ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Biology
Mid-Year End-of-Course Examination

January 2008 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 first semester participated in the *Biology Mid-Year End-of-Course Examination* in January 2008.

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 2008 operational administration. The test items included in Part II of this booklet are those items that contributed to the student performance results for that administration.

Students were given approximately an hour and a half each day to complete assigned test sessions during the two days of testing in January 2008. 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. Gregor Mendel's work with garden peas led him to a crucial understanding of inheritance. Before Mendel started his experiments, he had to ensure the plants were

A. hybrids.

B. asexual.

* C. purebred.

D. cross-pollinated.

2. Which statement is an example of a law of nature?

A. Amphibians evolved from fish living in shallow ponds.

B. A plant will be healthier when fertilizer is added to the soil each day.

C. The growth of a child is stunted when too much caffeine is consumed.

* D. The genes for a trait separate into different gametes during gamete formation.

3. People once believed that insects could spontaneously appear in a container with food. Which was the **most** likely reason that this belief was revised?

A. People saw fish appear from mud.

B. Microscopes and other tools were invented.

C. More people saw the insects appear in the containers.

* D. New observations were made when an experiment was conducted.

4. The presence of vertebrae is found in which kingdom?

A. Plantae

B. Protista

C. Archaea

* D. Animalia

5. In the seven major taxonomic categories, what appears between order and genus?

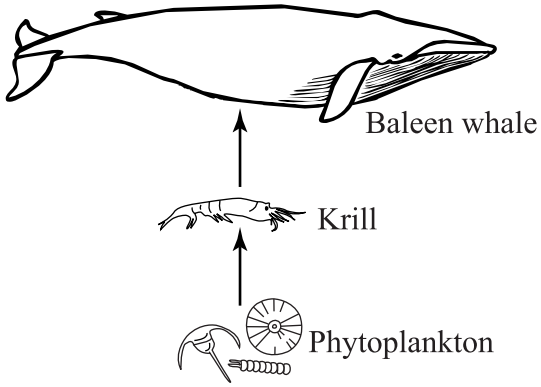
A. class

* B. family

C. species

D. phylum

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



A. krill

B. baleen whale

* C. phytoplankton

D. both krill and the baleen whale

7. Yeast, a common fungus, is economically important to the beverage industry because when placed in grape juice, it

A. releases sugars that react with alcohol in the juice.

B. acts as an enzyme to break down juice into alcohol.

* C. ferments carbohydrates in the juice and releases alcohol.

D. produces starch that bonds with juice sugars to form alcohol.

8. In terms of the structure of DNA, the scientist whose work is **most** significant is

* A. James Watson.

B. Gregor Mendel.

C. Barbara McClintock.

D. Thomas Hunt Morgan.

9. When an animal has to survive without food for a long time, it will eventually break down proteins for energy. However, this process occurs only after exhausting the animal's reserves of

A. DNA and RNA.

* B. carbohydrates and lipids.

C. carbon dioxide and water.

D. enzymes and nucleic acids.

10. A genetic counselor is examining a karyotype from a patient when an extra copy of chromosome 13 is noticed. This condition is referred to as

* A. trisomy.

B. diploidy.

C. triploidy.

D. monosomy.

11. One kind of bacteria lives, secretes enzymes into, and consumes dead organic matter in areas without oxygen. These bacteria can be classified as

A. parasites.

B. autotrophs.

C. eukaryotes.

* D. decomposers.

12. Based upon the partial DNA strand ACCTTGGGA, which partial mRNA strand would be transcripted?

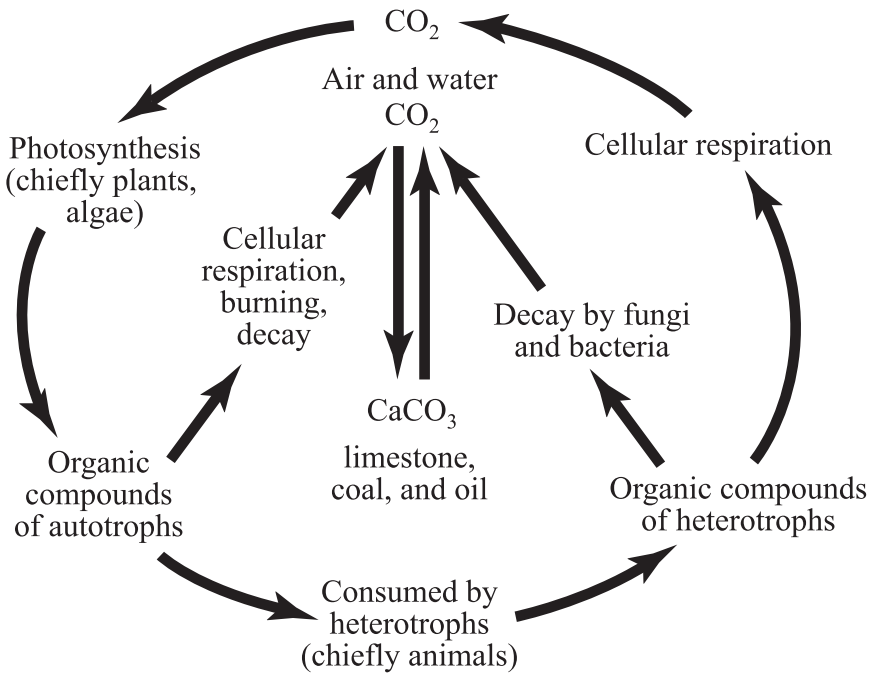
A. TGGAACCCT

B. TGGACTCCC

* C. UGGAACCCU

D. UGGACUCCC

13. Of what is the nutrient cycle below an example?



A. the water cycle

* B. the carbon cycle

C. the nitrogen cycle

D. the phosphate cycle

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14. What is mitosis?

A. cell respiration

* B. nuclear division

C. a method of taking in food

D. a method of removing waste

15. What aspect of the structure of viruses is similar to all living things?

A. microscopic size

B. absence of nuclei

* C. presence of nucleic acid

D. requirement of a host cell or body

16. A company that produces pesticides conducts an experiment to test the effectiveness of their newest product. The scientist involved in the development of the pesticide is the one who will interpret the results. Why is this a problem?

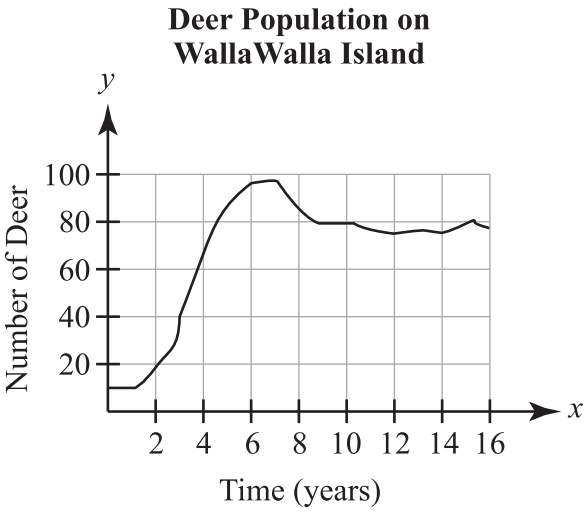
A. The pesticide could be made better during the process.

B. The results could be shared with a competing company.

C. The scientist will not know how to make accurate observations.

* D. The scientist may misinterpret the results because he knows what should happen.

17. Based on the graph below, what is the **best** explanation for the change in the deer population between years 2 and 6?



* A. There was limited predation of the deer.

B. Some deer left the area due to overcrowding.

C. The competition within the population for the resources increased.

D. The number of births equaled the number of deaths in the population.

18. How is primary succession **different** from secondary succession?

* A. Primary succession starts with bare rock, and secondary succession starts with soil.

B. Primary succession starts with soil, and secondary succession starts with bare rock.

C. Primary succession ends with grasslands, and secondary succession ends with a forest.

D. Primary succession ends with a forest, and secondary succession ends with grasslands.

19. Theory A is a well-established scientific theory. One hypothesis that could refute this theory is successfully tested over many experiments. What action must be taken for this hypothesis to pose a legitimate challenge to Theory A?

A. collecting empirical data

* B. publishing data for peer review

C. forming a question for an investigation

D. turning the hypothesis into scientific law

20. A person fills a drinking glass with water until the water is bulging slightly over the glass rim. The property of water that prevents the water from spilling is

A. pH.

B. osmosis.

* C. cohesion.

D. solubility.

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

A. DNA directs protein transport, while RNA aids in energy production.

B. DNA aids in energy production, while RNA directs protein transport.

* C. DNA stores genetic information, while RNA relays genetic information for protein synthesis.

D. DNA relays genetic information for protein synthesis, while RNA stores genetic information.

22. Reactions without enzymes are **different** from reactions where enzymes are present because they

* A. occur at a much slower rate.
B. require the presence of catalysts.
C. change the nature of their catalysts.
D. happen at much lower temperatures.

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

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

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

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

25. Humans could make the environment much more sustainable if technology could derive **most** of the world's energy supply from

A. coal.
B. wood.
* C. the Sun.
D. fossil fuels.

26. Geothermal energy can be converted from hot water or steam from deep within Earth's surface and transformed into electricity. One disadvantage of geothermal energy is that

A. it is a nonrenewable resource.
* B. habitats can be destroyed when drilling.
C. it releases hazardous waste into the atmosphere.
D. emitted toxins can gather in animals' bodies over time.

27. Which process produces two ATP molecules for every glucose molecule it breaks down?

* A. glycolysis
B. photosynthesis
C. the citric acid cycle
D. the electron transport chain

28. When scientists use human tissue samples for experiments, they are required to respect the rights and welfare of their human subjects. One way to do this is by

A. strictly following the scientific method during the experiment.
B. ensuring that the experiment results will greatly benefit humanity.
* C. obtaining informed consent from the subjects before taking the samples.
D. making public the names of the subjects and the data they obtained from them.

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

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

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

* A. 65 million years ago

B. 144 million years ago

C. 225 million years ago

D. 400 million years ago

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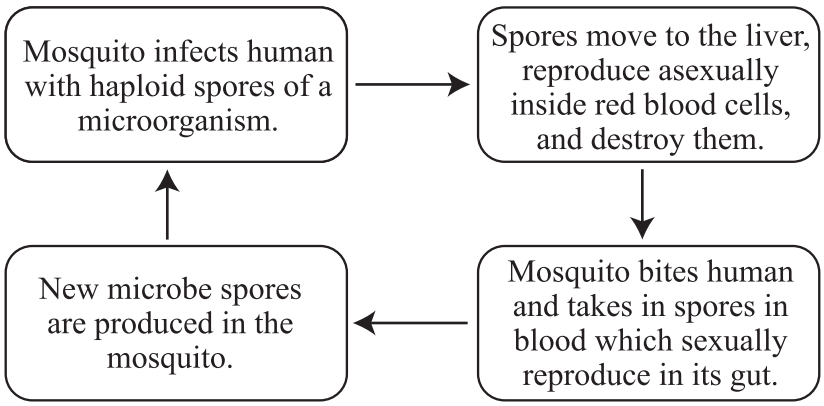
30. What does the diagram below reveal about the medical significance of protists?



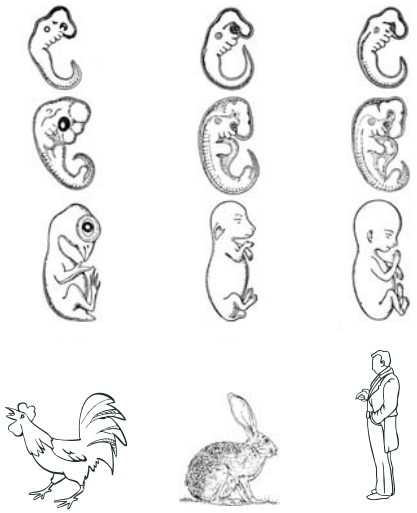
* A. They are often carried by other organisms.

B. They are considered to be living organisms.

C. They cause diseases that may not have cures.

D. They cause diseases that are not cured by antibiotics.

31. The figure below shows embryonic stages of three different kinds of organisms.



Chicken Rabbit Human

What does the figure suggest about these organisms?

A. They underwent similar mutations.

B. They share the same acquired traits.

C. They originated in the same location.

* D. They show similar embryonic development.

32. How are photosynthesis and cellular respiration similar?

A. They occur in animal cells.

B. They take place in the same organelle.

* C. They involve the conversion of energy.

D. They produce the same complex carbohydrate.

33. One issue caused by ozone depletion is increased

A. acid rain.

* B. skin cancer cases.

C. fossil fuel emissions.

D. number of infectious diseases.

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.	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. 8. Describe the main events in the cell cycle, including the differences in plant and animal cell division. • interphase • mitosis • cytokinesis 11. Discuss homeostasis using thermoregulation as an example.
	3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).	2. Describe and model the conversion of stored energy in organic molecules into usable cellular energy (ATP). • glycolysis • citric acid cycle • electron transport chain 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.
2. HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of heredity.	1. Summarize the outcomes of Gregor Mendel's experimental procedures. 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

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

PART III Curriculum Framework

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
2. HEREDITY AND EVOLUTION (HE)	5. Students shall investigate the molecular basis of genetics.	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. 6. Identify effects of changes brought about by mutations. • beneficial • harmful • neutral
	6. Students shall examine the development of the theory of biological evolution.	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
3. CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.	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. 7. Evaluate the medical and economic importance of viruses. 9. Classify bacteria according to their characteristics and adaptations. 10. Evaluate the medical and economic importance of bacteria. 11. Describe the characteristics used to classify protists. • plant-like • animal-like • fungal-like 12. Evaluate the medical and economic importance of protists. 14. Evaluate the medical and economic importance of fungi. 15. Differentiate between vascular and nonvascular plants. 18. Relate the structure of plant tissue to its function. • epidermal • ground • vascular 19. Evaluate the medical and economic importance of plants.

*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)	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).
5. NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing.	2. Compare and contrast hypotheses, theories, and laws. 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.	3. Identify sources of bias that could affect experimental outcome.
	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. 3. Summarize biological evolution. 7. Research current events and topics in biology.
	13. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems.	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. 2. Discuss why scientists should work within ethical parameters. 4. Explain how the cyclical relationship between science and technology results in reciprocal advancements in science and technology.
	15. Students shall describe various life science careers and the training required for the selected career.	1. Research and evaluate science careers using the following criteria. • educational requirements • salary • availability of jobs • working conditions

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

PART IV Item Correlation with Curriculum Framework

Released Items for Biology*

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

*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. 15. Students shall describe various life science careers and the training required for the selected career.

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

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

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QAI03410 RIB-B AR0806