



Arkansas Comprehensive Testing, Assessment, and Accountability Program

**RELEASED ITEM**  
**BOOKLET**  
**Biology**  
**End-of-Course Examinations**  
**2012–2013 Administrations**

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**Arkansas Department of Education**



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## PART I OVERVIEW

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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 in 2013 who had completed or were completing Biology by the end of first semester participated in the *Mid-Year Biology End-of-Course Examination*. Students in Arkansas public schools who had completed or were completing Biology by the end of the spring semester participated in the *Spring Biology End-of-Course Examination*.

This Released Item Booklet for the Biology End-of-Course Examinations contains test questions or items that were asked of students during the 2012–2013 operational administrations. The test items included in Part II of this booklet are some of the items that contributed to the student performance results for these administrations.

Students were given approximately an hour and a half each day to complete assigned test sessions during the two days of Mid-Year testing and approximately two hours each day to complete assigned test sessions during the two days of Spring 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 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, there may be many cases in which 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 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. 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 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**

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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. Readers are trained to score in only one content area. Qualified readers for Arkansas scoring will be those with a four-year college degree in science, education, or related fields.

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 prescored 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 prescored papers, and, in order to qualify, each reader scoring Biology responses must score in exact agreement on at least 80% of 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 MID-YEAR RELEASED BIOLOGY ITEMS

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1. Which describes a difference between DNA and RNA?
  - A. DNA constructs proteins whereas RNA translates genetic information.
  - B. DNA makes up ribosomes whereas RNA transfers genetic information.
  - C. DNA translates genetic information whereas RNA maintains genetic information.
  - \* D. DNA maintains genetic information whereas RNA helps construct proteins based on genetic information.
  
2. Under which environmental condition would primary succession occur?
  - \* A. bare rock exposed as glaciers melt
  - B. meadow following a controlled burn
  - C. forest after trees fall during a severe storm
  - D. farm field no longer being used to cultivate crops

3. A scientist is conducting an experiment to test the effect of vitamin D on the growth of mice. Two groups of mice are raised in identical conditions and fed the same diet. One group is given daily injections of vitamin D. The other group is given daily injections of saline solution.

Which is the independent variable in the experiment?

- A. growth of the mice
  - \* B. type of injection given
  - C. mice injected with vitamin D
  - D. mice injected with saline solution
- 
4. Which statement describes cytokinesis in animal cells?
    - A. A cell plate forms and pinches the cell in half.
    - B. Microtubules pull the cell halves to opposite poles.
    - \* C. A cleavage furrow forms and pinches the cell in half.
    - D. Spindle fibers pull the membrane into the center, cutting the cell in half.

5. What is the **main** function of vascular tissue in plants?
- A. support of the leaves
  - B. protection from injury
  - C. growth through division
  - \* D. transportation of nutrients
6. Which list contains **only** abiotic factors?
- \* A. water temperature, amount of sunlight, and soil type
  - B. density of predators, water depth, and types of parasites
  - C. precipitation amount, number of prey species, and plant types
  - D. variety of food sources, annual precipitation, and number of decomposers
7. Which describes the cell theory?
- \* A. Cells are the basic unit of structure for every living thing.
  - B. All living things are made up of many cells performing different functions.
  - C. All living things are made up of a single cell that performs different functions.
  - D. Cells contain hereditary information in DNA that is passed from cell to cell during division.
8. Which term is used for a chemical reaction that releases energy?
- A. potential
  - \* B. exergonic
  - C. endergonic
  - D. competitive
9. Which statement is correct when comparing RNA and DNA?
- A. DNA has the sugar ribose, while RNA has the sugar deoxyribose.
  - \* B. DNA is usually double-stranded while RNA is usually single-stranded.
  - C. DNA is usually single-stranded while RNA is usually double-stranded.
  - D. DNA has the nucleotides adenine, uracil, cytosine, and guanine while RNA has the nucleotides adenine, thymine, cytosine, and guanine.
10. Which is similar between autotrophs and heterotrophs?
- \* A. Both need to obtain energy.
  - B. Both need to produce glucose.
  - C. Both use the same method of absorbing water.
  - D. Both occupy the same position in a food chain.

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

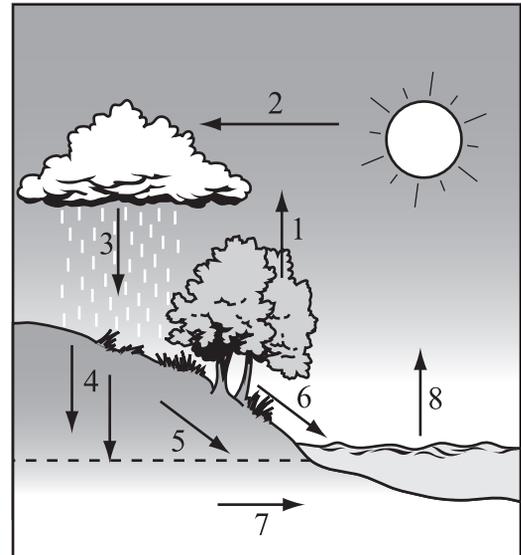
11. Which is true regarding biological evolution?

- A. involves a change in the frequency of males in a population
- \* B. involves a change in the frequency of alleles in a population
- C. involves a change in the frequency of females in a population
- D. involves a change in the frequency of families in a population

12. Which invertebrate has the simplest form of digestion?

- A. snail
- B. insect
- \* C. sponge
- D. flatworm

13. This diagram shows the water cycle.



Which number shows evaporation taking place?

- A. 3
- B. 4
- C. 5
- \* D. 8

14. In the early twentieth century, the pattern of inheritance called sex-linkage was discovered by Thomas Hunt Morgan. This discovery added new information to the work that Gregor Mendel completed nearly a century earlier.

Which principle of scientific inquiry does this illustrate?

- A. Conclusions must be verified before they are accepted.
  - B. Most principles are changed by discoveries in modern times.
  - \* C. Scientific understandings are modified or expanded when new information is found.
  - D. Theories must contain contributions or evidence from more than one scientist or more than one type of experiment.
15. Which involves the **least** number of species?

- A. biome
- B. ecosystem
- \* C. population
- D. community

16. What is the process that copies a gene's DNA sequence into a sequence of RNA?

- A. insertion
- B. initiation
- C. translation
- \* D. transcription

17. In the human body, the blood stream transports water and nutrients throughout the body.

Which type of tissue serves a similar function in plants?

- A. dermal
- B. ground
- \* C. vascular
- D. connective

18. Which process is found **only** in autotrophs?

- A. glycolysis
- \* B. photosynthesis
- C. citric acid cycle
- D. cellular respiration

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

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19. Examine the table below.

**Amino Acid Production**

Species	DNA Base Sequence	mRNA Base Sequence	Amino Acid
1	CCG	GGC	GLY
	TGC	ACG	THR
	ATA	UAU	TYR
	CAG	GUC	VAL
	GTA	CAU	HIS
2	TGC	ACG	THR
	TGC	ACG	THR
	ATA	UAU	TYR
	CCG	GGC	GLY
	GTA	CAU	HIS
3	CCG	GGC	GLY
	TGC	ACG	THR
	ATA	UAU	TYR
	CAG	GUC	VAL
	GTT	CAA	PRO
4	TGC	ACG	THR
	GTG	CAC	HIS
	ATG	UAC	TYR
	CCG	GGC	GLY
	GTC	CAG	GLN

Based on the information in the table above, which two species are **most** closely related?

- \* A. Species 1 and 3
- B. Species 2 and 3
- C. Species 2 and 4
- D. Species 3 and 4

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

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20. Two organisms belonging to the same order share which other taxonomic categories?

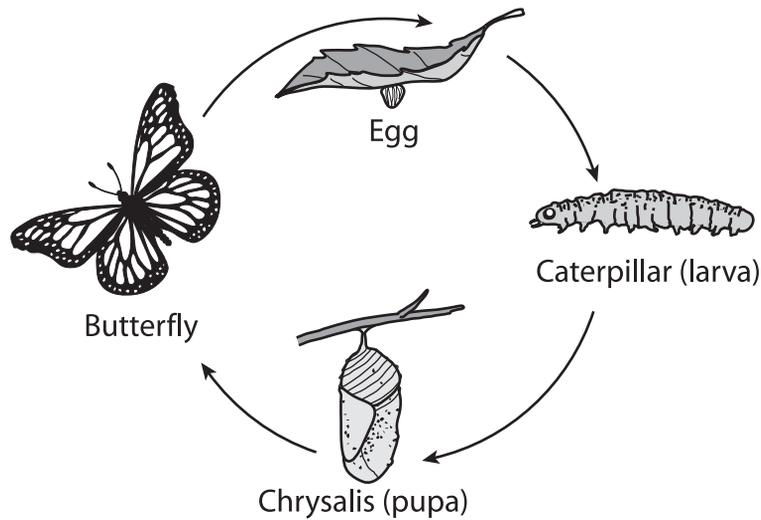
- A. class and genus
- B. family and class
- C. genus and species
- \* D. kingdom and phylum

21. Which has been a direct result of the development of the germ theory?

- \* A. increased sanitation and hygiene
- B. use of radiation in cancer treatment
- C. use of gene therapy to prevent disease
- D. increased use of magnetic resonance imaging

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

22. The diagram below represents the life cycle of a butterfly.



Which type of life cycle is represented in the diagram?

- A. asexual reproduction
  - \* B. complete metamorphosis
  - C. alternation of generations
  - D. incomplete metamorphosis
- 
23. Which are typical pioneer species during primary succession?
- A. trees
  - B. shrubs
  - \* C. lichens
  - D. grasses

24. A researcher needs to isolate mitochondria from a solution of lysed cells.

Which piece of equipment should be used?

- \* A. centrifuge
- B. microscope
- C. inoculating loop
- D. electrophoresis chamber

25. Which is **correctly** ordered from lesser complexity to greater complexity?
- \* A. organelle – cell – tissue – organ – organ system
  - B. cell – organism – ecosystem – population – community
  - C. organelles – organism – organ system – organs – tissues
  - D. ecosystem – organism – organ system – cell – organelles

26. The debate has continued for many years about nuclear energy. There are advantages and disadvantages to the production of electricity through nuclear energy. Human safety and disposal of the radioactive waste top the list of disadvantages.

Compared to the burning of fossil fuels, what advantage does nuclear power hold for the biosphere?

- A. eliminates the need for mining
- B. uses a renewable energy source
- \* C. releases less CO<sub>2</sub> waste products
- D. releases more CO<sub>2</sub> waste products

27. Examine the DNA sequences below.

**Original Sequence:**

**ATG GCC AGA TCA TGA**

**Sequence after a mutation event:**

**ATG GCC GGA TCA TGA**

Which type of mutation has occurred?

- \* A. point
  - B. deletion
  - C. inversion
  - D. frameshift
28. Which describes when two different species utilize the same resource?
- A. crowding
  - B. predation
  - C. parasitism
  - \* D. competition

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

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29. Which is a benefit of receiving a vaccination?

- A. Antigen production is blocked.
- B. Platelet production is triggered.
- \* C. Antibody production is triggered.
- D. White blood cell production is blocked.

30. Which must be true of any scientific hypothesis?

- \* A. must be testable
- B. must undergo peer review
- C. must be approved by professionals
- D. must be proven correct by research

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

- A.
1. Explain how the fossil record can provide evidence for evolution.
  2. Explain why some organisms are not fossilized and how this affects the overall fossil record.
  3. Explain how DNA analysis of organisms is used to provide evidence for evolution.
  4. Explain why DNA analysis is a more accurate method of inferring relationships among organisms than the fossil record.

BE SURE TO LABEL YOUR RESPONSES 1, 2, 3, AND 4.

<b>Item A Scoring Rubric—2013 Biology</b>
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Part	Points
1	1 point possible: Explains how the fossil record can provide evidence for evolution.
2	1 point possible: Explains why some organisms are not fossilized and how this affects the overall fossil record.
3	1 point possible: Explains how DNA analysis of organisms is used to provide evidence for evolution.
4	1 point possible: Explains why DNA analysis is a more accurate method of inferring relationships among organisms than the fossil record.

Score	Description
4	Response shows a <i>complete understanding</i> of evaluating evolution in terms of evidence. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of evaluating evolution in terms of evidence. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of evaluating evolution in terms of evidence. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of evaluating evolution in terms of evidence. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of evaluating evolution in terms of evidence. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

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### SOLUTION AND SCORING

4 points possible:

Part	Points
1	<p><b>1 point possible:</b></p> <p>Older fossils can be compared to younger fossils to show how the body structures (bones) of related organisms have changed over time.</p> <p><b>OR</b></p> <p>Fossils found in different layers can be used to compare and contrast body structures (bones). If changes are found it could be evidence of evolution.</p>
2	<p><b>1 point possible:</b></p> <p>Many organisms that have soft bodies would have been destroyed before a fossil could have been formed.</p> <p><b>OR</b></p> <p>Organisms decayed too fast for a fossil to be formed.</p> <p><b>OR</b></p> <p>Organisms die where fossils cannot be formed.</p> <p><b>AND</b></p> <p>Because not all organisms formed fossils there are gaps in the fossil record.</p> <p><b>OR</b></p> <p>Not all organisms are represented in the fossil record.</p>
3	<p><b>1 point possible:</b></p> <p>The DNA sequences of organisms can be compared. The more alike the sequences are the closer two organisms are related.</p>
4	<p><b>1 point possible:</b></p> <p>Two fossils may look similar but they may share analogous not homologous structures. This means they developed these structures because of the environment they lived in not because they are closely related. DNA evidence is less subjective. DNA analysis provides concrete evidence of relatedness.</p>

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

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B. The following is a partial list of vertebrate classes:

- **Amphibians**
- **Reptiles**
- **Birds**
- **Mammals**

1. List two of the above classes and describe a similarity in the circulatory system of the two classes listed.
2. List two of the above classes and describe a difference in the circulatory system of the two classes listed.
3. List two of the above classes and describe a similarity in the respiratory system of the two classes listed.
4. List two of the above classes and describe a difference in the respiratory system of the two classes listed.

BE SURE TO LABEL YOUR RESPONSE 1, 2, 3, AND 4.

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

### Item B Scoring Rubric—2013 Biology

Part	Points
1	1 point possible: Describes a similarity in the circulatory system of the two classes listed.
2	1 point possible: Describes a difference in the circulatory system of the two classes listed.
3	1 point possible: Describes a similarity in the respiratory system of the two classes listed.
4	1 point possible: Describes a difference in the respiratory system of the two classes listed.

Score	Description
4	Response shows a <i>complete understanding</i> of comparing and contrasting the major vertebrate classes. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of comparing and contrasting the major vertebrate classes. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of comparing and contrasting the major vertebrate classes. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of comparing and contrasting the major vertebrate classes. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of comparing and contrasting the major vertebrate classes. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

## PART II MID-YEAR RELEASED BIOLOGY ITEMS

### SOLUTION AND SCORING

4 points possible:

Part	Points																				
<b>1</b>	<b>2 points possible: 1 point for a similarity and 1 point for a difference</b>																				
<b>and</b>	Circulatory Systems																				
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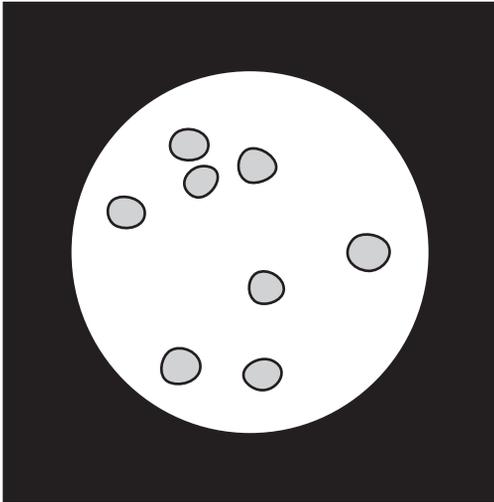
## PART II MID-YEAR RELEASED BIOLOGY ITEMS

Part	Points																								
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1. Which matches a type of transport with its description?
  - \* A. Phagocytosis – engulfing large particles into a cell
  - B. Pinocytosis – expelling large amounts of liquid from the cell
  - C. Endocytosis – releasing large amounts of material from the cell
  - D. Exocytosis – taking materials into the cell by means of infoldings of the cell membrane
  
2. Which waste management plan allows for the disposal of waste while reducing the consumption of raw materials for new products?
  - \* A. recycling
  - B. incineration
  - C. trash compaction
  - D. landfill expansion
  
3. Which is the **most** important criteria for a hypothesis to be useful in science?
  - A. It is correct.
  - \* B. It is testable.
  - C. It can be observed.
  - D. It can be measured.
  
4. Which **correctly** compares the structures and functions of mitochondria with those of chloroplasts?
  - A. Mitochondria have thylakoids and convert light energy into chemical energy. Chloroplasts have cristae and convert chemical energy into ATP.
  - B. Mitochondria have cristae and convert light energy into chemical energy. Chloroplasts have thylakoids and convert chemical energy into ATP.
  - \* C. Mitochondria have cristae and convert chemical energy into ATP. Chloroplasts have thylakoids and convert light energy into chemical energy.
  - D. Mitochondria have thylakoids and convert chemical energy into ATP. Chloroplasts have many cristae and convert light energy into chemical energy.
  
5. Which is true if a population is in genetic equilibrium?
  - A. Evolution is occurring.
  - B. New species are evolving.
  - C. Allele frequency is changing from one generation to the next.
  - \* D. Allele frequency is remaining the same from one generation to the next.

## PART II SPRING RELEASED BIOLOGY ITEMS

6. The graphic below shows bacterial cells as seen through a microscope.



Which describes the shape of these bacteria?

- A. vibrio
  - \* B. coccus
  - C. bacillus
  - D. spirillum
7. Which has declined because of the growth of the human population?
- \* A. biodiversity
  - B. deforestation
  - C. extinction rates
  - D. habitat destruction

8. When an individual is heterozygous for a particular allele, the dominant allele always masks the recessive allele in the phenotype.

What is this an example of?

- A. a hypothesis
  - B. an experiment
  - \* C. a scientific law
  - D. a scientific theory
9. Which is a function of ribosomes in a cell?
- A. produce energy
  - \* B. produce protein
  - C. perform respiration
  - D. perform photosynthesis
10. Viruses are infectious particles made of nucleic acid and protein.

Based on the cell theory, how would viruses be described today?

- A. Viruses are living because they are made of cells.
- B. Viruses are non-living because they are not multicellular.
- \* C. Viruses are non-living because they are not made of cells.
- D. Viruses are living because they are produced from existing cells.

11. Which describes how meiosis helps maintain an organism's chromosome number over generations?
- A. Meiosis occurs in organisms that reproduce asexually, with each parent needing half the chromosome number for faster division.
  - B. A constant chromosome number occurs in organisms that reproduce sexually to ensure that they can reproduce by binary fission.
  - C. A constant chromosome number occurs in organisms that reproduce asexually to ensure that they can continue to reproduce asexually.
  - \* D. Meiosis occurs in organisms that reproduce sexually, with each parent contributing half of the required genetic material to the offspring.
12. Which characteristic makes a protist animal-like?
- A. having a nucleus
  - B. having chloroplasts
  - C. acting as an autotroph
  - \* D. acting as a heterotroph

13. Which describes a similarity between cellular respiration and photosynthesis?
- A. Animal cells carry out both reactions in different organelles.
  - B. Lysosomes break down waste products during both reactions.
  - \* C. Part of both reactions occurs in specialized organelle membranes.
  - D. Both reactions begin with a breakdown of molecules in the cytoplasm.
14. Look at the Punnett square below.

	Y	y
Y		
y		

In this cross, a yellow seed pea plant (Yy) is crossed with a yellow seed pea plant (Yy).

What are the genotypes for the offspring in this cross?

- A. Yy, Yy, Yy, Yy
- \* B. YY, Yy, Yy, yy
- C. YY, YY, Yy, Yy
- D. YY, YY, YY, YY

## PART II SPRING RELEASED BIOLOGY ITEMS

15. The Montreal Protocol is an agreement among some countries to decrease and eliminate the use of certain chemicals such as chlorofluorocarbons (CFCs) in aerosol cans.

What is the Montreal Protocol **directly** trying to protect?

- \* A. ozone layer
  - B. polar ice caps
  - C. old growth forests
  - D. endangered species
16. The table below displays the scientific names of three different bears.

Bear	Scientific Name
A	<i>Ursus maritimus</i>
B	<i>Ailuropoda melanoleuca</i>
C	<i>Ursus arctos</i>

Which statement is correct?

- \* A. Bears A and C belong to the same genus.
- B. Bears A and C belong to the same species.
- C. Bears A and B are most similar to one another.
- D. Bears B and C are most similar to one another.

17. A student collected data on the percent of time cells spent in each phase of the cell cycle.

Which type of graph would **best** display this data?

- \* A. pie
  - B. bar
  - C. scatter plot
  - D. multiple line
18. Which do aerobic respiration and anaerobic respiration have in common?
- A. Both require oxygen.
  - B. Both produce alcohol.
  - \* C. Both begin with glycolysis.
  - D. Both occur in the mitochondria.
19. An organism has a nucleus and is multicellular but has no cell wall and no chloroplasts.

This organism belongs to which kingdom?

- A. Fungi
- B. Plantae
- \* C. Animalia
- D. Eubacteria

20. Which **best** describes an ecosystem?
- A. a group of species that inhabits a particular area
  - \* B. a group of populations as well as the abiotic environment
  - C. all the organisms of one species that inhabit a particular area
  - D. all the zones of Earth's land, water, and air where living organisms are found

21. Which is true regarding the function of DNA and RNA?
- A. RNA serves to ensure that DNA is protected when it leaves the nucleus. DNA serves as the storage facility for instructions.
  - B. DNA serves as the instructions to make all necessary cell products. RNA is the storage site for the amino acids needed to make these products.
  - C. RNA serves as the blueprint which contains all the information that the cell needs to function. DNA serves as the translator between the nucleic acid language and the amino acid language in proteins.
  - \* D. DNA serves as the blueprint which contains all the information that the cell needs to function. RNA serves as the translator between the nucleic acid language and the amino acid language in proteins.

22. Which term describes all trees?

- \* A. vascular
- B. angiosperm
- C. nonvascular
- D. gymnosperm

23. Examine the DNA sequence below.

**TAC CCG ATC AAA GCC**

Which represents the complementary strand of DNA?

- A. CGT TTA GCT GGG ATT
  - \* B. ATG GGC TAG TTT CGG
  - C. GCA AAT CGA CCC TAA
  - D. UAC CCG AUC AAA GCC
24. Which biome is characterized by a cold, wet climate and coniferous trees?
- \* A. taiga
  - B. desert
  - C. tundra
  - D. grassland
25. Which is primarily composed of the molecules cytosine, guanine, adenine, and thymine?
- A. lipid
  - \* B. DNA
  - C. RNA
  - D. protein

## PART II SPRING RELEASED BIOLOGY ITEMS

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26. Understanding cell division in order to develop treatments for cancer is an example of which type of science?

- A. pure
- \* B. applied
- C. bioethics
- D. theoretical

27. Why is Mendel known as the father of genetics?

- A. He was the first to study the traits of plants.
- B. He was the first to keep detailed records during experiments.
- C. He was the first to establish that DNA is passed from parents to offspring.
- \* D. He was the first to describe the process of inheritance between parents and offspring.

28. The class Mammalia can be split into more restrictive groups such as Carnivora, Insectivora, and Marsupialia.

Which taxonomic level describes Carnivora, Insectivora, and Marsupialia?

- \* A. order
- B. phylum
- C. domain
- D. kingdom

29. Which statement describes a **main** difference between primary and secondary succession?

- A. Primary succession is always followed by secondary succession.
- B. Secondary succession always ends in a climax community while primary succession does not.
- \* C. Primary succession always starts with barren, rock areas while secondary succession does not.
- D. Secondary succession always reaches a climax community of trees while primary succession ends with pioneer species.

30. Gestation period is the length of time the female carries the developing young before birth. The graph below represents the gestation period and the average life span of five mammals.

**Mammal Gestation**

<b>Animal</b>	<b>Gestation Period (in days)</b>	<b>Average Life Span (in years)</b>
Rat	21	4
Horse	360	25
Squirrel	44	8
Elephant	660	70
Grey wolf	62	10

Which is a valid conclusion based on the data above?

- \* A. The longer the gestation period for each animal, the longer the life span.
- B. The longer the gestation period for each animal, the shorter the life span.
- C. Mammals living in temperate climates live longer than those in the tropics.
- D. Placental mammals have a shorter gestation period than marsupial mammals.

## PART II SPRING RELEASED BIOLOGY ITEMS

- A.
1. Describe one event that occurs during interphase of the cell cycle.
  2. Describe one event that occurs during metaphase of mitosis.
  3. Describe one event that occurs during anaphase of mitosis.
  4. Describe one way cytokinesis in animal cells is different from cytokinesis in plant cells.

BE SURE TO LABEL YOUR RESPONSES 1, 2, 3, AND 4.

### Item A Scoring Rubric—2013 Biology

Part	Points
1	1 point possible: Describes one event that occurs during interphase of the cell cycle.
2	1 point possible: Describes one event that occurs during metaphase of mitosis.
3	1 point possible: Describes one event that occurs during anaphase of mitosis.
4	1 point possible: Describes one way cytokinesis in animal cells is different from cytokinesis in plant cells.

Score	Description
4	Response shows a <i>complete understanding</i> of the main events in the cell cycle, including the differences in plant and animal cell division. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of the main events in the cell cycle, including the differences in plant and animal cell division. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of the main events in the cell cycle, including the differences in plant and animal cell division. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of the main events in the cell cycle, including the differences in plant and animal cell division. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of the main events in the cell cycle, including the differences in plant and animal cell division. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

**SOLUTION AND SCORING**

**4 points possible:**

Part	Points
<b>1</b>	<p><b>1 point possible:</b></p> <p>Cell grows and produces organelles and proteins (G1)</p> <p><b>OR</b></p> <p>DNA replication (copies its chromosomes)      (S)</p> <p><b>OR</b></p> <p>Formation of centrioles in animal cells      (G2)</p>
<b>2</b>	<p><b>1 point possible:</b></p> <p>The chromosomes meet on the metaphase plate.</p> <p><b>OR</b></p> <p>The centrosomes are now at the opposite ends (poles) of the cell.</p> <p><b>OR</b></p> <p>Chromatids are attached to microtubules coming from opposite poles of the cell.</p>
<b>3</b>	<p><b>1 point possible:</b></p> <p>The paired centromeres separate and the sister chromatids split apart.</p> <p><b>OR</b></p> <p>Daughter chromosomes begin to move toward opposite poles of the cell (microtubules are shortening).</p> <p><b>OR</b></p> <p>Poles of the cell move further apart.</p>
<b>4</b>	<p><b>1 point possible:</b></p> <p>Cytokinesis in plant cells involves production of a cell plate. (In animal cells cytokinesis begins with a cleavage furrow.)</p> <p><b>OR</b></p> <p>In animal cells, cytokinesis results in two completely separate cells, while in plant cells the result of cytokinesis is two daughter cells with a cell plate formed between them.</p>

## PART II SPRING RELEASED BIOLOGY ITEMS

- B.** In recent years there has been an increase in the use of electric and hybrid cars by the general public.
- Identify and explain a positive environmental effect of the increased use of hybrid and electric cars.
  - Identify and explain a negative environmental effect of the increased use of hybrid and electric cars.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

### Item B Scoring Rubric—2013 Biology

Part	Points
1	2 points possible: 1 point for identification of a positive environmental effect of more hybrid and electric cars being used. 1 point for an explanation of a positive environmental effect of more hybrid and electric cars being used.
2	2 points possible: 1 point for identification of a negative environmental effect of more hybrid and electric cars being used. 1 point for an explanation of a negative environmental effect of more hybrid and electric cars being used.

Score	Description
4	Response shows a <i>complete understanding</i> of analyzing the effects of human population growth and technology on the environment/biosphere. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of analyzing the effects of human population growth and technology on the environment/biosphere. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of analyzing the effects of human population growth and technology on the environment/biosphere. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of analyzing the effects of human population growth and technology on the environment/biosphere. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of analyzing the effects of human population growth and technology on the environment/biosphere. The reader may not be able to understand how and why decisions were made.
<b>B</b>	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

**SOLUTION AND SCORING**

**4 points possible:**

Part	Points		
<b>1</b>	<p><b>2 points possible:</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <p><b>1 Point Identification</b> Less fossil fuels are burned</p> <p>Less fuel is bought from foreign countries</p> </td> <td style="width: 50%; border: none; vertical-align: top;"> <p><b>1 Point Explanation</b> Less CO<sub>2</sub> goes into the atmosphere Slow down the depletion of natural resources. Less pollution from transporting fuels great distances.</p> </td> </tr> </table>	<p><b>1 Point Identification</b> Less fossil fuels are burned</p> <p>Less fuel is bought from foreign countries</p>	<p><b>1 Point Explanation</b> Less CO<sub>2</sub> goes into the atmosphere Slow down the depletion of natural resources. Less pollution from transporting fuels great distances.</p>
<p><b>1 Point Identification</b> Less fossil fuels are burned</p> <p>Less fuel is bought from foreign countries</p>	<p><b>1 Point Explanation</b> Less CO<sub>2</sub> goes into the atmosphere Slow down the depletion of natural resources. Less pollution from transporting fuels great distances.</p>		
<b>2</b>	<p><b>2 points possible:</b></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> <p><b>1 Point Identification</b> Increased use of coal</p> <p>Increased pollution from power plants</p> </td> <td style="width: 50%; border: none; vertical-align: top;"> <p><b>1 Point Explanation</b> The electricity may be produced in power plants that use coal which will lead to more pollution.</p> <p>Most electricity is produced in power plants that use fossil fuels. There may not be any decrease in emissions.</p> </td> </tr> </table>	<p><b>1 Point Identification</b> Increased use of coal</p> <p>Increased pollution from power plants</p>	<p><b>1 Point Explanation</b> The electricity may be produced in power plants that use coal which will lead to more pollution.</p> <p>Most electricity is produced in power plants that use fossil fuels. There may not be any decrease in emissions.</p>
<p><b>1 Point Identification</b> Increased use of coal</p> <p>Increased pollution from power plants</p>	<p><b>1 Point Explanation</b> The electricity may be produced in power plants that use coal which will lead to more pollution.</p> <p>Most electricity is produced in power plants that use fossil fuels. There may not be any decrease in emissions.</p>		

## PART II SPRING RELEASED BIOLOGY ITEMS

- C. A new medication for the treatment of high blood pressure is developed by a pharmaceutical company. Research and experimentation has shown it to be safe and effective in non-human animal testing. The next phase is testing on humans. A “blind study” is proposed in which some patients will receive the medication and others will receive a placebo. Researchers will observe and record any effects of the medication on the disorder, along with possible side-effects.
1. Identify the dependent variable in this study.  
Explain why this is the dependent variable.
  2. Identify the independent variable in this study.  
Explain why this is the independent variable.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

### Item C Scoring Rubric—2013 Biology

Part	Points
1	2 points possible: 1 point for identifying dependent variable, 1 point for explaining why this is the dependent variable.
2	2 points possible: 1 point for identifying independent variable, 1 point for explaining why this is the independent variable.

Score	Description
4	Response shows a <i>complete understanding</i> of the appropriate procedure, controls, and variables in scientific experimentation. The student answers correctly and responds to all parts of the task.
3	Response shows a <i>nearly complete understanding</i> of the appropriate procedure, controls, and variables in scientific experimentation. The student presents nearly all answers correctly and responds to all parts of the task. The response may contain minor errors.
2	Response shows a <i>limited understanding</i> of the appropriate procedure, controls, and variables in scientific experimentation. The student answers some questions correctly and responds correctly to most parts of the task. The response may contain a major error.
1	Response shows a <i>minimal understanding</i> of the appropriate procedure, controls, and variables in scientific experimentation. The student presents some correct work that contributes to a correct answer. The response contains incomplete answers and major errors.
0	Response shows <i>insufficient understanding</i> of the appropriate procedure, controls, and variables in scientific experimentation. The reader may not be able to understand how and why decisions were made.
B	Blank—No response. A score of “B” will be reported as “NA.” (No attempt to answer the item. Score of “0” is assigned for the item.)

**SOLUTION AND SCORING**

**4 points possible:**

<b>Part</b>	<b>Points</b>
<b>1</b>	<b>2 points possible:</b>  <b>1 point for the dependent variable:</b> The change in the patient's blood pressure.  <b>1 point for the explanation:</b> The change in blood pressure <b>depends</b> on the effectiveness of the medication.  <b>OR</b>  The change in blood pressure is being evaluated with respect to the new medication.
<b>2</b>	<b>2 points possible:</b>  <b>1 point for the independent variable:</b> The medication given to the patient.  <b>1 point for the explanation:</b> The medication is the independent variable because it is what is being evaluated in the study.

## 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.	2. Describe the relationship between an enzyme and its substrate molecule(s). 4. Explain the role of energy in chemical reactions of living systems: <ul style="list-style-type: none"> <li>• <i>activation energy</i></li> <li>• <i>exergonic reactions</i></li> <li>• <i>endergonic reactions</i></li> </ul>
	2. Students shall demonstrate an understanding of the structure and function of cells.	1. Construct a hierarchy of life from cells to <i>ecosystems</i> . 3. Describe the role of sub-cellular structures in the life of a cell: <ul style="list-style-type: none"> <li>• <i>organelles</i></li> <li>• <i>ribosomes</i></li> <li>• <i>cytoskeleton</i></li> </ul> 4. Relate the function of the <i>plasma (cell) membrane</i> to its structure. 5. Compare and contrast the structures of an animal cell to a plant cell. 6. Compare and contrast the functions of <i>autotrophs</i> and <i>heterotrophs</i> . 7. Compare and contrast active transport and passive transport mechanisms: <ul style="list-style-type: none"> <li>• <i>diffusion</i></li> <li>• <i>osmosis</i></li> <li>• <i>endocytosis</i></li> <li>• <i>exocytosis</i></li> <li>• <i>phagocytosis</i></li> <li>• <i>pinocytosis</i></li> </ul> 8. Describe the main events in the <i>cell cycle</i> , including the differences in plant and animal cell division: <ul style="list-style-type: none"> <li>• <i>interphase</i></li> <li>• <i>mitosis</i></li> <li>• <i>cytokinesis</i></li> </ul> 9. List in order and describe the stages of <i>mitosis</i> : <ul style="list-style-type: none"> <li>• <i>prophase</i></li> <li>• <i>metaphase</i></li> <li>• <i>anaphase</i></li> <li>• <i>telophase</i></li> </ul> 10. Analyze the meiotic maintenance of a constant <i>chromosome</i> number from one generation to the next. 11. Discuss <i>homeostasis</i> using <i>thermoregulation</i> as an example.
	3. Students shall demonstrate an understanding of how cells obtain and use energy ( <i>energetics</i> ).	1. Compare and contrast the structure and function of <i>mitochondria</i> and <i>chloroplasts</i> . 3. Compare and contrast aerobic and anaerobic respiration: <ul style="list-style-type: none"> <li>• <i>lactic acid fermentation</i></li> <li>• <i>alcoholic fermentation</i></li> </ul> 5. Compare and contrast <i>cellular respiration</i> and <i>photosynthesis</i> as energy conversion pathways.

\*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2013 Mid-Year and Spring End-of-Course Biology Examinations.

The Arkansas Biology Science Curriculum Framework\*

Strands	Content Standards	Student Learning Expectations
<p>2. HEREDITY AND EVOLUTION (HE)</p>	<p>4. Students shall demonstrate an understanding of heredity.</p>	<p>1. Summarize the outcomes of Gregor Mendel's experimental procedures.</p> <p>3. Use the <i>laws</i> of probability and <i>Punnett</i> squares to predict <i>genotypic</i> and <i>phenotypic ratios</i>.</p> <p>5. Analyze the historically significant work of prominent geneticists.</p> <p>6. Evaluate <i>karyotypes</i> for abnormalities:</p> <ul style="list-style-type: none"> <li>• monosomy</li> <li>• trisomy</li> </ul>
	<p>5. Students shall investigate the molecular basis of genetics.</p>	<p>1. Model the components of a <i>DNA nucleotide</i> and an <i>RNA nucleotide</i>.</p> <p>2. Describe the Watson-Crick <i>double helix</i> model of DNA, using the <i>base-pairing rule</i> (<i>adenine-thymine, cytosine-guanine</i>).</p> <p>3. Compare and contrast the structure and function of <i>DNA</i> and <i>RNA</i>.</p> <p>4. Describe and model the processes of <i>replication, transcription, and translation</i>.</p> <p>5. Compare and contrast the different types of mutation events, including <i>point mutation, frameshift mutation, deletion, and inversion</i>.</p> <p>6. Identify effects of changes brought about by <i>mutations</i>:</p> <ul style="list-style-type: none"> <li>• beneficial</li> <li>• harmful</li> <li>• neutral</li> </ul>
	<p>6. Students shall examine the development of the <i>theory of biological evolution</i>.</p>	<p>2. Recognize that <i>evolution</i> involves a change in allele frequencies in a <i>population</i> across successive generations.</p> <p>3. Analyze the effects of mutations and the resulting variations within a <i>population</i> in terms of <i>natural selection</i>.</p> <p>5. Evaluate <i>evolution</i> in terms of evidence as found in the following:</p> <ul style="list-style-type: none"> <li>• fossil record</li> <li>• <i>DNA</i> analysis</li> <li>• <i>artificial selection</i></li> <li>• morphology</li> <li>• embryology</li> <li>• viral <i>evolution</i></li> <li>• geographic distribution of related <i>species</i></li> <li>• <i>antibiotic</i> and <i>pesticide resistance</i> in various organisms</li> </ul>

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## PART III CURRICULUM FRAMEWORK

### The Arkansas Biology Science Curriculum Framework\*

Strands	Content Standards	Student Learning Expectations
<p>3. CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)</p>	<p>7. Students shall demonstrate an understanding that organisms are diverse.</p>	<p>2. Differentiate the characteristics of the six kingdoms:</p> <ul style="list-style-type: none"> <li>• Eubacteria</li> <li>• Archaea</li> <li>• Protista</li> <li>• <i>Fungi</i></li> <li>• Plantae</li> <li>• Animalia</li> </ul> <p>3. Identify the seven major taxonomic categories:</p> <ul style="list-style-type: none"> <li>• kingdom</li> <li>• phylum</li> <li>• class</li> <li>• order</li> <li>• family</li> <li>• <i>genus</i></li> <li>• <i>species</i></li> </ul> <p>4. Classify and name organisms based on their similarities and differences applying <i>taxonomic nomenclature</i> using <i>dichotomous keys</i>.</p> <p>5. Investigate Arkansas' <i>biodiversity</i> using appropriate tools and <i>technology</i>.</p> <p>6. Compare and contrast the structures and characteristics of viruses (<i>lytic</i> and <i>lysogenic cycles</i>) with non-living and living things.</p> <p>7. Evaluate the medical and economic importance of <i>viruses</i>.</p> <p>8. Compare and contrast life cycles of familiar organisms:</p> <ul style="list-style-type: none"> <li>• sexual reproduction</li> <li>• asexual reproduction</li> <li>• metamorphosis</li> <li>• <i>alternation of generations</i></li> </ul> <p>9. Classify <i>bacteria</i> according to their characteristics and adaptations:</p> <p>10. Evaluate the medical and economic importance of <i>bacteria</i>.</p> <p>11. Describe the characteristics used to classify protists:</p> <ul style="list-style-type: none"> <li>• plant-like</li> <li>• animal-like</li> <li>• fungal-like</li> </ul> <p>14. Evaluate the medical and economic importance of <i>fungi</i>.</p> <p>15. Differentiate between <i>vascular</i> and <i>nonvascular</i> plants.</p> <p>16. Differentiate among cycads, gymnosperms, and angiosperms.</p> <p>18. Relate the structure of plant tissue to its function:</p> <ul style="list-style-type: none"> <li>• epidermal</li> <li>• ground</li> <li>• vascular</li> </ul> <p>19. Evaluate the medical and economic importance of plants.</p> <p>20. Identify the symmetry of organisms:</p> <ul style="list-style-type: none"> <li>• radial</li> <li>• bilateral</li> <li>• asymmetrical</li> </ul> <p>21. Compare and contrast the major invertebrate classes according to their nervous, respiratory, excretory, circulatory, and digestive systems.</p> <p>22. Compare and contrast the major vertebrate classes according to their nervous, respiratory, excretory, circulatory, digestive, reproductive and integumentary systems.</p>

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The Arkansas Biology Science Curriculum Framework\*

Strands	Content Standards	Student Learning Expectations
<p>4. ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)</p>	<p>8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms.</p>	<ol style="list-style-type: none"> <li>1. Cite examples of abiotic and biotic factors of <i>ecosystems</i>.</li> <li>2. Compare and contrast the characteristics of biomes.</li> <li>3. Diagram the carbon, nitrogen, phosphate, and water cycles in an <i>ecosystem</i>.</li> <li>5. Identify and predict the factors that control <i>population</i>, including <i>predation</i>, <i>competition</i>, crowding, water, nutrients, and shelter.</li> <li>6. Summarize the symbiotic ways in which individuals within a community interact with each other:               <ul style="list-style-type: none"> <li>• <i>commensalism</i></li> <li>• <i>parasitism</i></li> <li>• <i>mutualism</i></li> </ul> </li> <li>7. Compare and contrast <i>primary succession</i> with <i>secondary succession</i>.</li> <li>8. Identify the properties of each of the five levels of <i>ecology</i>:               <ul style="list-style-type: none"> <li>• <i>organism</i></li> <li>• <i>population</i></li> <li>• <i>community</i></li> <li>• <i>ecosystem</i></li> <li>• <i>biosphere</i></li> </ul> </li> </ol>
	<p>9. Students shall demonstrate an understanding of the ecological impact of global issues.</p>	<ol style="list-style-type: none"> <li>1. Analyze the effects of human population growth and technology on the <i>environment/biosphere</i>.</li> <li>2. Evaluate long range plans concerning resource use and by-product disposal in terms of their environmental, economic, and political impact.</li> <li>3. Assess current world issues applying scientific themes (e.g., global changes in climate, <i>epidemics</i>, <i>pandemics</i>, ozone depletion, UV radiation, natural resources, use of <i>technology</i>, and public policy).</li> </ol>

\*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2013 Mid-Year and Spring End-of-Course Biology Examinations.

## 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.	2. Compare and contrast <i>hypotheses</i> , <i>theories</i> , and <i>laws</i> . 4. Summarize the guidelines of science: <ul style="list-style-type: none"> <li>• <i>explanations</i> are based on observations, evidence, and testing</li> <li>• <i>hypotheses</i> must be testable</li> <li>• understandings and/or conclusions may change with additional empirical data</li> <li>• scientific knowledge must have peer review and verification before acceptance</li> </ul>
	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. 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.	4. Relate the development of the <i>cell theory</i> to current trends in cellular biology. 5. Describe the relationship between the <i>germ theory of disease</i> and our current knowledge of immunology and control of infectious diseases.
	13. Students shall use mathematics, science equipment, and <i>technology</i> 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 <i>technology</i> to communicate research findings.
	14. Students shall describe the connections between <i>pure</i> and <i>applied science</i> .	1. Compare and contrast biological concepts in <i>pure science</i> and <i>applied science</i> .

\*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the 2013 Mid-Year and Spring End-of-Course Biology Examinations.

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Mid-Year Released Biology Items\*

Strands	Content Standards
1— MOLECULES AND CELLS (MC)	<ol style="list-style-type: none"><li>1. Students shall demonstrate an understanding of the role of chemistry in life processes.</li><li>2. Students shall demonstrate an understanding of the structure and function of cells.</li></ol>
2— HEREDITY AND EVOLUTION (HE)	<ol style="list-style-type: none"><li>5. Students shall investigate the molecular basis of genetics.</li><li>6. Students shall examine the development of the theory of biological evolution.</li></ol>
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	<ol style="list-style-type: none"><li>7. Students shall demonstrate an understanding that organisms are diverse.</li></ol>
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	<ol style="list-style-type: none"><li>8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms.</li><li>9. Students shall demonstrate an understanding of the ecological impact of global issues.</li></ol>
5— NATURE OF SCIENCE (NS)	<ol style="list-style-type: none"><li>10. Students shall demonstrate an understanding that science is a way of knowing.</li><li>11. Students shall design and safely conduct a scientific inquiry.</li><li>12. Students shall demonstrate an understanding of current life science theories.</li><li>13. Students shall use mathematics, science equipment, and <i>technology</i> as tools to communicate and solve life science problems.</li></ol>

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

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### Mid-Year Released Biology Items\*

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

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Spring Released Biology Items\*

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 ( <i>energetics</i> ).
2— HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of <i>heredity</i> . 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the <i>theory of biological evolution</i> .
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing. 11. Students shall design and safely conduct a scientific inquiry to solve valid problems. 12. Students shall demonstrate an understanding of current life science theories. 13. Students shall use mathematics, science equipment, and <i>technology</i> as tools to communicate and solve life science problems. 14. Students shall describe the connections between pure and applied science.

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

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### Spring Released Biology Items\*

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

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Mid-Year Non-Released Biology Items\*

<b>Strands</b>	<b>Content Standards</b>
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. 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.

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

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### Mid-Year Non-Released Biology Items\*

Strand	Content Standard	Student Learning Expectation
MC	2	6
CDL	7	20
HE	6	5
CDL	7	5
EBR	8	8
NS	11	5
NS	10	2
MC	2	1
HE	4	3
CDL	7	16
EBR	8	1
EBR	9	2
NS	11	4
MC	2	9
MC	3	5
HE	6	5
CDL	7	14
EBR	8	5
NS	13	1
EBR	8	1
MC	2	4
HE	4	1
HE	6	3
CDL	7	10
NS	11	6
MC	2	5
CDL	7	18
NS	14	1
MC	2	11
HE	5	1
EBR	8	8
EBR	9	3
NS	13	1

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Spring Non-Released Biology Items\*

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.

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

## PART IV ITEM CORRELATION WITH CURRICULUM FRAMEWORK

### Spring Non-Released Biology Items\*

Strand	Content Standard	Student Learning Expectation
HE	6	5
CDL	7	3
HE	6	5
CDL	7	10
EBR	8	5
HE	5	6
EBR	8	2
NS	11	4
CDL	7	10
NS	12	4
MC	1	2
HE	4	1
EBR	9	1
HE	5	4
NS	11	5
MC	2	9
EBR	8	6
NS	11	4
HE	4	3
CDL	7	6
MC	3	3
CDL	7	16
NS	10	2
MC	2	11
CDL	7	19
EBR	9	3
MC	2	8
EBR	9	2
NS	13	3
MC	1	2
HE	4	6
CDL	7	4

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



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