



ISTEP+: Biology I

End of Course Assessment

Released Items and Scoring Notes

Introduction

Indiana students enrolled in Biology I participated in the *ISTEP+: Biology I Graduation Examination* End of Course Assessment (ECA) during the 2013-2014 test administration windows. The Biology I ECA consists of two item types which contribute to a student's scale score: multiple-choice and constructed-response. It is important to keep in mind that a significant portion of a student's score is calculated from the multiple-choice items on the assessment, which are not addressed within this document.

This document consists of open-ended items from the Spring 2014 administration and includes:

- Sample released open-ended questions
- Rubrics used by trained evaluators to score student responses
- Sample papers used by trained evaluators to distinguish between rubric score point values
- Annotations describing the rationale for scoring student responses

The purpose of this guide is to provide additional Biology I ECA sample items and to model the types of items that are scored using rubrics.

Reporting Category 3: Genetics and the Molecular Basis of Heredity

Question 1

Rabbits may have a coat of black fur or a coat of brown fur. Black fur is completely dominant over brown fur.

A rabbit homozygous for black fur is crossed with a rabbit homozygous for brown fur.

What are the possible genotypes of the parents in this cross?

What phenotype(s) of the offspring are possible in this cross?

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A rabbit homozygous for brown fur is crossed with a rabbit heterozygous for black fur.

What are the possible genotypes of the parents in this cross?

What phenotype(s) of the offspring are possible in this cross?

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Question 1

Key Elements:

Part A

- The parents are BB (homozygous dominant) and bb (homozygous recessive).
- All offspring have a phenotype of a black coat.

Part B

- The parents are Bb (heterozygous dominant) and bb (homozygous recessive).
- Half of the offspring have a phenotype of a black coat; half of the offspring have a phenotype of a brown coat.

Rubric:

3 points	Four key elements
2 points	Two or three key elements
1 point	One key element
0 points	Other

Question 1, Sample A – 3 points

Parent Genotypes- BB, bb
Offspring Phenotypes- 100% Black fur

Parent Genotypes- Bb, bb
Offspring Phenotypes- 50% black fur, 50% brown fur

Notes: Part one of the response correctly identifies the possible genotypes of the parents and phenotypes of the offspring in that cross (2 key elements). Part two of the response correctly identifies the possible genotypes of the parents and phenotypes of the offspring in that cross (2 key elements).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 1, Sample B – 2 points

BBxbb and 75% black fur and 25% brown fur

bbxBb and 50% black fur and 50% brown fur

Notes: Part one of the response correctly identifies only the possible genotypes of the parents, but incorrectly identifies the possible phenotypes of the offspring (1 key element). Part two of the response correctly identifies the possible genotypes of the parents and the possible phenotypes of the offspring (2 key elements).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 1, Sample C – 1 point

Bb

Bb, and bb

Notes: Part one of the response incorrectly describes the possible genotypes of the parents in this cross (0 key elements). Part two of the response correctly identifies the possible genotypes of the parents in this cross (1 key element).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 1, Sample D – 0 points

that the black fur is dominant over the brown fur because the black fur is dominant and brown fur is recessive

black fur is genotype and brown is phenotype

Notes: Part one of the response incorrectly identifies either genotypes of the parents or the phenotypes of the offspring in this cross (0 key elements). Part two of the response incorrectly identifies either genotypes of the parents or the phenotypes of the offspring in this cross (0 key elements).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Reporting Category 2: Matter Cycles, Energy Transfer, and Interdependence

Question 2

Describe the function of the cell membrane.

Explain how a cell could be affected if the cell membrane does not function properly.

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Explain why plant cells require cell walls in addition to the cell membrane.

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Question 2

Key Elements:

Part A

- The cell membrane regulates which substances enter and leave the cell.
- OR
- The cell membrane separates the interior of the cell from the exterior, and holds the contents of the cell intact (under normal conditions).
 - The cell membrane creates an electrochemical gradient.
 - The cell membrane is responsible for movement in pseudopods.

AND

- If the cell membrane does not function properly, the substances that need to cross the membrane interior the cell will not be delivered (or the substances that need to be released from the cell will not be released) and the cell will not be able to conduct normal cellular activities needed for the cell to survive.
- If the cell membrane does not function properly, communication between cells is limited.

Part B

- Cell walls in plants provide strength and protection against physical pressure and pressure caused by the contents of the cell, in particular the central vacuole.
- OR
- Cell walls in plants provide structural integrity to the plant so it remains upright and intact in order to conduct photosynthesis and grow.

Rubric:

3 points	Describes function of membrane, explanation, describes reason for cell wall
2 points	Describes function of membrane and explanation, OR describes function of membrane and reason for cell wall, OR explanation and reason for cell wall
1 point	Describes function of membrane OR explanation OR describes reason for cell wall
0 points	Other

Question 2, Sample A – 3 points

The cell membrane keeps things out of the cell, while letting molecules that the cell needs in. If that cell membrane would fail to function, it could either starve the cell of what it needs, or it could let anything that's on the outside rush into the cell.

Plant cells need cell walls to support both itself and the plant because the plant has no structure besides the cells themselves.

Notes: Part one of the response correctly describes the function of the cell membrane and how the cell would be affected if the cell membrane does not function properly (2 key elements). Part two of the response correctly explains the role of cell walls in plants (1 key element).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 2, Sample B – 2 points

The cell membrane controls what enters and exits the cell. If it does not function properly, then harmful substances could enter into the cell.

Plant cells require cell walls in addition to a cell membrane because it helps absorb sunlight for photosynthesis.

Notes: Part one of the response correctly describes the function of the cell membrane and how the cell would be affected if the cell membrane does not function properly (2 key elements). Part two of the response incorrectly identifies the role of the cell wall in plants (0 key elements).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 2, Sample C – 1 point

If the cell membrane does not function correctly the cell would be full of waste and combust.

The cell walls in plant cells help keep the cells rigid shape and help the size of the cell.

Notes: Part one of the response includes an incorrect statement (the cell would combust) and is too vague (0 key elements). Part two of the response correctly identifies the role of the cell wall in plants (1 key element).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 2, Sample D – 0 points

If the cell membrane does not function properly than the entire cell is dysfunctional.

To help with the photosynthesis and keeping bad things away.

Notes: Part one of the response incorrectly describes how a cell would be affected if the cell membrane does not function properly (0 key elements). Part two of the response incorrectly identifies the role of the cell wall in plants (0 key elements).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Reporting Category 4: Cellular Reproduction

Question 3

Mitosis is the process by which cells divide into two daughter cells. Mitosis can be divided into four stages—prophase, metaphase, anaphase, and telophase.

Select one of the stages of mitosis and describe what happens during that stage.

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Explain why DNA replication is essential before beginning mitosis.

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Question 3

Key Elements:

Part A (One of the following)

- Prophase – The chromosomes begin condensing, the nuclear envelope begins breaking down, and the network of spindle fibers form.
- Metaphase – Chromosomes move to the center of the cell and line up along the middle. Each chromosome is held in place by the microtubules attached to the kinetochore.
- Anaphase – The two chromatids separate when the centromere divides. The chromatids (now called chromosomes) are pulled to the opposite sides of the cell by the attached fibers.
- Telophase – The chromosomes uncoil and a new nuclear envelope forms. The spindle fibers break down and disappear.

AND

Part B

- The cell must have two sets of chromosomes present so that each daughter cell receives a copy of each chromosome. This is essential in maintaining the correct number of chromosomes in each daughter cell.

Rubric:

2 points One description AND one explanation

1 point One description OR one explanation

0 points Other

Question 3, Sample A – 2 points

In metaphase the chromosomes are lining up in the middle of the cell to get ready for the cell to divide

DNA replication (which happens during the S phase or Interphase) is important because each of the daughter cells of mitoses have to have 46 chromosomes.

Notes: Part one of the response correctly identifies and describes a stage of mitosis (1 key element). Part two of the response correctly explains why DNA replication is essential before beginning mitosis (1 key element).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 3, Sample B – 1 point

Prophase is when the cell is being prepared for division by separating out the components inside it.

You have to replicate the DNA so that you would have something to divide in half. If you did not replicate it would have half the number of chromosomes.

Notes: Part one of the response correctly identifies a stage of mitosis but the description of the stage is too vague (0 key elements). Part two of the response correctly explains why DNA replication is essential before beginning mitosis (1 key element).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.

Question 3, Sample C – 0 points

Anaphase is were the cell splits in to two.

It has to know what kinda of cell to make.

Notes: Part one of the response incorrectly identifies and describes a stage of mitosis (0 key elements). Part two of the response incorrectly explains why DNA replication is essential before beginning mitosis (0 key elements).

Please note that responses are scored for science content only, not for accurate grammar, spelling, or punctuation.