning Expectation
1	CDL	07	01
2	HE	04	05
3	EBR	08	04
4	EBR	09	02
5	HE	04	01
6	CDL	07	02
7	CDL	07	06
8	NS	11	01
9	CDL	07	04
10	EBR	08	02
11	EBR	08	03
12	CDL	07	03
13	MC	02	06
14	NS	14	04
15	NS	12	04
16	HE	05	01
17	MC	02	10
18	MC	01	01
19	NS	12	05
20	HE	04	02
21	EBR	08	06
22	HE	04	04
23	CDL	07	14
24	HE	05	04
25	CDL	07	22
26	EBR	08	07
27	NS	13	02
28	HE	06	05
29	MC	02	09
30	MC	03	01
31	NS	13	03
32	EBR	09	01
33	MC	02	04

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

PART IV Item Correlation with Curriculum Framework

Non-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. 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.

Item	Strand	Content Standard	Student Learning Expectation
1	CDL	07	05
2	EBR	08	01
3	MC	02	07
4	MC	03	02
5	MC	01	04
6	HE	04	03
7	NS	10	04
8	HE	06	03
9	HE	04	06
10	NS	11	02
11	CDL	07	08
12	NS	11	05
13	EBR	08	05
14	EBR	09	01
15	CDL	07	11
16	MC	01	03
17	MC	01	02
18	NS	12	02
19	CDL	07	17
20	HE	05	03
21	MC	02	05
22	EBR	08	08
23	NS	14	01
24	NS	13	01
25	EBR	09	03
26	CDL	07	20
27	HE	05	05
A	MC	03	05
B	CDL	07	20
C	NS	11	01
D	EBR	09	01
E	HE	04	03

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

ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

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

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