



Arkansas Comprehensive Testing, Assessment, and Accountability Program

TEACHER HANDBOOK

BIOLOGY

END-OF-COURSE EXAMINATION

2014–2015 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 Examination was based on the *Arkansas Biology Science Curriculum Framework*.

In January or April 2015, 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 Examination 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. All readers who qualify for scoring the Biology End-of-Course Examination will have a four year college degree.

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 *2015 Mid-Year and Spring Biology End-of-Course Examination*. 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—2015 BIOLOGY

A. The diagram below represents a simple food chain in a river ecosystem.



1. Identify one factor that could limit the Large Fish population in the river ecosystem. Explain why this factor could limit the Large Fish population.
2. Identify one factor that could limit the Algae population in the river ecosystem. Explain why this factor could limit the Algae population.
3. The River Otter population in the river ecosystem is reduced by half. Predict how this reduction may affect one of the other populations in the food chain. Explain your answer.
4. Explain why the food chain above can sustain only a certain number of individuals in each population living in the river ecosystem.

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

| |
|---|
| Item A Scoring Rubric—2015 Biology |
|---|

| Parts | Points |
|-------|--|
| 1 | 1 point possible: 1 point: Identifies one factor that would limit the size of the large fish population in this food chain (½ point). Explains why this would occur (½ point). |
| 2 | 1 point possible: 1 point: Identifies one factor that would limit the size of the population of algae in this food chain (½ point). Explains why this would occur (½ point). |
| 3 | 1 point possible: 1 point: Predicts one change in the populations of other organisms if the river otter population was decreased by half (½ point). Explanation (½ point). |
| 4 | 1 point possible: 1 point: Explains why the food chain above can only sustain a certain number of individuals in each population. |

| Score | Description |
|-------|---|
| 4 | Response shows a <i>complete understanding</i> of identifying and predicting the factors that control populations. The student presents correct descriptions to all parts of the task. |
| 3 | Response shows a <i>nearly complete understanding</i> of identifying and predicting the factors that control populations. The student presents nearly all descriptions to all parts of the task. The response may contain minor errors. |
| 2 | Response shows a <i>limited understanding</i> of identifying and predicting the factors that control populations. The student presents some descriptions correctly to most parts of the task. The response may contain a major error. |
| 1 | Response shows a <i>minimal understanding</i> of identifying and predicting the factors that control populations. The student presents some descriptions. The response contains incomplete descriptions and major errors. |
| 0 | Response shows <i>insufficient understanding</i> of identifying and predicting the factors that control populations. The descriptions, if any, contain major errors. There may be no descriptions, or the reader may not be able to understand the explanation. The reader may not be able to understand how and why decisions were made. |

ITEM A SOLUTION AND SCORING—2015 BIOLOGY

SOLUTION AND SCORING

4 points possible:

| Parts | Points |
|-------|---|
| 1 | <p>1 point possible: ½ point for identifying one factor. ½ point for the explanation.</p> <p>Factors and explanations may include:</p> <ul style="list-style-type: none"> · Less available food (fewer Small Fish) could reduce the number of Large Fish that survive and/or reproduce. · Introduction of a new disease organism could kill the Large Fish or prevent the reproduction of the Large Fish, or could kill the food source of the Large Fish (Small Fish). · Introduction of an invasive species could reduce the amount of food and other resources available for the Large Fish because an invasive species may compete with the Large Fish for these resources OR the invasive species could be a predator of the Large Fish. · Increased birthrate for River Otter could reduce the Large Fish population because of increased predation OR decreased birthrate for Small Fish could reduce the Large Fish population because of less available food. · Human interactions with Large Fish and/or their habitat such as overfishing, oil spills, pollution, acid rain, and boating may reduce the Large Fish population. |
| 2 | <p>1 point possible: ½ point for identifying one factor. ½ point for the explanation.</p> <p>Factors and explanations may include:</p> <ul style="list-style-type: none"> · A reduction in the amount of light will limit photosynthesis which the Algae need for energy for life processes. · A reduction in amount of nutrients limits the ability of the Algae to perform life processes. · Human interactions with Algae and/or their habitat such as pollution, oil spills, acid rain, and boating may kill Algae or prevent Algae from reproducing. · Increased populations of organisms (i.e., Small Fish) that feed on algae may cause Algae to be consumed faster than it can reproduce. <p>Any factor that negatively affects the growth or reproduction of the Algae would tend to decrease the population of Algae, because it can only grow and reproduce normally if the resources it needs are plentiful in the environment.</p> |
| 3 | <p>1 point possible: ½ point for predicting one change. ½ point for the explanation.</p> <p>The Large Fish population may increase because of less predation by the River Otters. OR The Small Fish population may decrease because an increase in the Large Fish population (due to decreased predation of Large Fish by River Otters) may increase predation on Small Fish. OR The Algae population may increase because of a decrease in the Small Fish population (due to increased predation by Large Fish, due to decreased predation by River Otter).</p> |
| 4 | <p>1 point possible: 1 point for the explanation.</p> <p>A food chain sustains only a certain number of organisms because there is a limited amount of resources in an ecosystem such as food, water, shelter, and nutrients.</p> |

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 4

| Part 1: | | Points |
|------------------------|---|---------------|
| Correct Identification | “decrease in the amount of Small Fish “ | ½ |
| Correct Explanation | “limit the amount of food that the Large Fish will have” | ½ |
| Part 2: | | Points |
| Correct Identification | “increase in Small Fish” | ½ |
| Correct Explanation | “the Small Fish have to sustain the rise in numbers by eating more Algae” | ½ |
| Part 3: | | Points |
| Correct Prediction | “whose numbers will grow.” | ½ |
| Correct Explanation | “there will be fewer of them to feed on the Large Fish” | ½ |
| Part 4: | | Points |
| Correct Explanation | “there will always be competition for limited resources” | 1 |
| Total Points | | 4 |

1.) The Large Fish population could be limited by a decrease in the amount of Small Fish in the ecosystem. This would limit the amount of food that the Large Fish will have, causing their numbers to shrink.

2.) An increase in Small Fish would limit the Algae population because the Small Fish have to sustain the rise in numbers by eating more Algae.

3.) If the River Otter population is reduced, then there will be fewer of them to feed on the Large Fish, whose numbers will grow.

4.) An ecosystem can only sustain a certain number of any organism because there will always be competition for limited resources.

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 3

Part 1:

| | | Points |
|------------------------|--|--------|
| Correct Identification | “something else eating the small fish“ | 1/2 |
| Correct Explanation | “The large fish have to eat too.” | 1/2 |

Part 2:

| | | Points |
|------------------------|---|--------|
| Correct Identification | “not sunny enough for long enough period of time” | 1/2 |
| Correct Explanation | “The algae need sunlight for food.” | 1/2 |

Part 3:

| | | Points |
|---------------------|--|--------|
| Correct Prediction | “large fish population will increase ” | 1/2 |
| Correct Explanation | “river otter population is down & they eat the large fish” | 1/2 |

Part 4:

| | | Points |
|-----------------------|--|----------|
| Incorrect Explanation | “If one number of individuals gets out of whack, they all do.” | - |
| Total Points | | 3 |

1) If something else was eating the small fish, the large fish population would decrease with them. The large fish have to eat too.

2) If it is not sunny enough for long enough period of time, the algae will begin to die. The algae need sunlight for food.

3) Because the river otter population is down & they eat the large fish, the large fish population will increase. Because of a larger large fish population, they will eat more small fish, thus decreasing the small fish population.

4) If you have too many otters, your large fish population will decrease, and due to that, your small fish population will increase, thus decreasing the algae population.
If one number of individuals gets out of whack, they all do.

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 2

Part 1:

| | | Points |
|------------------------|--|--------|
| Correct Identification | “small fish population decrease because of not enough Algae” | 1/2 |
| Correct Explanation | “not enough small fish to eat” | 1/2 |

Part 2:

| | | Points |
|--------------------------|-------------------------------|--------|
| Incorrect Identification | “pond is destroyed” | – |
| Incorrect Explanation | “wouldn’t have where to grow” | – |

Part 3:

| | | Points |
|---------------------|--|--------|
| Correct Prediction | “Large fish population would increase” | 1/2 |
| Correct Explanation | “there would be less predators (the otters)” | 1/2 |

Part 4:

| | | Points |
|------------------------|--|--------|
| Incomplete Explanation | “If there is an increase or decrease of any population, the food chain would be unbalanced.” | – |

Total Points **2**

① If the small fish population decreases because of not enough Algae in the area, the large fish population would also decrease because not enough small fish to eat.

② If a pond is destroyed algae wouldn't have where to grow. This would limit the algae population

③ If the River otter population is reduced by half than the large fish population would increase because there would be less predators (the otters)

④ If there is an increase or decrease of any population, the food chain would be unbalanced. There population of either animal/plant could either decrease/increase

ITEM A SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 1

Part 1:

| | | Points |
|------------------------|---|--------|
| Correct Identification | “decrease in the small fish population” | 1/2 |
| Incorrect Explanation | | — |

Part 2:

| | | Points |
|------------------------|------------------------|--------|
| Correct Identification | “disease in the water” | 1/2 |
| Incorrect Explanation | | — |

Part 3:

| | | Points |
|-----------------------|---|--------|
| Incorrect Prediction | “This wouldn’t limit of the other provided animals” | — |
| Incorrect Explanation | | — |

Part 4:

| | | Points |
|-----------------------|--|----------|
| Incorrect Explanation | “If you eat too many fish, you could destroy the food chain” | — |
| Total Points | | 1 |

① One thing that could limit the large fish is a decrease in small fish population.

② There could be a disease in the water that kills the algae.

③ This wouldn't limit of the other provided animals.

④ If you eat too many fish, you could destroy the food chain.

SCORE POINT: 0

Part 1:

| | | Points |
|--------------------------|--|--------|
| Incorrect Identification | “Large fish eats Algae” | – |
| Incorrect Explanation | “it’s trying to increase it’s population.” | – |

Part 2:

| | | Points |
|--------------------------|---|--------|
| Incorrect Identification | “Algae tries to eat something” | – |
| Incorrect Explanation | “so it can increase it’s size and population” | – |

Part 3:

| | | Points |
|-----------------------|---|--------|
| Incorrect Prediction | “it affect the Algae and the fish” | – |
| Incorrect Explanation | “it gets hungry. size, and population.” | – |

Part 4:

| | | Points |
|-----------------------|---|--------|
| Incorrect Explanation | “if you have to much in a population then what can you do to catch them.” | – |

Total Points **0**

1. Large fish eats Algae because it's trying to increase it's population

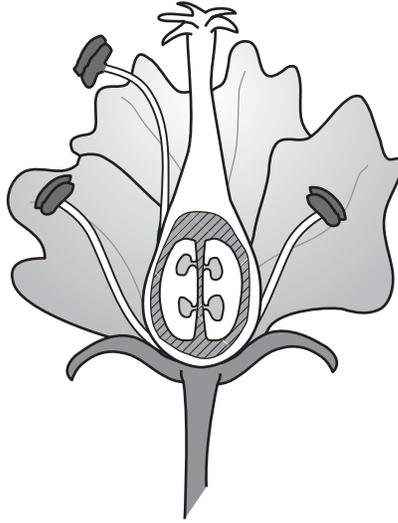
2. Algae tries to eat something so it can increase it's size and population.

3. it's affect the Algae and the fish because it gets hungry, size, and population

4. Because if you have to much in a population then what can you do to catch them

ITEM B—2015 BIOLOGY

B. Look at the diagram of a flower below.



1. Identify a structure found in the diagram of the flower above.
2. Describe the function of the structure identified in Part 1.
3. Identify another structure found in the diagram of the flower above.
4. Describe the function of the structure identified in Part 3.

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

Item B Scoring Rubric—2015 Biology

| Parts | Points |
|-------|--|
| 1 | 1 point possible: 1 point: Correctly identifies a structure in the diagram. |
| 2 | 1 point possible: 1 point: Correctly describes the function of the structure identified in Part 1. |
| 3 | 1 point possible: 1 point: Correctly identifies another structure in the diagram. |
| 4 | 1 point possible: 1 point: Correctly describes the function of the structure identified in Part 3. |

| Score | Description |
|-------|---|
| 4 | Response shows a <i>complete understanding</i> of describing the structure and function of the major parts of a plant. The student presents correct descriptions to all parts of the task. |
| 3 | Response shows a <i>nearly complete understanding</i> of describing the structure and function of the major parts of a plant. The student presents nearly all descriptions to all parts of the task. The response may contain minor errors. |
| 2 | Response shows a <i>limited understanding</i> of describing the structure and function of the major parts of a plant. The student presents some descriptions correctly to most parts of the task. The response may contain a major error. |
| 1 | Response shows a <i>minimal understanding</i> of describing the structure and function of the major parts of a plant. The student presents some descriptions. The response contains incomplete descriptions and major errors. |
| 0 | Response shows <i>insufficient understanding</i> of describing the structure and function of the major parts of a plant. The descriptions, if any, contain major errors. There may be no descriptions, or the reader may not be able to understand the explanation. The reader may not be able to understand how and why decisions were made. |

ITEM B—2015 BIOLOGY

SOLUTION AND SCORING

4 points possible:

| Part | Points |
|---------|--|
| 1 and 3 | <p>1 point possible: 1 point for correct identification.</p> <p>Structures include: Pistil, stigma, style, ovary, stamen, anther, filament, petal, sepal, peduncle, receptacle</p> |
| 2 and 4 | <p>1 point possible: 1 point for correct description of function.</p> <p>Functions of each flower structure:</p> <ul style="list-style-type: none">pistil - female part of the flower that consists of stigma, style, and ovarystyle - the stalk of a carpel through which the pollen tube growsstigma - top of carpel which serves as receptive surface for pollenovary - base of carpel that contains ovules, female reproductive gametes; matures to become a fruitstamen - male part of the flower that makes pollen grainsanther - the pollen bearing portion of the stamenfilament - the stalk of the stamen that bears the antherpetal - sometimes can produce nectar, but is usually colorful to attract pollinators to plantsepal - leaf-like structure that protects young flower budpeduncle - portion of flower stalk that bears the flower organsreceptacle - flower stalk |

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 4

| Part 1: | | Points |
|------------------------|---|---------------|
| Correct Identification | “sepals” | 1 |
| Part 2: | | Points |
| Correct Description | “protect the flower before it buds” | 1 |
| Part 3: | | Points |
| Correct Identification | “petals” | 1 |
| Part 4: | | Points |
| Correct Description | “attract insects for pollination to happen” | 1 |
| Total Points | | 4 |

1.  sepals

2. protect the flower before it buds

3. petals 

4. attract insects for pollination to happen

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 3

| Part 1: | | Points |
|------------------------|------------------------------|---------------|
| Correct Identification | “petals” | 1 |
| Part 2: | | Points |
| Correct Description | “to attract the insects” | 1 |
| Part 3: | | Points |
| Correct Identification | “anthers” | 1 |
| Part 4: | | Points |
| Incomplete Description | “the top part of the stamen” | – |
| Total Points | | 3 |

| | |
|-----------------------|---|
| <p>1. The petals</p> | <p>2. The petals are usually brightly colored to attract the insects.</p> |
| <p>3. The anthers</p> | <p>4. The anther is the top part of the stamen. The stamen has 2 parts to it.</p> |

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 2

| Part 1: | | Points |
|--------------------------|--|---------------|
| Incorrect Identification | “stroma” | – |
| Part 2: | | Points |
| Incorrect Description | “the part leading to the uterus where the egg is.” | – |
| Part 3: | | Points |
| Correct Identification | “anther” | 1 |
| Part 4: | | Points |
| Correct Description | “contains pollen, the longer it is the better chance it has to get the pollen blown off in the wind” | 1 |
| Total Points | | 2 |

① Stroma

② the stroma is the part leading to the uterus where the egg is. It gets pollinated from birds or insects, then pulls it down to the egg.

③ anther

④ the anther extends from the bottom of the flower, and contains pollen, the longer it is, the better chance it has to get the pollen blown off in the wind, or to the stroma.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 1

| Part 1: | | Points |
|--------------------------|---|---------------|
| Correct Identification | “pistil” | 1 |
| Part 2: | | Points |
| Incorrect Description | “part of the male flower reproduction.” | – |
| Part 3: | | Points |
| Incorrect Identification | “buds” | – |
| Part 4: | | Points |
| Incorrect Description | “what pollinates the flower” | – |
| Total Points | | 1 |

- 1) one structure found in the diagram above is the pistil.
- 2) The pistil is part of the male flower reproduction.
- 3) Another structure found in the diagram are the buds of a flower.
- 4) The buds of a flower are what pollinates the flower over and over again.

ITEM B SAMPLE RESPONSES AND ANNOTATIONS—2015 BIOLOGY

SCORE POINT: 0

| Part 1: | | Points |
|--------------------------|---|---------------|
| Incorrect Identification | “Bloom” | – |
| Part 2: | | Points |
| Incorrect Description | “wind will blow all the pollen off of it and start new flowers” | – |
| Part 3: | | Points |
| Incorrect Identification | “leaves” | – |
| Part 4: | | Points |
| Incorrect Description | “get nutrients out to other parts of the flower” | – |
| Total Points | | 0 |

1.) the bloom of the flower.

2.) that is used to be repolinated. like wind will blow all the pollen off of it and start new flowers. also insects will come by and get the pollen.

3.) the leaves on the flower.

4.) the leaves act kind of like veins and they get nutrients out to other parts of the flower.

ACTAAP

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

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