ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

Released Item Booklet

Biology End-of-Course Examinations

2011–2012 Administrations

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 in 2012 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 2011–2012 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

While multiple-choice items are scored by machine to determine if the student chose the correct answer from four options, responses to open-response items must be scored by trained "readers" using a pre-established set of scoring criteria.

The Arkansas Biology Rangefinding Committee assisted in the development of the scoring criteria. The committee comprises active Arkansas educators with expertise in science education.

Reader Training

Before readers are allowed to begin assigning scores to any student responses, they go through intensive training. The first step in that training is for the readers to read the Biology open-response items as they appear in the test booklet and to respond—just as the student test takers are required to do. This step gives the readers some insight into how the students might have responded. The next step is the readers' introduction to the scoring rubric. All of the specific requirements of the rubric are explained by the Scoring Director who has been specifically trained to lead the scoring group. Then responses (anchor papers) that illustrate the score points of the rubric are presented to the readers and discussed. The goal of this discussion is for the readers to understand why a particular response (or type of response) receives a particular score. After discussion of the rubric and anchor papers, readers practice scoring sets of responses that have been pre-scored and selected for use as training papers. Detailed discussion of the responses and the scores they receive follows.

After three or four of these practice sets, readers are given "qualifying rounds." These are additional sets of pre-scored papers, and, in order to qualify, each reader must score in exact agreement on at least 80% of the responses and have no more than 5% non-adjacent agreement on the responses. Readers who do not score within the required rate of agreement are not allowed to score the Biology End-of-Course Examination responses.

Once scoring of the actual student responses begins, readers are monitored constantly throughout the project to ensure that they are scoring according to the criteria. Daily and cumulative statistics are posted and analyzed, and Scoring Directors or Team Leaders reread selected responses scored by the readers. These procedures promote reliable and consistent scoring. Any reader who does not maintain an acceptable level of agreement is dismissed from the project.

Scoring Procedures

All student responses to the Biology End-of-Course Examination open-response test items are scored independently by two readers. Those two scores are compared, and responses that receive scores that are non-adjacent (a "1" and a "3," for example) are scored a third time by a Team Leader or the Scoring Director for resolution.

PART II Mid-Year Released Biology Items

1. Which invertebrate group has an exoskeleton and jointed appendages?

A. Cnidaria
B. Nematoda
* C. Arthropoda
D. Platyhelminthes

2. A rodent population leaves an ecosystem due to decreased temperatures and increased rain. Which **best** explains why the rodents left?

A. increase in predation
B. decrease in parasitism
C. change in biotic factors
* D. change in abiotic factors

3. Which describes the relationship in the shape between an enzyme and a substrate?

A. competitive
B. regenerative
C. symmetrical
* D. complementary

4. A red rose bush cross-pollinates a white rose bush. The offspring have white flowers with red streaks. What type of inheritance is this?

* A. codominance
B. crossing over
C. multiple alleles
D. incomplete dominance

5. Malaria causes over one million deaths per year. The disease is transmitted by female mosquitoes carrying the protist *Plasmodium*.

Why was it important for scientists to discover the cause of this disease?

* A. to develop a more effective means of prevention
B. to fully describe the symptoms seen in the patients
C. to accurately estimate the number of people affected
D. to determine the areas of the world where the infections occur

6. Which statement is true of the ethical parameters used by scientists?

A. used only for studies involving new medicines

B. used only for research projects involving animals

C. used to prevent researchers from paying their subjects

* D. used to prevent unnecessary suffering or harm to all organisms

7. Which describes the process of photosynthesis?

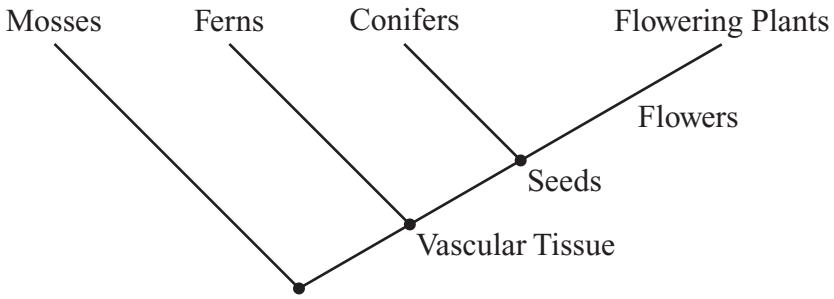
* A. carbon dioxide + water → glucose + oxygen

B. glucose + oxygen → carbon dioxide + water

C. water + oxygen → glucose + carbon dioxide

D. glucose + carbon dioxide → water + oxygen

8. Examine the cladogram below.



Based on the cladogram, which describes the difference between ferns and flowering plants?

A. Ferns have seeds and flowering plants do not.
* B. Flowering plants have seeds and ferns do not.
C. Ferns contain vascular tissue and flowering plants do not.
D. Flowering plants undergo photosynthesis and ferns do not.

9. Which set of taxonomic categories is ordered from largest to smallest?

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

10. How are UV radiation and the ozone layer related?

A. UV radiation is produced by ozone.
* B. UV radiation is absorbed by ozone.
C. UV radiation is destroyed by ozone.
D. UV radiation shields the Earth from ozone.

11. Why is peer review important to the acceptance of a theory?

A. determines when the theory can be modified
* B. confirms that the theory is scientifically sound
C. explains how the theory can be proven in the future
D. evaluates if the theory can be applied to other explanations

12. The H1N1 Virus, commonly known as the swine flu, was declared a pandemic by the World Health Organization in 2009.

Which approach is **most** effective in preventing the spread of the virus?

* A. vaccination
B. sterilization
C. use of antibiotics
D. use of fungicides

13. Which describes the use of pieces of chromosomes to replace faulty or absent pieces that cause disease?

A. karyotyping
* B. gene therapy
C. nondisjunction
D. DNA fingerprinting

14. Which base sequence **cannot** occur in RNA?

* A. TGCTAT
B. GCUAGG
C. CCUAAC
D. AAGCCC

15. Which event would occur before primary succession?

A. tornado
B. hurricane
* C. lava flow
D. forest fire

16. Tapeworms can live in the digestive tracts of dogs by absorbing food nutrients. In order for this situation to be considered a parasitic relationship, which must also be true?

A. The dog digests the tapeworm.
B. The dog is unaffected by the tapeworm.
C. The tapeworm provides benefits to the dog.
* D. The amount of nutrients available to the dog is decreased.

PART II Mid-Year Released Biology Items

17. A DNA strand with the sequences of bases shown below is transcribed to mRNA.

ATT CGA GTT

Which is the **correct** base sequence in the mRNA?

A. ATT CGA GTT
B. TAA GCT CAA
C. TUU GCT CUU
* D. UAA GCU CAA

18. Which serves as the outer boundary of a cell?

A. Golgi apparatus
* B. plasma membrane
C. nuclear membrane
D. endoplasmic reticulum

19. Which list contains **only** functions of ground tissue in plants?

* A. photosynthesis, storage, and support
B. photosynthesis, storage, and aeration
C. photosynthesis, support, and transport
D. photosynthesis, aeration, and transport

20. Which theory is based on the work of Louis Pasteur and is central to the practice of modern medicine?

A. cell theory
* B. germ theory
C. evolutionary theory
D. chromosome theory

21. Which is a property of water?

A. The water molecule is non-polar.
B. Solid water is denser than liquid water.
C. Water molecules repel other water molecules.
* D. Water has the ability to dissolve many different substances.

22. Who first proposed the double-helix structure of the DNA molecule?

A. Pauling
B. McClintock
* C. Watson and Crick
D. Harris and Watkins

23. Which has the greatest impact on determining the characteristics of different biomes?

* A. climate
B. longitude
C. number of lakes
D. diversity of plants

24. Which term describes the failure of homologous chromosomes to segregate properly during meiosis?

A. polyploidy
B. recombination
* C. nondisjunction
D. independent assortment

25. Animals and plants are classified into which domain?

A. Archaea
B. Bacteria
* C. Eukarya
D. Prokarya

26. Which completely describes the components of an ecosystem?

A. all the living things on Earth
B. a group of populations living in one area
* C. a community of organisms and their physical environment
D. all the organisms of one species that live together and interbreed

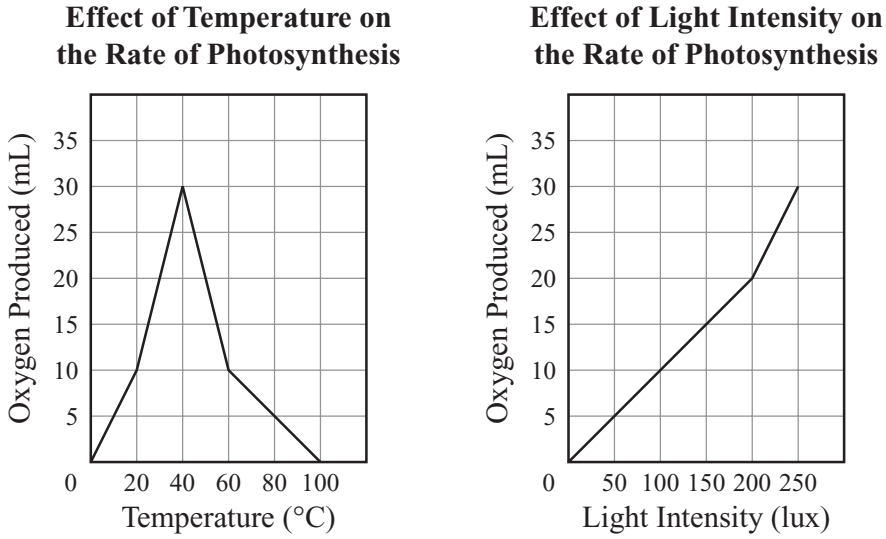
27. Which is an example of applied science?

A. formulating the cell theory
* B. developing new medicines
C. generating hypotheses on the origin of life
D. discovering the law of independent assortment

28. How is information from the field of embryology used as evidence for evolution?

A. It shows that organisms from the same species have similar DNA.
B. It shows that organisms from different species have similar DNA.
* C. It shows that organisms from different species have similar developmental patterns.
D. It shows that organisms from the same species have similar developmental patterns.

29. The graphs below display data collected as algae undergo photosynthesis under different conditions.



Which would be the **best** conditions for algae to undergo photosynthesis?

A. temperature around 20°C with a light intensity of 50 lux
* B. temperature around 40°C with a light intensity of 250 lux
C. temperature around 60°C with a light intensity of 125 lux
D. temperature around 100°C with a light intensity of 250 lux

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30. Which cellular structure produces proteins using coded instructions from DNA?

* A. ribosome
B. lysosome
C. Golgi apparatus
D. endoplasmic reticulum

PART II MID-YEAR RELEASED BIOLOGY ITEMS

A. According to one evolutionary theory, insect species such as bees increased dramatically after the emergence of flowering plants. This may have led to an increase in the adaptations of the insects and the plants.

1. Describe one reason why the number of insect species may have increased when flowering plants appeared.

2. Describe another reason why the number of insect species may have increased when flowering plants appeared.

3. Describe one adaptation that plant species may have developed in response to the increase in insect species.

4. Describe another adaptation that plant species may have developed in response to the increase in insect species.

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

Item A Scoring Rubric—2012 Biology

Part	Points
1	1 point possible: Correctly identifies one reason for the increase in insect species.
2	1 point possible: Correctly identifies another reason for the increase in insect species.
3	1 point possible: Correctly identifies one adaptation plants developed in response to the increase in insect species.
4	1 point possible: Correctly identifies another adaptation plants developed in response to the increase in insect species.

Score	Description
4	The response shows a *complete understanding* of the concepts of evaluating evolution in terms of evidence as required by the problem. The student responds correctly to all parts of the task.
3	The response shows a *nearly complete understanding* of the concepts of evaluating evolution in terms of evidence as required by the problem. The student responds correctly to most parts of the task. The response may contain minor errors.
2	The response shows a *limited understanding* of the concepts of evaluating evolution in terms of evidence as required by the problem. The response may contain a major error.
1	The response shows a *minimal understanding* of the concepts of evaluating evolution in terms of evidence as required by the problem. The response contains incomplete information and major errors.
0	The response shows *insufficient understanding* of the concepts evaluating evolution in terms of evidence as required by the problem. The reader may not be able to understand how and why decisions were made. There is no evidence that the student understands the task. The response may be off task or completely irrelevant.
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

Part	Points
1 and 2	**1 point possible for each part:** a new source of food a new habitat an increase in habitats a new niche protection from predators a place to reproduce and other correct reasons for the increase in insect species
3 and 4	**1 point possible for each part:** producing less pollen toxins thorns offensive odors pheromones sticky pollen stronger stems brighter petals fragrant odors and other correct plant adaptations

B. Organisms are often classified based on type of symmetry.

1. Identify one type of symmetry used to classify organisms. Name an organism which has this type of symmetry. Explain how this organism shows this type of symmetry.

2. Identify another type of symmetry used to classify organisms. Name an organism which has this type of symmetry. Explain how this organism shows this type of symmetry.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

Item B Scoring Rubric—2012 Biology

Part	Points
1	2 points possible: States a form of symmetry (1/2 pt), correctly names an organism which exhibits that type of symmetry (1/2 pt), correctly describes the symmetry of the organism they chose (1 pt).
2	2 points possible: States another form of symmetry (1/2 pt), correctly names an organism which exhibits that type of symmetry(1/2 pt), correctly describes the symmetry of the organism they chose (1 pt).

Score	Description
4	The response shows a *complete understanding* of types of symmetry. The student responds correctly to all parts of the task.
3	The response shows a *nearly complete understanding* of types of symmetry. The student responds correctly to most parts of the task. The response may contain minor errors.
2	The response shows a *limited understanding* of types of symmetry. The response may contain a major error.
1	The response shows a *minimal understanding* of types of symmetry. The response contains incomplete information and major errors.
0	The response shows *insufficient understanding* of types of symmetry. There is no evidence that the student understands the task. The response may be off task or completely irrelevant.
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

Part	Points
1 and 2	**2 points possible for each part:** **Radial symmetry:** Organism has many lines of symmetry that pass through the central axis. OR Body parts are arranged regularly around a central axis. Plants – flowers have roughly identical petals, sepals and stamens around the center of the flower Sea urchins and sea stars – have parts arranged about the axis of mouth in equal sectors Jellyfish – have four canals and thus can be divided into four equal parts **Bilateral symmetry:** Organism has one line of symmetry that extends from the anterior end to the posterior end running through the midline of the body. The left and right side are mirror images. Humans – are divided by a single plane (sagittal) into two halves which are mirror images Orchids & peas – flowers can be divided into two mirror image halves Octopus, squid, dog, cat, worm, mice, squirrel, fish **Asymmetrical symmetry:** – have no symmetry Sponges **Spherical symmetry:** Organism has many lines of symmetry that pass through the center point and divides the organism into two identical halves. Radiolarians, Volvox **Biradial symmetry:** similar parts are located to either side of the central axis and each of the four sides are identical to the opposite side but different from the adjacent side. Biradial is a combination of radial and bilateral symmetry. Ctenophores exhibit biradial symmetry **Pentaradial symmetry:** 5 equal parts radiating from a center axis. Various flowering plants exhibit this, as well as radiolarians. Also sea stars, sea urchins (as adults).

PART II Spring Released Biology Items

1. Which is present **only** in plant cells?

A. nucleus
* B. large vacuole
C. mitochondrion
D. cell membrane

2. Which would explain why green algae are classified as plant-like protists?

A. They are heterotrophic.
B. They live off of decaying matter.
* C. They contain photosynthetic pigments.
D. They use pseudopods to move and capture food.

3. What is the function of mitochondria?

A. to make new DNA through DNA replication
B. to make protein through the process of translation
C. to convert sunlight into glucose through photosynthesis
* D. to convert pyruvate into ATP through cellular respiration

4. What is the complementary DNA sequence for the following segment of DNA?

CTG GAA CTA

A. CTG GAA CTA
B. GAG GTT GAT
C. TAT CAA GGT
* D. GAC CTT GAT

5. Why are ethics important in science?

A. provides interesting topics to study
* B. keeps research within moral boundaries
C. allows controversial issues to be resolved
D. reflects the values of everyone in the community

6. Which list shows the **correct** order of organization from simple to complex?

A. cell, community, organism
* B. cell, population, community
C. organism, community, population
D. community, population, organism

7. Which is the broadest level in the study of ecology?

* A. biosphere
B. ecosystem
C. population
D. community

8. What name is given to the condition of stability enabled by a set of processes such as those involved in the maintenance of internal body temperature?

A. respiration
B. metabolism
* C. homeostasis
D. metamorphosis

9. Which idea about evolution was held by Darwin but **not** by Lamarck?

A. Species are fixed and do not change.
B. Species are moving toward perfection.
* C. Organisms best suited to their environment survive and reproduce.
D. The use or disuse of an organ determines its appearance in a species.

10. Which is the **greatest** threat to biodiversity?

A. hunting and fishing without a license
* B. introducing non-native species into a habitat
C. growing flowers and vegetables in a home garden
D. increasing the amount of land set aside for conservation

11. Which is a biotic factor in an Arkansas pine forest ecosystem?

A. rainfall
* B. bacteria
C. minerals
D. nitrogen

12. In order to sequence their genomes, a scientist wants to separate protists from a sample of pond water. Which would be most helpful in removing the protists from the water?

* A. centrifuge
B. microscope
C. gel electrophoresis
D. computer hardware

13. Which word describes the energy in an exergonic reaction?

A. created
* B. released
C. absorbed
D. destroyed

14. During the growth and development of an insect, the developing larva may look completely different from the adult. What name is given to the process in which form and shape change completely between stages of development?

A. molting
B. mutation
C. evolution
* D. metamorphosis

15. According to natural selection, which of the following results would be considered a beneficial mutation to an organism?

* A. resistance to a virus
B. formation of cancer cells
C. inability to undergo sexual reproduction
D. stopping the production of an essential protein

16. Which biome has low temperatures, small amounts of precipitation, and permafrost?

A. taiga
B. forest
* C. tundra
D. grassland

17. Which statement **correctly** describes the number of chromosomes in body cells and gametes?

A. body cells and gametes are both diploid
B. body cells and gametes are both haploid
* C. body cells are diploid and gametes are haploid
D. body cells are haploid and gametes are diploid

18. Which is a conclusion drawn from the observed DNA similarities found between apes and chimpanzees?

A. Apes and chimpanzees are in the same genus.
B. Apes and chimpanzees are in the same species.
C. Apes and chimpanzees are products of artificial selection.
* D. Apes and chimpanzees are thought to have evolved from a common ancestor.

19. Which human activity is a major part of the carbon cycle?

A. building dams
* B. burning fossil fuels
C. using inorganic fertilizers
D. removing species from their habitat

20. What must be true of theories before they are accepted by the scientific community?

A. Practical applications must be suggested.
B. Similar explanations must be in existence.
* C. They must be supported by empirical data.
D. Experiments must be conducted to refute the idea.

21. The table below shows the heights of different plants.

Plant Height Data

Height (cm)	Number of Plants
2	3
4	6
6	4
8	2

What is the mode in this set of data?

* A. 4
B. 8
C. 15
D. 20

22. Which is common to both DNA and RNA?

A. uracil
B. thymine
* C. cytosine
D. deoxyribose

23. Streptococci are the organisms that cause strep throat. Strep throat can be successfully treated with antibiotics.

Which type of organisms are streptococci?

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

24. A deer tick feeds on the blood of a host and can transmit bacteria that can cause disease. The deer tick and the host are an example of what type of symbiotic relationship?

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

25. What assumption is made during the relative dating of fossils?

A. Remains of extinct organisms can be compared to organisms living today.
B. By comparing rock layers, a pattern is seen of organisms becoming simpler over time.
* C. Upper rock layers contain younger remains and older remains are found in deeper layers.
D. The time it takes for known radioactive materials to break down is used to age the remains.

26. Which is a contributor to a decrease in biodiversity?

A. wetlands restoration
B. use of alternative fuels
* C. human population growth
D. formation of nature preserves

27. What type of symmetry does the human body have?

A. radial
* B. bilateral
C. spherical
D. asymmetrical

28. A scientist develops a new strain of corn. She then receives a large grant from the government to determine how well the new corn grows. She is also responsible for choosing where the new strain of corn will be grown and collecting data on its growth and yield. When the study is completed, she will also write the final report. Which is the **most** likely source of bias in this experiment?

A. The scientist grows the corn in fertile soil.
B. The scientist does not grow any corn because of drought.
C. The scientist may take too much time to finish the report.
* D. The scientist is making conclusions about a product that she developed.

29. Which is the function of the epidermal layer of a plant?

* A. prevent water loss
B. preserve extra food
C. prohibit gas exchange
D. protect reproductive organs

30. Which is included in the definition of a scientific theory?

* A. a well-tested explanation of natural events
B. a statement of what most people believe to be true
C. a description of natural events based on casual observations
D. a conclusion agreed upon by people without experimentation

PART II Spring Released Biology Items

A. Meiosis is the specialized type of cell division that takes place to form gametes.

1. What are the haploid and diploid numbers of chromosomes in a human cell?

2. Explain why it is important for gametes to have a haploid number of chromosomes.

3. Give an example of a disorder that can occur in development if a gamete does not have the proper number of chromosomes. How does this occur?

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

Item A Scoring Rubric—2012 Biology

Part	Points
1	1 point possible: Correctly identifies the number of chromosomes in human haploid and diploid cells.
2	1 point possible: Correctly describes why it is important for gametes to have a haploid number of chromosomes.
3	2 points possible: Names a disorder that can occur if the number of chromosomes is not correct AND explains how this occurs.

Score	Description
4	The response shows a *complete understanding* of the concepts of meiosis required by the problem. The student responds correctly to all parts of the task.
3	The response shows a *nearly complete understanding* of the concepts of meiosis required by the problem. The student responds correctly to most parts of the task. The response may contain minor errors.
2	The response shows a *limited understanding* of the concepts of meiosis required by the problem. The response may contain a major error.
1	The response shows a *minimal understanding* of the concepts of meiosis required by the problem. The response contains incomplete information and major errors.
0	The response shows *insufficient understanding* of the concepts of meiosis required by the problem. There is no evidence that the student understands the task. The response may be off task or completely irrelevant.
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

Part	Points
1	**1 point possible:** Haploid – 23 chromosomes Diploid – 46 chromosomes
2	**1 point possible:** Gametes must have a haploid number of chromosomes so when they fuse in fertilization the resulting zygote will have the correct number of chromosome pairs.
3	**2 points possible:** 1 Point for identification: • Down syndrome (Trisomy 21) • Turner's syndrome (Monosomy X) • Klinefelter syndrome (XXY) • Edward's syndrome (Trisomy 18) • 47 (XYY) • Trisomy X (XXX) • Patau syndrome (Trisomy 13) **AND** 1 Point for explanation: • Nondisjunction occurs in meiosis, resulting in gametes that have an extra chromosome. (Down syndrome, Klinefelter syndrome, Edward's syndrome, Trisomy X, 47) **OR** Nondisjunction occurs in meiosis, resulting in gametes that have fewer chromosomes. (Turner's syndrome)

B. 1. Identify and describe one process that moves carbon through the carbon cycle.

2. Identify and describe another process that moves carbon through the carbon cycle.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

Item B Scoring Rubric—2012 Biology

Part	Points
1	2 points possible: Identifies and describes a process that moves carbon through its cycle, 1 point for each.
2	2 points possible: Identifies and describes a process that moves carbon through its cycle, 1 point for each.

Score	Description
4	The response shows a *complete understanding* of processes that move carbon through the carbon cycle. The student responds correctly to all parts of the task.
3	The response shows a *nearly complete understanding* of processes that move carbon through the carbon cycle. The student responds correctly to most parts of the task. The response may contain minor errors.
2	The response shows a *limited understanding* of processes that move carbon through the carbon cycle. The response may contain a major error.
1	The response shows a *minimal understanding* of processes that move carbon through the carbon cycle. The response contains incomplete information and major errors.
0	The response shows *insufficient understanding* of processes that move carbon through the carbon cycle. There is no evidence that the student understands the task. The response may be off task or completely irrelevant.
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

Part	Points
1	**2 points possible (1 point each):** **Identification** Combustion Photosynthesis Cellular Respiration Diffusion Decomposition Fossil Fuel and Limestone Formation Consumption of Organic Materials Volcanic Eruption
2	**2 points possible (1 point each):** **Explanation** **Combustion** – Fossil fuels are burned and CO_2 is released **Photosynthesis** – Plants remove CO_2 from the atmosphere and it is converted to glucose **Cellular Respiration** – Glucose is converted and CO_2 is returned to the atmosphere **Diffusion** – CO_2 is dissolved in the oceans **Decomposition** – CO_2 or CH_4 is produced and released as dead animals or animal waste is broken down **Fossil Fuel and Limestone Formation** – Conversion of organic materials as the result of pressure **Consumption of Organic Materials** – Primary consumers eat plants, secondary consumers eat primary consumers etc. **Volcanic Eruption** – CO_2 and CO are released into the atmosphere

C. Investigators conduct an experiment to see which type of exercise is most effective for weight loss. Investigators compare running and swimming for 100 participants in the study.

1. Identify and describe three factors that should be held constant in this experiment.

2. What effect would it have on the results of this investigation if these factors were not held constant? Explain your answer.

BE SURE TO LABEL YOUR RESPONSES 1 AND 2.

Item C Scoring Rubric—2012 Biology

Part	Points
1	3 points possible: (½ point Identification + ½ point Description for each factor) Identification and description of three factors that should be held constant.
2	1 point possible: Description of what might happen if the factors were not held constant.

Score	Description
4	The response shows a *complete understanding* of factors that should be held constant in the experiment. The student responds correctly to all parts of the task.
3	The response shows a *nearly complete understanding* of factors that should be held constant in the experiment. The student responds correctly to most parts of the task. The response may contain minor errors.
2	The response shows a *limited understanding* of factors that should be held constant in the experiment. The response may contain a major error.
1	The response shows a *minimum understanding* of factors that should be held constant in the experiment. The response contains incomplete information and major errors.
0	The response shows *insufficient understanding* of factors that should be held constant in the experiment. There is no evidence that the student understands the task. The response may be off task or completely irrelevant.
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

Part	Points
1	**3 points possible (1 point each):** have the same general health be all one gender or evenly split between male and female remain the same throughout the experiment have the same diet be the same age or the ages of each group should be similar be measured with the same scale be measured the same number of times be measured the same time of day exercise for the same amount of time or distance exercise at the same intensity exercise the same number of times per week exercise under the same conditions
2	**1 point possible:** The results of the investigation would not be valid. There would be no way to determine if either exercise or another variable was responsible for the weight loss.

The Arkansas Biology Science Curriculum Framework*

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

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the *2012 Mid-Year* and *Spring End-of-Course Biology Examinations.*

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
2. HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of heredity.	1. Summarize the outcomes of Gregor Mendel's experimental procedures. 4. Examine different modes of inheritance: • sex linkage • codominance • crossing over • incomplete dominance • multiple alleles 5. Analyze the historically significant work of prominent geneticists. 6. Evaluate karyotypes for abnormalities: • monosomy • trisomy
	5. Students shall investigate the molecular basis of genetics.	1. Model the components of a DNA nucleotide and an RNA nucleotide. 2. Describe the Watson-Crick double helix model of DNA, using the base-pairing rule (adenine-thymine, cytosine-guanine). 3. Compare and contrast the structure and function of DNA and RNA. 4. Describe and model the processes of replication, transcription, and translation. 5. Compare and contrast the different types of mutation events, including point mutation, frameshift mutation, deletion, and inversion. 6. Identify effects of changes brought about by mutations: • beneficial • harmful • neutral
	6. Students shall examine the development of the theory of biological evolution.	1. Compare and contrast Lamarck's explanation of evolution with Darwin's theory of evolution by natural selection. 2. Recognize that evolution involves a change in allele frequencies in a *population* across successive generations. 3. Analyze the effects of mutations and the resulting variations within a population in terms of natural selection. 5. Evaluate *evolution* in terms of evidence as found in the following: • fossil record • *DNA* analysis • *artificial selection* • morphology • embryology • viral *evolution* • geographic distribution of related *species* • *antibiotic* and *pesticide resistance* in various organisms 6. Compare the processes of *relative dating* and *radioactive dating* to determine the age of fossils. 7. Interpret a *Cladogram*.

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The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
3. CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.	1. Differentiate among the different domains: • Bacteria • Archaea • Eukarya 2. Differentiate the characteristics of the six kingdoms: • Eubacteria • Archaea • Protista • Fungi • Plantae • Animalia 3. Identify the seven major taxonomic categories: • kingdom • phylum • class • order • family • genus • species 4. Classify and name organisms based on their similarities and differences applying taxonomic nomenclature using dichotomous keys. 5. Investigate Arkansas' biodiversity using appropriate tools and technology. 6. Compare and contrast the structures and characteristics of viruses (lytic and lysogenic cycles) with non-living and living things. 7. Evaluate the medical and economic importance of viruses. 8. Compare and contrast life cycles of familiar organisms: • sexual reproduction • asexual reproduction • metamorphosis • alternation of generations 10. Evaluate the medical and economic importance of bacteria. 11. Describe the characteristics used to classify protists: • plant-like • animal-like • fungal-like 12. Evaluate the medical and economic importance of protists. 17. Describe the structure and function of the major parts of a plant: • roots • stems • leaves • flowers 18. Relate the structure of plant tissue to its function: • epidermal • ground • vascular 19. Evaluate the medical and economic importance of plants. 20. Identify the symmetry of organisms: • radial • bilateral • asymmetrical 21. Compare and contrast the major invertebrate classes according to their nervous, respiratory, excretory, circulatory, and digestive systems.

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The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
4. ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms.	1. Cite examples of abiotic and biotic factors of ecosystems. 2. Compare and contrast the characteristics of biomes. 3. Diagram the carbon, nitrogen, phosphate, and water cycles in an ecosystem. 4. Analyze an ecosystem's energy flow through food chains, food webs, and energy pyramids. 5. Identify and predict the factors that control population, including predation, competition, crowding, water, nutrients, and shelter. 6. Summarize the symbiotic ways in which individuals within a community interact with each other: • commensalism • parasitism • mutualism 7. Compare and contrast primary succession with secondary succession. 8. Identify the properties of each of the five levels of ecology: • organism • population • community • ecosystem • biosphere
	9. Students shall demonstrate an understanding of the ecological impact of global issues.	1. Analyze the effects of human population growth and technology on the environment/biosphere. 3. Assess current world issues applying scientific themes (e.g., global changes in climate, *epidemics, pandemics*, ozone depletion, UV radiation, natural resources, use of *technology*, and public policy).

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the *2012 Mid-Year* and *Spring End-of-Course Biology Examinations.*

The Arkansas Biology Science Curriculum Framework*

Strands	Content Standards	Student Learning Expectations
5. NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing.	1. Explain why science is limited to natural explanations of how the world works. 2. Compare and contrast hypotheses, theories, and laws. 3. Distinguish between a scientific *theory* and the term *"theory"* used in general conversation.
	11. Students shall design and safely conduct a scientific inquiry.	1. Develop and explain the appropriate procedure, controls, and variables (dependent and independent) in scientific experimentation. 3. Identify sources of bias that could affect experimental outcome. 4. Gather and analyze data using appropriate summary statistics. 5. Formulate valid conclusions without bias.
	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. 4. Relate the development of the cell theory to current trends in cellular biology. 5. Describe the relationship between the germ theory of disease and our current knowledge of immunology and control of infectious diseases. 6. Relate the chromosome theory of heredity to recent findings in genetic research (e.g., Human Genome Project–HGP, chromosome therapy). 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.	1. Collect and analyze scientific data using appropriate mathematical calculations, figures, and tables. 2. Use appropriate equipment and technology as tools for solving problems (e.g., microscopes, centrifuges, flexible arm cameras, computer software and hardware). 3. Utilize *technology* to communicate research findings.
	14. Students shall describe the connections between pure and applied science.	1. Compare and contrast biological concepts in pure science and applied science. 2. Discuss why scientists should work within ethical parameters. 3. Evaluate long-range plans concerning resource use and by-product disposal for environmental, economic, and political impact.

*The Content Standards and Student Learning Expectations listed are those that specifically relate to the items in the *2012 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)	1. Students shall demonstrate an understanding of the role of chemistry in life processes. 2. Students shall demonstrate an understanding of the structure and function of cells. 3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
2— HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of heredity. 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the theory of biological evolution.
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	11. Students shall design and safely conduct a scientific inquiry. 12. Students shall demonstrate an understanding of current life science theories. 14. Students shall describe the connections between pure and applied science.

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

*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)	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)	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. 14. Students shall describe the connections between pure and applied science.

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

Strands	Content Standards
1— MOLECULES AND CELLS (MC)	1. Students shall demonstrate an understanding of the role of chemistry in life processes. 2. Students shall demonstrate an understanding of the structure and function of cells. 3. Students shall demonstrate an understanding of how cells obtain and use energy (energetics).
2— HEREDITY AND EVOLUTION (HE)	4. Students shall demonstrate an understanding of heredity. 5. Students shall investigate the molecular basis of genetics. 6. Students shall examine the development of the theory of biological evolution.
3— CLASSIFICATION AND THE DIVERSITY OF LIFE (CDL)	7. Students shall demonstrate an understanding that organisms are diverse.
4— ECOLOGY AND BEHAVIORAL RELATIONSHIPS (EBR)	8. Students shall demonstrate an understanding of ecological and behavioral relationships among organisms. 9. Students shall demonstrate an understanding of the ecological impact of global issues.
5— NATURE OF SCIENCE (NS)	10. Students shall demonstrate an understanding that science is a way of knowing. 11. Students shall design and safely conduct a scientific inquiry. 12. Students shall demonstrate an understanding of current life science theories. 13. Students shall use mathematics, science equipment, and technology as tools to communicate and solve life science problems. 14. Students shall describe the connections between pure and applied science.

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

*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. 14. Students shall describe the connections between pure and applied science.

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

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Arkansas Comprehensive Testing, Assessment, and Accountability Program

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