



Arkansas Comprehensive Testing, Assessment, and Accountability Program

TEACHER HANDBOOK

BIOLOGY

END-OF-COURSE EXAMINATIONS

2012–2013 ADMINISTRATIONS

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Arkansas Department of Education

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The **Arkansas Comprehensive Testing, Assessment, and Accountability Program** (ACTAAP) includes *Mid-Year* and *Spring Biology End-of-Course Examinations* for students completing Biology for high school graduation credit. The examinations consist of multiple-choice and open-response questions that directly assess student knowledge. The development of the Biology End-of-Course Examinations was based on the *Arkansas Biology Science Curriculum Framework*.

In January or April 2013, all students who had completed or were completing the required course work for Biology for high school graduation credit participated in the *Mid-Year* or *Spring Biology End-of-Course Examination*. Results of the Biology End-of-Course Examinations will be provided to all students, schools, and districts to be used as the basis for instructional change.

This handbook provides information regarding the scoring of student responses to the Biology open-response items. It describes the scoring procedures and the scoring criteria (rubrics) used to assess student responses. Copies of actual student responses are provided, along with scores given to those responses, to illustrate how the scoring criteria were applied to Biology open-response items.

Additional information about the Biology End-of-Course Examination is available through the Arkansas Department of Education. Questions can be addressed to the Office of Student Assessment at 501-682-4558.

SCORING STUDENT RESPONSES TO OPEN-RESPONSE ITEMS

The multiple-choice and open-response test items for the Biology End-of-Course Examination are developed with the assistance and approval of the Biology Content Advisory Committee. This committee comprises active Arkansas educators with expertise in Science education. The Biology Content Advisory Committee develops and reviews multiple-choice and open-response items to ensure that they reflect the *Arkansas Biology Science Curriculum Framework*.

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.

READER TRAINING

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

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 pre-scored 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.

On the following pages, open-response items are presented as they appeared in the *2013 Mid-Year* and *Spring Biology End-of-Course Examinations*. The specific scoring rubric for each item and annotated responses for each score point of the rubric follows. The goal is for classroom teachers and their students to understand how responses are scored. It is hoped that this understanding will help students see what kind of performance is expected of them on the Biology End-of-Course Examination.

BIOLOGY RESPONSES

ITEM A—2013 BIOLOGY

- 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.

Item A Scoring Rubric—2013 Biology

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.)

SOLUTION AND SCORING

4 points possible:

Part	Points
1	<p>1 point possible:</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>OR</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>1 point possible:</p> <p>Many organisms that have soft bodies would have been destroyed before a fossil could have been formed.</p> <p>OR</p> <p>Organisms decayed too fast for a fossil to be formed.</p> <p>OR</p> <p>Organisms die where fossils cannot be formed.</p> <p>AND</p> <p>Because not all organisms formed fossils there are gaps in the fossil record.</p> <p>OR</p> <p>Not all organisms are represented in the fossil record.</p>
3	<p>1 point possible:</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>1 point possible:</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>

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct response:	"...because at the bottom layers we can see more simple pioneer species. As the layers go up it gets more complex..."	1
<u>Part 2</u>		Points
Correct response:	"Some organisms are not fossilized because of the location they died in. Swamps completely decay organisms... This leaves a gap in the fossil record..."	1
<u>Part 3</u>		Points
Correct response:	"...scientists compare amino acid sequences and genetic information... because if two sequences are very similar, we can see that 2 organisms evolved from one common ancestor."	1
<u>Part 4</u>		Points
Correct response:	"...because not all species have fossilized but all living things have DNA."	1
Total Points		4

- ① The fossil record helps provide evidence because at the bottom layers we can see more simple pioneer species. As the layers go up, it gets more complex. We can also tell where natural disasters like the asteroid occurred and how species changed because of it.
- ② Some organisms are not fossilized because of the location they died in. Swamps completely decay organisms in little time and so swamp dwellers may not be fossilized. This leaves a gap in the fossil record and can make it less dependable.
- ③ DNA analysis is where scientists compare amino acid sequences and genetic information of two or more organisms. It shows evolution because if two sequences are very similar, we can see that 2 organisms evolved from one common ancestor. We can then observe how they changed over time.
- ④ It is more accurate because DNA does not lie, is more detailed, and has fewer holes. It is also more accurate because not all species have fossilized but all living things have DNA.

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct response:	“Fossils can show similarities in animals and exactly how they physically changed over time.”	1
<u>Part 2</u>		Points
Incorrect response:	“only some organisms died in the right environment for fossilization, so the rest of the organisms may have been completely decomposed by detritivores or eaten.”	0
<u>Part 3</u>		Points
Correct response:	“...by showing very similar DNA in very similar organisms over a period of time...”	1
<u>Part 4</u>		Points
Correct response:	“fossils only show structure, DNA shows precise molecular similarities or differences...”	1
Total Points		3

1. Fossils can show similarities in animals and exactly how they physically changed over time.

2. only some organisms died in the right environment for fossilization, so the rest of the organisms may have been completely decomposed by detritivores, or eaten.

3. DNA analysis is used to provide evidence for evolution by showing very similar DNA in very similar organisms over a period of time, and the little changes that support that they evolved. in their molecular structure

4. Fossils only show structure, DNA shows precise molecular similarities or differences that support theories of evolution more accurately.

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct response:	“Scientists can use the fossil record to compare older fossils to newer fossils...because based on the fossils’ shape and structure, they have changed over time.”	1
<u>Part 2</u>		Points
Correct response:	“...because they decay over time and the bones and other matter dissolves. This affects the overall fossil record because not all organisms can be recorded.”	1
<u>Part 3</u>		Points
Incorrect response:	“Scientists can compare DNA from older organisms to newer ones to see how they’ve changed.”	0
<u>Part 4</u>		Points
Incorrect response:	“The DNA analysis can show you more of a genetic relationship than the fossil record can.”	0
Total Points		2

- 1.) Scientists can use the fossil record to compare older fossils to newer fossils. This provides evidence of evolution because based on the fossils' shape and structure, they have changed over time.

- 2.) Some organisms are not fossilized because they decay over time and the bones and other matter dissolves. This affects the overall fossil record because not all organisms can be recorded.

- 3.) Scientists can compare DNA from older organisms to newer ones to see how they've changed.

- 4.) The DNA analysis can show you more of a genetic relationship than the fossil record can.

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect response:	“Depending on how old the fossil is, what it looks like, and how damaged it is, you can provide evidence for how much evolution has occurred over the year”	0
<u>Part 2</u>		Points
Incorrect response:	“some organisms are not fossilized because there aren’t enough remains of the organism to tell much about them, if anything.”	0
<u>Part 3</u>		Points
Incorrect response:	“The closer the DNA to another organisms DNA, the more they can tell about the evolution over the number of years.”	0
<u>Part 4</u>		Points
Correct response:	“cause no matter how much alike an animal may be, their DNA’s could be completely different & scientists group organisms according to their DNA for that reason.”	1
Total Points		1

① Depending on how old the fossil is, what it looks like, and how damaged it is, you can provide evidence for how much evolution has occurred over the year.

② some organisms are not fossilized because there aren't enough remains of the organism to tell much about them, if anything.

③ The closer the DNA to another organisms DNA, the more they can tell about the evolution over the number of years.

④ cause no matter how much alike an animal may be, their DNA's could be completely different & scientist group organisms according to their DNA for that reason.

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect response:	“you can find out ages of them.”	0
<u>Part 2</u>		Points
Incorrect response:	“some organisms are to small or the organisms body just breaks down.”	0
<u>Part 3</u>		Points
Incorrect response:	“DNA gives all information.”	0
<u>Part 4</u>		Points
Incorrect response:	“It’s more accurate because it going in the organisms blood.”	0
Total Points		0

- 1.) you can find out ages of them
- 2.) some organisms are to small or the organisms body just breaks down
- 3.) DNA gives all information
- 4.) It's more accurate because it going in the organisms blood

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.

ITEM B SOLUTION AND SCORING—2013 BIOLOGY

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.)

SOLUTION AND SCORING

4 points possible:

Part	Points																				
1 and 2	<p>2 points possible: 1 point for a similarity and 1 point for a difference</p> <p>Circulatory Systems</p> <table border="1"> <thead> <tr> <th>Amphibian</th> <th>Reptile</th> <th>Bird</th> <th>Mammals</th> </tr> </thead> <tbody> <tr> <td>3 Chamber heart- 2 atria and 1 ventricle</td> <td>3 Chamber heart- 2 atria and 1 ventricle (note: some reptiles have a partial separation of the ventricle but are considered to have only 1 ventricle present)</td> <td>4 Chamber heart- 2 atria and 2 ventricles</td> <td>4 Chamber heart- 2 atria and 2 ventricles</td> </tr> <tr> <td>No separation of oxygen rich and oxygen depleted blood while in the heart</td> <td>Partial separation of oxygen rich and oxygen depleted blood while in the heart</td> <td>Complete separation of the oxygen rich and oxygen depleted blood while in the heart</td> <td>Complete separation of the oxygen rich and oxygen depleted blood while in the heart</td> </tr> <tr> <td>Closed Circulatory System</td> <td>Closed Circulatory System</td> <td>Closed Circulatory System</td> <td>Closed Circulatory System</td> </tr> <tr> <td>Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body</td> <td>Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body</td> <td>Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body</td> <td>Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body</td> </tr> </tbody> </table>	Amphibian	Reptile	Bird	Mammals	3 Chamber heart- 2 atria and 1 ventricle	3 Chamber heart- 2 atria and 1 ventricle (note: some reptiles have a partial separation of the ventricle but are considered to have only 1 ventricle present)	4 Chamber heart- 2 atria and 2 ventricles	4 Chamber heart- 2 atria and 2 ventricles	No separation of oxygen rich and oxygen depleted blood while in the heart	Partial separation of oxygen rich and oxygen depleted blood while in the heart	Complete separation of the oxygen rich and oxygen depleted blood while in the heart	Complete separation of the oxygen rich and oxygen depleted blood while in the heart	Closed Circulatory System	Closed Circulatory System	Closed Circulatory System	Closed Circulatory System	Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body	Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body	Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body	Double circulatory system-one is the pulmonary system (oxygen depleted) and the other is the systemic circulation (oxygen rich) which moves blood to the rest of the body
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ITEM B—2013 BIOLOGY

Part	Points			
3	2 points possible: 1 point for a similarity and 1 point for a difference			
and 4	Respiratory Systems Amphibian	Reptile	Bird	Mammals
	Lungs—primary importance to breathing control	Lungs—no airway tree	Lungs and air sacs	Lungs
	Skin-highly vascularized and moist for rapid gas exchange when submerged in water	No diaphragm	No diaphragm or pleural cavity or space	Diaphragm and pleural cavity or space
	Had gills at one time during their life cycle	Inhaling and exhaling controlled by intercostal muscle contractions	Gas exchange occurs between air capillaries and blood capillaries	Lungs do not have a fixed volume
			Lungs are a fixed volume	Inhaling and exhaling occur by the contraction of the diaphragm
			Lungs of birds also do not have the capacity to inflate as birds lack a diaphragm and a pleural cavity	Lungs have an airway tree - Air enters through the oral and nasal cavities; it flows through the larynx, trachea and bronchi and expands the alveoli

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct similarity:	"Birds and Mammals both have a four chambered heart."	1
<u>Part 2</u>		Points
Correct difference:	"Reptiles only have a 3 chambered heart while mammals have a 4 chambered heart."	1
<u>Part 3</u>		Points
Correct similarity:	"Mammals and reptiles both use lungs their entire life to breathe."	1
<u>Part 4</u>		Points
Correct difference:	"Amphibians like a frog start off having gills to breath in water while they are still a tadpole, then develop lungs once they are an adult frog. Mammals have lungs their whole life."	1
Total Points		4

① Birds and Mammals both have a four chambered heart.

② Reptiles only have a 3 chambered heart while mammals have a 4 chambered heart.

③ Mammals and Reptiles both use lungs their entire life to breathe.

④ Amphibians like a frog start off having gills to breath in water while they are still a tadpole, then develop lungs once they are an adult frog. Mammals have lungs their whole life.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct similarity:	“Mammals and Birds both have a 4-chambered heart with two atriums and two ventricles.”	1
<u>Part 2</u>		Points
Correct difference:	“Mammals have completely seperated ventricles. Reptiles have a nonseperated ventricle where oxygenated blood & deoxygenated blood are.”	1
<u>Part 3</u>		Points
Incorrect similarity:	“Birds and Reptiles both have folded up alveoli sacs to help increase the surface area of the rib cage & increase breathing.”	0
<u>Part 4</u>		Points
Correct difference:	“Mammals have a set of 2 lungs, while birds have a set of 2 lungs but also include other posterior air sacs...”	1
Total Points		3

1. Mammals + Birds - ^{circulatory similarity}
Mammals and Birds both have a 4-chambered heart with two atriums and two ventricles.

2. Mammals and Reptiles - ^{circulatory difference}
Mammals have completely seperated ventricles. Reptiles have a nonseperated ventricle where oxygenated blood + deoxygenated blood are.

3. Birds and Reptiles - ^{respiratory similarity}
Birds and Reptiles both have folded up alveoli sacs to help increase the surface area of the rib cage + increase breathing. Both systems are highly efficient.

4. Birds and Mammals - ^{respiratory difference}
Mammals have a set of 2 lungs, while birds have a set of 2 lungs, but also include other posterior air sacs to help them fly at high altitudes.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct similarity:	" <u>Amphibians</u> and <u>Reptiles</u> have closed circulatory systems."	1
<u>Part 2</u>		Points
Incorrect difference:	" <u>Mammals</u> have a 4-chambered heart, and <u>Birds</u> have a 3-chambered heart."	0
<u>Part 3</u>		Points
Correct similarity:	" <u>Birds</u> and <u>Mammals</u> both use lungs to breathe."	1
<u>Part 4</u>		Points
Incorrect difference:	"Birds have lungs, but Amphibians do not."	0
Total Points		2

(1) Amphibians and Reptiles have closed circulatory systems

(2) Mammals have a 4-chambered heart, and Birds have a 3-chambered heart.

(3) Birds and Mammals both use lungs to breathe.

(4) Birds have lungs, but Amphibians do not.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect similarity:	“Both have cold blood.”	0
<u>Part 2</u>		Points
Incorrect difference:	“birds are warm blooded and reptiles are cold blooded.”	0
<u>Part 3</u>		Points
Incorrect similarity:	“Both mammals and birds breathe.”	0
<u>Part 4</u>		Points
Correct difference:	“Amphibians can breathe through their skin and birds can not.”	1
Total Points		1

- 1.) Amphibians and reptiles have similar organs. Both take in nutrients and expell waste. Both have cold blood.
- 2.) Birds and reptiles are different because birds are warm blooded and reptiles are cold blooded.
- 3.) Both mammals and birds breathe
- 4.) Amphibians can breathe through their skin and birds can not.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect similarity:	“mammals and birds both use lungs as their circulatory system.”	0
<u>Part 2</u>		Points
Incorrect difference:	“mammals use lungs and amphibians use cloaca.”	0
<u>Part 3</u>		Points
Incorrect similarity:	“amphibians and most reptiles have 2 chambered hearts.”	0
<u>Part 4</u>		Points
Incorrect difference:	“mammals have 4 chambered hearts and birds have 3 chambered hearts.”	0
Total Points		0

<p>1.) mammals and birds both use lungs as their circulatory system.</p>	<p>2.) mammals use lungs and amphibians use cloaca.</p>
<p>3.) amphibians and most reptiles have 2 chambered hearts</p>	<p>4.) mammals have 4 chambered hearts and birds have 3 chambered hearts.</p>

ITEM C—2013 BIOLOGY

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

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct event:	“In interphase the cell synthesizes proteins.”	1
<u>Part 2</u>		Points
Correct event:	“In metaphase the chromosomes line up across the equator of the cell.”	1
<u>Part 3</u>		Points
Correct event:	“In anaphase the centrioles pull the chromosomes apart and to opposite ends of the cell.”	1
<u>Part 4</u>		Points
Correct difference:	“In plant cells, a cell plate forms on the equator of the cell and the cell wall grows from either side of the plate, dividing the cell into two identical daughter cells. In animal cells, the cell merely splits in half down the equator, creating the two daughter cells.”	1
Total Points		4

1. In interphase the cell synthesizes proteins.
2. In metaphase the chromosomes line up across the equator of the cell.
3. In anaphase the centrioles pull the chromosomes apart and to opposite ends of the cell.
4. In plant cells, a cell plate forms on the equator of the cell and the cell wall grows from either side of the plate, dividing the cell into two identical daughter cells. In animal cells, the cell merely splits in half down the equator, creating the two daughter cells.

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct event:	“DNA replication occurs”	1
<u>Part 2</u>		Points
Incorrect event:	“spindle fibers formation occurs”	0
<u>Part 3</u>		Points
Correct event:	“chromosomes move to opposite sides”	1
<u>Part 4</u>		Points
Correct difference:	“In animal cells a cleavage furrow appears, and in plant cells a cell plate appears”	1
Total Points		3

1. DNA Replication occurs.

2. Spindle fibers formation occurs

3. chromosomes move to opposite sides

4. In animal cells a cleavage furrow appears, and in plant cells a cell plate appears

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct event:	"S occurs during interphase. S is when the cells gentic material, DNA, is copied."	1
<u>Part 2</u>		Points
Incorrect event:	"During Metaphase the chrosomes are being pulled apart"	0
<u>Part 3</u>		Points
Correct event:	"Durning anaphase chrosomes are being pulled to opp. poles (ends)."	1
<u>Part 4</u>		Points
Incorrect difference:	"Animal cells splits by binary fusion which is the pinching of a cell. Plant cells split by the plant building a new cell wall in the middle of the cell."	0
Total Points		2

1. S. occurs during interphase. S, is when the cells gentic material, DNA, is copied.

2. During meta phase the chrosomes are being pulled apart



3. Durning, anaphase the chrosomes are being pulled to opp. poles (ends).



4. Animal cells splits by binary fusion which is the pinching of a cell.
 Plant cells split by the plant building a new cell wall in the middle of the cell.

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect event:	“-During interphase the cell cycle begins. In this phase mitosis will split.”	0
<u>Part 2</u>		Points
Correct event:	“-Metaphase of mitosis the spindle fibers will align the chromosomes.”	1
<u>Part 3</u>		Points
Incorrect event:	“-Anaphase they pair the chromosomes together.”	0
<u>Part 4</u>		Points
Incorrect difference:	“Cytokinesis in animal cells forms a fiber ring and in plant cells they don't.”	0
Total Points		1

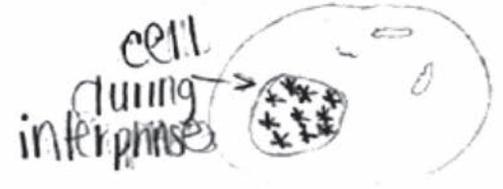
<p>1.</p> <p>- During interphase the cell cycle begins. In this phase mitosis will split.</p>	<p>2.</p> <p>- Metaphase of mitosis the spindle fibers will align the chromosomes.</p>
<p>3.</p> <p>- Anaphase they pair the chromosomes together.</p>	<p>4. Cytokinesis in animal cells forms a fiber ring and in plant cells they don't.</p>

ITEM C SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

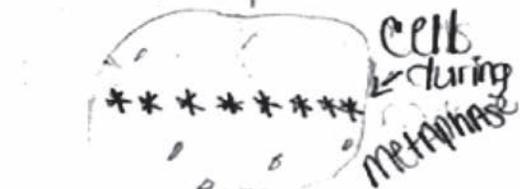
SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect event:	"During interphase the cells are gathered together, ready to replicate."	0
<u>Part 2</u>		Points
Incorrect event:	"During Metaphase of mitosis the cells line up in the middle of the cycle."	0
<u>Part 3</u>		Points
Incorrect event:	"During Anaphase of mitosis, the cells separate from each other."	0
<u>Part 4</u>		Points
Incorrect difference:	"Cytokinesis in animal cells go through more replication than cytokinesis in plant cells."	0
Total Points		0

1. During interphase the cells are gathered together, ready to replicate.



2. During metaphase of mitosis, the cells line up in the middle of the cycle.



3. During anaphase of mitosis, the cells separate from each other.



4. Cytokinesis in animal cells go through more replication than cytokinesis in plant cells.

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

ITEM D SOLUTION AND SCORING—2013 BIOLOGY

SOLUTION AND SCORING

4 points possible:

Part	Points
1	<p>2 points possible:</p> <p>1 Point Identification Less fossil fuels are burned</p> <p>Less fuel is bought from foreign countries</p> <p>1 Point Explanation Less CO₂ goes into the atmosphere Slow down the depletion of natural resources. Less pollution from transporting fuels great distances.</p>
2	<p>2 points possible:</p> <p>1 Point Identification Increased use of coal</p> <p>Increased pollution from power plants</p> <p>1 Point Explanation 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>

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct identification:	“-electric and hybrid cars use little or no gasoline ...”	1
Correct explanation:	“...which allows them to produce less carbon dioxide back into the air...”	1

<u>Part 2</u>		Points
Correct identification:	“-electric and some hybrid cars have to be charged which uses electricity in large amounts...”	1
Correct explanation:	“Therefor power plants...burn coal and fossil fuels which pollute the air and contribute to acid rain...”	1
Total Points		4

1. Cleaner air- electric and hybrid cars use little or no gasoline which allows them to produce less carbon dioxide back into the air which means less polluted air ☺ that us humans and animals breathe.

2. Power plants pollute the air- electric and some hybrid cars have to be charged which uses electricity in large amounts. Therefor power plants are producing more electricity and the machines burn coal and fossil fuels which pollute the air and contribute to acid rain that could be harmful to plants and wildlife.

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct identification:	"...having electric and hybrid cars is that we won't need as much oil..."	1
Incorrect explanation:	"This way we won't have to pay 4 dollars a gallon for the little fuel we will need."	0

<u>Part 2</u>		Points
Correct identification:	"It takes coal and other things burning to be able to generate electricity to power the vehicle."	1
Correct explanation:	"With the electric cars, they aren't burning fuel directly, but somewhere along the line fossil fuels are being released into the air."	1
Total Points		3

1. a positive environmental effect on having electric and hybrid cars is that we won't need as much oil. This way we won't have to pay 4 dollars a gallon for the little fuel we will need.

2. with the electric cars, they aren't burning fuel directly, but somewhere along the line fossil fuels are being released into the air. It takes coal and other things burning to be able to generate electricity to power the vehicle

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 2

<u>Part 1</u>		Points
Correct identification:	"...the decrease in burning fossil fuels."	1
Correct explanation:	"Less fossil fuel use leads to less CO ₂ in the atmosphere."	1

<u>Part 2</u>		Points
Incorrect identification:	"...is the change in carbon cycle."	0
Incorrect explanation:	"There's less CO ₂ for plants to make oxygen."	0
Total Points		2

1. ^{int. point} A positive environmental effect of hybrids and electrical cars is the decrease in burning fossil fuels. ^{3. meth.} Hybrids & electrics don't use gas (or at least, a lot less) Less fossil fuel use leads to less CO₂ in the atmosphere.

2. A negative environmental effect is the change in the carbon cycle. Burning fossil fuels is a big part in the cycle. Without it, There's less CO₂ for plants to make oxygen.

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 1

<u>Part 1</u>		Points
Incorrect identification:	"...they don't produce gasses which destroy the ozone layer."	0
Incorrect explanation:	"Gas powered cars produce harmful gasses that destroy the ozone layer, hybrid and electric cars destroy this harmful gas production."	0

<u>Part 2</u>		Points
Correct identification:	"These cars are using more electricity..."	1
Incorrect explanation:	"...they are destroying our electricity sources."	0
Total Points		1

① It is good that hybrid and electric cars have increased, because they do not produce gasses which destroy the ozone layer. Gas powered cars produce harmful gasses that destroy the ozone layer, hybrid and electric cars destroy this harmful gas production.

② It is bad that hybrid and electric cars have increased because they use electricity. These cars are using more electricity than a normal car, therefore they are destroying our electricity sources.

ITEM D SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect identification:	"cars put carbon dioxide into the air, which puts it into our oxygen supply..."	0
Incorrect explanation:	"...its not good for trees or plants to absorb carbon dioxide because that puts it in our oxygen."	0

<u>Part 2</u>		Points
Incorrect identification:	"Its better to use electric cars because that's less carbon dioxide being put in our air."	0
Incorrect explanation:	"...less killing of plants."	0
Total Points		0

1 • Cars Put carbondioxide into the air which puts it to our oxygen supply & its not good for trees or plants to absorb carbondioxide because that puts it in our oxygen & its killing our oxygen source.

2- they don't use gas, its better to use electric cars because thats less carbondioxide being put in our air. & less killing of plants.

ITEM E—2013 BIOLOGY

- E. 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 E 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:

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

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 4

<u>Part 1</u>		Points
Correct identification:	"...is the effects of the medication, if any, on the disorder."	1
Correct explanation:	"...it is what changes in the experiment, as a result of the independent variable."	1

<u>Part 2</u>		Points
Correct identification:	"...the medication itself."	1
Correct explanation:	"...because it is what is manipulated to change the dependent variable (the effects of the drug on high blood pressure)"	1
Total Points		4

1] The dependent variable in this experiment is the effects of the medication, if any, on the disorder. This is the dependent variable because it is what changes in the experiment, as a result of the independent variable.

2] The independent variable in this experiment is the medication itself. This is the independent variable because it is what is manipulated to change the dependent variable (the effects of the drug on high blood pressure)

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 3

<u>Part 1</u>		Points
Correct identification:	"...the high blood pressure"	1
Correct explanation:	"It is the dependent variable because it being effected by (or responding to) the independent variable. It is the variable that is being measured."	1

<u>Part 2</u>		Points
Incorrect identification:	"...the amount of the medication given."	0
Correct explanation:	"It is the independent variable because it is effecting (or manipulating) the dependent variable."	1
Total Points		3

1. The dependent variable is the high blood pressure
 It is the dependent variable because it is being effected by (or responding to) the independent variable. It is the variable that is being measured.

2. The independent variable is the amount of the medication^{given}. It is the independent variable because it is effecting (or manipulating) the dependent variable.

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 2

<u>Part 1</u>		Points
Incorrect identification:	"...the placebo of the medication..."	0
Incorrect explanation:	"...because it won't change anything on the person that took it."	0

<u>Part 2</u>		Points
Correct identification:	"...blood pressure medication..."	1
Correct explanation:	"...because it can change the person's blood pressure level."	1
Total Points		2

1. The dependent variable in this study is the placebo of the medication because it won't change anything on the person that took it.
2. The independent variable is the blood pressure medication. This is because it can change the person's blood pressure level.

ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

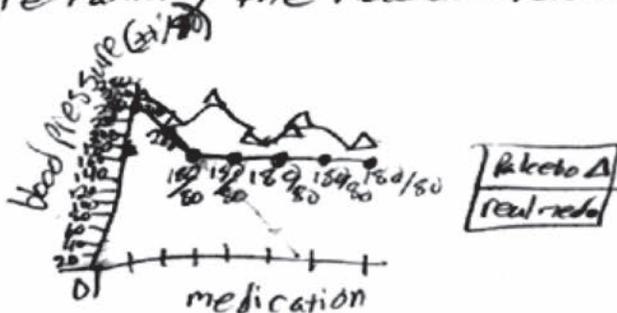
SCORE POINT: 1

<u>Part 1</u>		Points
Correct identification:	"... <u>high blood pressure</u> ."	1
Incorrect explanation:	"Everyone in this test has high blood pressure or at least they think they do."	0

<u>Part 2</u>		Points
Incorrect identification:	"...the groups who are taking the placebo/actual medication."	0
Incorrect explanation:	No explanation provided	0
Total Points		1

1) The dependent variable in this study is high blood pressure. Everyone in this test has high blood pressure of at least they think they do.

2) The independent variables are the groups who are taking the placebo/actual medication.



ITEM E SAMPLE RESPONSES AND ANNOTATIONS—2013 BIOLOGY

SCORE POINT: 0

<u>Part 1</u>		Points
Incorrect identification:	"...the new medication..."	0
Incorrect explanation:	"The dependent variable is the factor that remains the same throughout an experiment."	0

<u>Part 2</u>		Points
Incorrect identification:	"...the people who are taking the treatment of high blood pressure medicine..."	0
Incorrect explanation:	"...the factor that changes throughout an experiment."	0
Total Points		0

- 1) The dependent variable in the study is the new medication because the medication will not ever change, only the animals or humans that consume it will. The dependent variable is the factor that remains the same throughout an experiment. The new medication represents the dependent variable.
- 2) The independent variable in the study is the people who are taking the treatment of high blood pressure medicine because when they do a study and test the new medication on some people, there might be side effects that could change the person's health. The independent variable is the factor that changes throughout an experiment. The people who are being given the new medication are the independent variable.

ACTAAP

Arkansas Comprehensive Testing, Assessment, and Accountability Program

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

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