ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Biology
End-of-Course Examination

April 2010 Administration

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 2010.

This Released Item Booklet for the *Biology End-of-Course Examination* contains test questions or items that were asked of students during the April 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 two hours each day to complete assigned test sessions during the two days of testing in April 2010. 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 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. If one parent is homozygous recessive for attached earlobes and the other is heterozygous, what is the probability that their children will have attached earlobes?

A. 25%
*B. 50%
C. 75%
D. 100%

2. Which structure is found in **most** gymnosperms and has the same function as the flower in angiosperms?

A. sori
B. roots
*C. cones
D. needles

3. Which biome would **most** likely contain the largest number of hibernating animals?

A. marine
B. savanna
*C. temperate forest
D. tropical rain forest

4. Which is the **best** description of a scientific law?

A. a statement that identifies a specific opinion
*B. a statement that describes a pattern observed in nature
C. a statement that explains why events will sometimes occur
D. a statement that provides a clear prediction that can be tested through observation

5. Which statement **best** describes what happened after Darwin developed his theory of evolution?

A. It was made into a law.
B. It was automatically approved as fact.
*C. It was reviewed by peers for verification.
D. It was voted on by scientists to be accepted or rejected.

6. A student is performing an investigation of the effects of fire on pine seedlings in a forest. The student conducts a study of ten plots that are burned annually. What is an appropriate control for this experiment?

A. ten plowed plots
B. ten cleared plots
*C. ten unburned plots
D. ten herbicide-treated plots

7. Patients with a specific medical condition have been provided with a new device that helps them manage their condition. The patients will be required to participate in a survey regarding the usefulness of these devices. How can the manufacturer be certain that no bias enters into the surveys?

A. by paying the patients for their participation

B. by waiting until the survey is completed to sell the device

*C. by having a second, independent party conduct the survey

D. by providing a toll-free number in case there are questions about the devices

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

A. They leave the cell.

B. They are destroyed.

C. They reattach quickly.

*D. They become chromosomes.

9. Which statement **best** describes the mapping of the human genome?

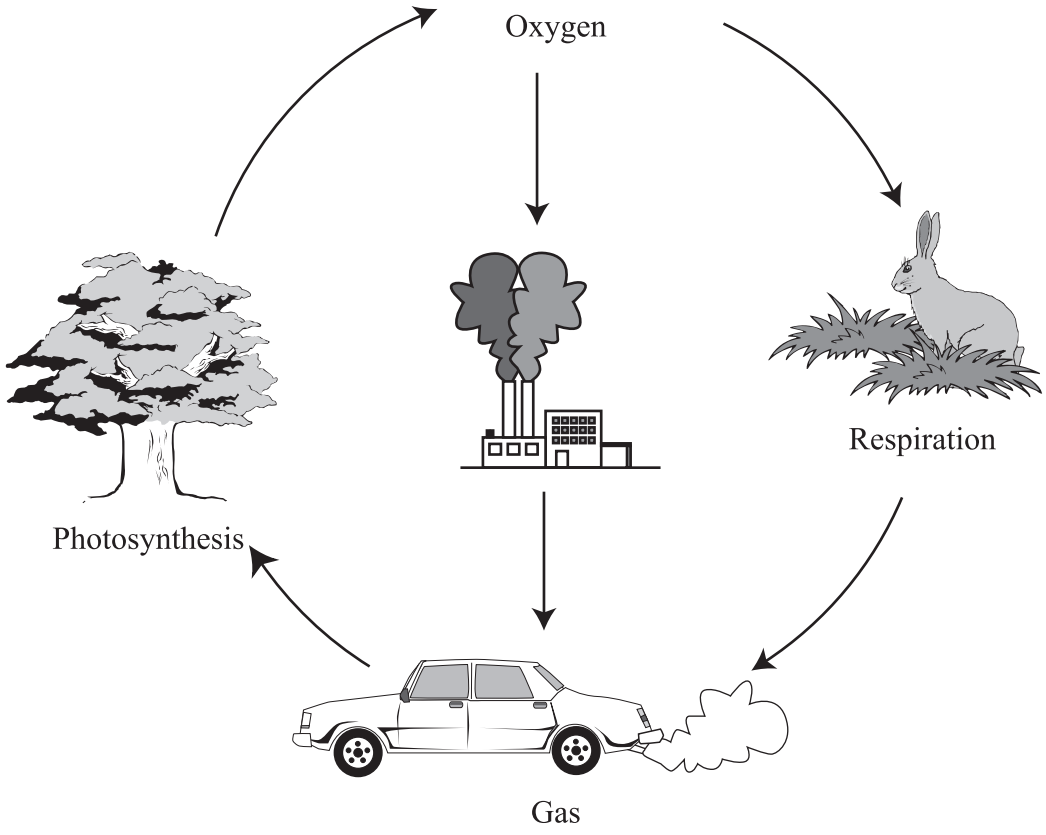
A. It has rejected the basic premise of cell theory.

B. It is built on a foundation reaching back to the germ theory of disease.

C. It has rejected the basic premise of the chromosome theory of heredity.

*D. It is built on a foundation reaching back to the chromosome theory of heredity.

10. The diagram below shows a specific nutrient cycle in nature.



Which nutrient is being recycled?

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

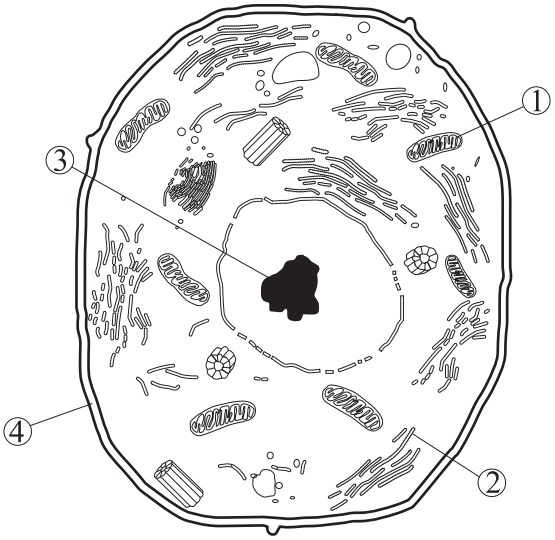
11. How are bacteria **different** from viruses?

A. Bacteria lack a nucleus.
B. Bacteria are microscopic.
*C. Bacteria are classified as living things.
D. Bacteria can cause diseases in humans.

12. What was one contribution Gregor Mendel made to science by performing his experiments on plants?

*A. showing that traits are inherited
B. proving that acquired traits can be inherited
C. showing that the structure of DNA is a double helix
D. proving that random mutations cause the creation of new species

13. This figure below shows an animal cell.



Which number corresponds to the organelle that produces cellular energy?

*A. 1
B. 2
C. 3
D. 4

14. The Egyptian Plover bird is allowed to fly into the mouth of a crocodile and eat food scraps found there. Which term **best** describes this relationship?

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

15. What is the main function of epidermal plant tissue?

A. to provide support
*B. to prevent water loss
C. to carry on photosynthesis
D. to transport water and nutrients

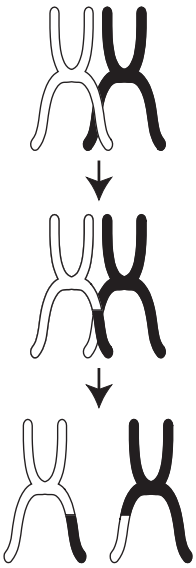
16. Lycopods have strands of tissue which allow water to flow from roots to leaves. What term describes this characteristic?

A. asexual
*B. vascular
C. prokaryotic
D. microscopic

17. Why is it important that the number of chromosomes be reduced during meiosis?

A. The cell can grow without the DNA content increasing.
B. The amount of DNA in the cell can remain at its lowest number.
*C. The chromosome number will stay constant from one generation to the next.
D. The nucleus of the cell will not be allowed to become larger due to cell growth.

18. What is true of the mode of inheritance shown below?



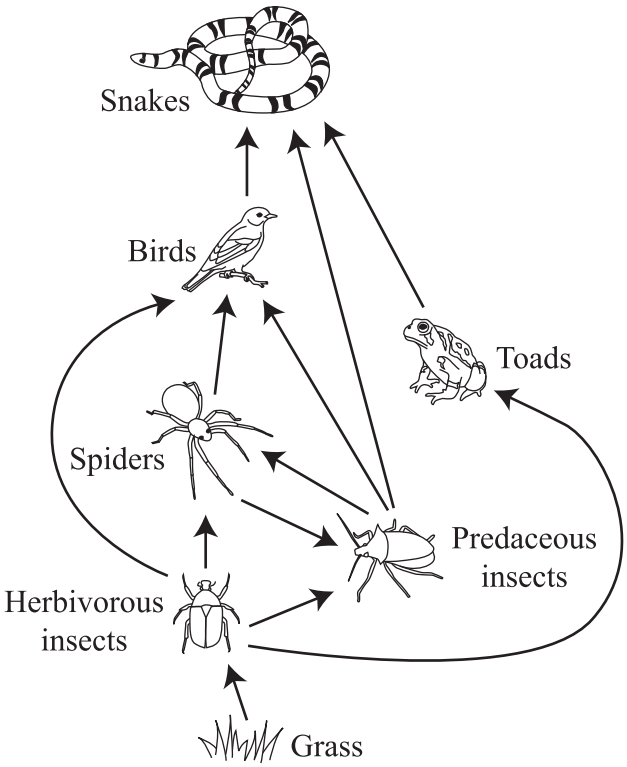
*A. Genetic information is exchanged.

B. Neither of the two genes masks each other.

C. The gene is always inherited from the same sex.

D. The offspring have a different and intermediate form of the parents' genes.

19. A simplified food web is shown below.



Suppose the bird population declines due to a shortage of nesting sites. Which organism would be **most** negatively affected by a decline in the bird population?

A. spider

*B. snake

C. grass

D. toad

20. A student used a microscope to study a tissue sample. Each cell had a cell wall. Which organism was studied?

*A. fern
B. deer
C. coral
D. shark

21. What is an example of the human body achieving homeostasis through thermoregulation?

A. Sweat is produced when exercising to expel excess water.
*B. Sweat is produced when exercising to keep the body cool.
C. In order to lower body temperature, extra melanin is produced in the skin.
D. In order to keep the body warm in the winter, extra blood flows out to the fingers and toes.

22. When viewing a karyotype, which evidence provides the strongest support that an individual body cell has the condition of trisomy?

*A. The cell has an odd number of chromosomes.
B. The cell has an even number of chromosomes.
C. One chromosome appears shorter than its match.
D. One chromosome appears to be inverted in comparison to its match.

23. Based on the table below, which taxa do the human and armadillo have in common?

Taxonomic Table

Human	**Armadillo**
Animalia	Animalia
Chordata	Chordata
Mammalia	Mammalia
Primata	Cingulata
Hominidae	Dasypodidae
Homo	*Dasypus*
sapiens	*novemcinctus*

A. kingdom, order
B. order, family, genus
C. family, genus, species
*D. kingdom, phylum, class

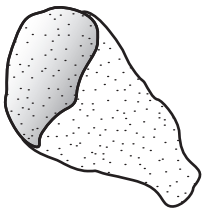
24. Which disturbance would set the stage for primary succession?

A. A farmer's field is flooded.
B. A rainforest is clear cut for timber.
*C. A volcano covers the ground with lava.
D. A fire burns through a temperate forest.

25. What breaks down to form carbon dioxide when bread dough is rising?

A. fat
B. fiber
C. protein
*D. glucose

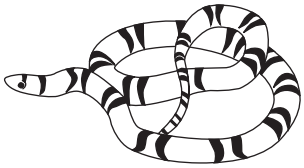
26. Which organism provides the **best** example of radial symmetry?

A. 

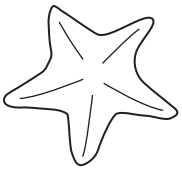
Sponge

B. 

Termite

C. 

Snake

*D. 

Starfish

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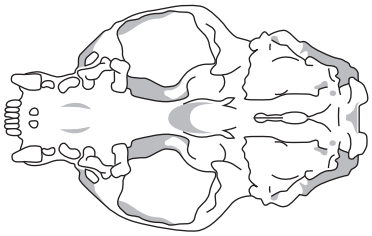
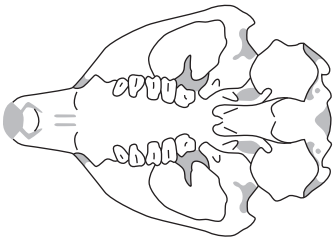
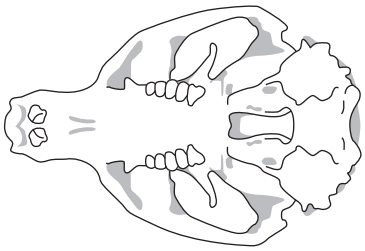
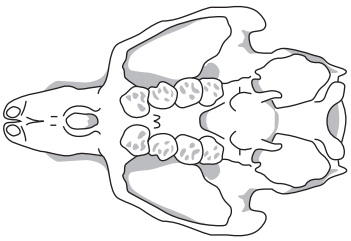
27. Which skull represents an animal that is **most** distantly related to the other three?

*A. 

B. 

C. 

D. 

28. How would the development of hybrid cars minimize the effects of human population growth on the environment?

A. by increasing noise pollution
B. by increasing smog production
*C. by decreasing dependence on fossil fuels
D. by decreasing the number of people traveling on highways

29. How are mitochondria and chloroplasts **different**?

*A. Mitochondria do not contain chlorophyll, and chloroplasts do.
B. Mitochondria only have one membrane, and chloroplasts have two.
C. Mitochondria capture light energy, and chloroplasts transform energy.
D. Mitochondria are found only in plant cells, and chloroplasts are found in both plant and animal cells.

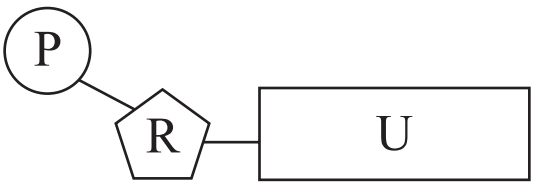
30. The table below presents the results of an experiment testing the number of hours it took for several flowers to bloom.

Flower	Hours
1	24
2	28
3	27
4	24
5	30
6	29

What is the mode of these data?

*A. 24.0
B. 27.0
C. 27.5
D. 30.0

31. The figure below shows an RNA nucleotide found within the cell.



What does the letter U represent in this nucleotide?

A. ribose sugar
*B. nitrogen base
C. phosphate group
D. deoxyribose sugar

32. Manufacturers in the United States have eliminated chlorofluorocarbons from common household aerosol products. This has reduced their contribution to which environmental problem?

A. acid rain
B. desertification
C. global climate change
*D. atmospheric ozone depletion

33. Which technological advance has increased the exchange of scientific knowledge the **most** around the world?

*A. the Internet
B. the microscope
C. the laptop computer
D. the handheld calculator

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 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. 3. Describe the role of sub-cellular structures in the life of a cell: • organelles • ribosomes • cytoskeleton 5. Compare and contrast the structures of an animal cell to a plant cell. 6. Compare and contrast the functions of autotrophs and heterotrophs. 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

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the April 2010 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.	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. 6. Identify effects of changes brought about by mutations: • beneficial • harmful • neutral
	6. Students shall examine the development of the theory of biological evolution.	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.

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the April 2010 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 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 12. Evaluate the medical and economic importance of protists. 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 20. Identify the symmetry of organisms: • radial • bilateral • asymmetrical

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

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.
	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 April 2010 End-of-Course Biology Examination.

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.	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.	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. 5. Formulate valid conclusions without bias.
	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. 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. 2. Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware).
	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 April 2010 End-of-Course Biology Examination.

PART IV Item Correlation with Curriculum Framework

Released Items for Biology*

Strands	Content Standards
1— Molecules and Cells (MC)	2. Students shall demonstrate an understanding of the structure and function of cells. 3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
2— Heredity and Evolution (HE)	4. Students shall demonstrate an understanding of heredity. 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the theory of biological evolution.
3— Classification and the Diversity of Life (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— Ecology and Behavioral Relationships (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— Nature of Science (NS)	10. Students shall demonstrate an understanding that science is a way of knowing. 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	HE	4	3
2	CDL	7	16
3	EBR	8	2
4	NS	10	2
5	NS	12	1
6	NS	11	1
7	NS	11	3
8	MC	2	9
9	NS	12	6
10	EBR	8	3
11	CDL	7	6
12	HE	4	5
13	MC	2	3
14	EBR	8	6
15	CDL	7	18
16	CDL	7	15
17	MC	2	10
18	HE	4	4
19	EBR	8	5
20	MC	2	5
21	MC	2	11
22	HE	4	6
23	CDL	7	3
24	EBR	8	7
25	MC	3	3
26	CDL	7	20
27	HE	6	5
28	EBR	9	1
29	MC	3	1
30	NS	13	1
31	HE	5	1
32	EBR	9	3
33	NS	14	4

*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	MC	1	1
2	NS	10	1
3	EBR	8	1
4	CDL	7	1
5	HE	4	2
6	MC	1	4
7	CDL	7	2
8	EBR	9	2
9	EBR	8	4
10	MC	2	1
11	HE	5	3
12	EBR	8	7
13	HE	5	2
14	NS	11	5
15	CDL	7	12
16	CDL	7	11
17	CDL	7	17
18	HE	5	6
19	HE	6	7
20	CDL	7	8
21	MC	3	4
22	NS	14	1
23	HE	6	6
24	EBR	9	2
25	NS	12	5
26	NS	13	2
27	MC	2	6
A	CDL	7	15
B	EBR	9	2
C	MC	2	5
D	NS	10	2
E	HE	6	6

*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

QAI-06216 RIB-B AR1004

QAI06216