Biology I Item Sampler
(Updated April 2011)

Purpose

The purpose of this Item Sampler is to provide teachers and students with examples of the types of questions that will appear on the *ISTEP+*: Biology I End-of-Course Assessment. The types of questions on the assessment include multiple-choice and constructed-response items.

For schools testing online, there is an online practice test to be given prior to the actual test. The purpose of the online practice test is to help familiarize students with the online functionalities and item types. Schools testing online, as well as those testing with the paper-and-pencil version, are encouraged to use this item sampler.

Teachers are encouraged to use this Item Sampler to:

- Familiarize themselves and their students with the types of items that are part of the Biology I End-of-Course Assessment.
- Gather information about students' knowledge of the standards and use that information to drive instruction.
- Assist in creating other assessments and activities.

Depth of Knowledge (DOK)

Every item on the Biology I assessment is assigned a "depth of knowledge" level by a committee of Indiana educators consisting of teachers and science specialists. The assignment of Depth of Knowledge (DOK) levels ensures the items on each test represent a range with regard to the cognitive demand required from students as they respond to test questions. The No Child Left Behind Act requires different levels of complexity within assessments.

See the Biology I Depth of Knowledge PowerPoint for a general overview at http://www.doe.in.gov/core40eca/.

Scoring

Multiple-Choice: All multiple-choice items on the *ISTEP+:* Biology I End-of-Course Assessment are machine-scored.

Constructed Response:

Each constructed-response (CR) question is scored according to its own rubric. For all CR questions, students can receive full or partial credit. For some questions, students are expected to explain and justify their responses. Students' ability to communicate concepts is critical in understanding science and is emphasized in Indiana's Science Standards.

Molecules and Cells

1. Intravenous saline injections are often given as a treatment for severe dehydration. The concentration of saline (0.9% NaCl) in these injections is that same as that present in human cells. What would happen if pure water was introduced into the body instead of saline?

A The cells would gain water and swell.
B The cells would lose water and shrivel.
C The cells would become impermeable to sodium (Na+) ions.
D The cells would become impermeable to chlorine (Cl–) ions.

2. Which organelle produces proteins?

A nucleus
B lysosome
C ribosome
D Golgi body

3. Predict whether you would expect muscle cells or fat cells to contain more mitochondria and explain why.

4. The work performed in cells is carried out by proteins, lipids, carbohydrates and nucleic acids.

Choose three of these molecules and describe one function that each of them carries out within the cell.

Developmental and Organismal Biology

1. What is the primary purpose of the receptor proteins located within a cell membrane?

A diffusion
B communication
C active transport
D energy production

2. Animals that are active at night are MOST likely to have which of the following features?

A oval-shaped eyes to reduce friction and pressure
B a membrane behind the eye to reflect light back to the retina
C tear ducts to wet the eyes and eyelids to sweep dirt from the eye
D eyes located on the sides of the head to produce a wide field of view

3. Explain how the multiplication of individual cells in a multi-cellular organism is similar to reproduction in a single-celled organism.

Genetics

1. The curled ears of the American Curl cat are caused by an autosomal dominant allele. What are the chances of a heterozygous female and a homozygous recessive male producing offspring with curled ears?

A 1 in 4
B 2 in 4
C 3 in 4
D 4 in 4

2. One strand of DNA could be as long as a football field if it were stretched out lengthwise. One of the factors allowing DNA to fit inside the nucleus of a cell is its ability to:

A break apart into separate genes
B extend to form very long, think molecules
C coil tightly around associated proteins
D denature form the effect of an enzyme

3. Explain why a male with a recessive X-linked trait usually produces no female offspring with the trait.

If a male with a recessive X-linked trait does produce a female offspring with the trait, what are possible genotypes of the mother?

Evolution and Historical Perspectives

1. The Giant Anteater of South America, the Giant Armadillo of North America, the Giant Pangolin of Africa, and the Spiny Anteater of Oceania share many characteristics. They all eat ants, have long narrow snouts, few teeth, and large salivary glands, yet they do not share a common ancestor. This is an example of which of the following?

A genetic drift
B founder effect
C adaptive radiation
D convergent evolution

2. Which of the following is a true statement about evolution?

A Individuals evolve more slowly than populations.
B Individuals evolve; populations do not.
C Individuals evolve by changing the gene pool.
D Populations evolve; individuals do not.

3. In 1859, twenty-four European rabbits were brought to Australia for sport hunting. The rabbits had no natural predators, resulting in an exponential growth pattern for the rabbits. They ate crops and became a serious, destructive pest within a relatively short period of time. In an attempt to control the rabbit population, the *myxoma* virus was introduced into the rabbit population in 1950. Initially, the virus was highly effective, reducing the rabbit population by 99%. Currently, the *myxoma* mortality rate is less than 50%.

Describe one scientifically probable change in the rabbit population of Australia that resulted in the reduced effectiveness of the *myxoma* virus in controlling the number of wild rabbits.

Describe one scientifically probable change in the *myxoma* virus that resulted in the reduced effectiveness of the virus in controlling the number of wild rabbits.

4. List TWO significant contributions made by Gregor Mendel to the field of biology.

Ecology

1. Which of the following desert organisms is a producer?

A fox
B lizard
C cactus
D scorpion

2. What is the maximum percentage of food energy available to a wolf that consumes a herbivorous field mouse?

A 0.1%
B 1%
C 10%
D 100%

3. When populations increase, resource depletion may bring about:

A exponential growth
B straight-line growth
C increased competition
D decreased competition

Answer Key

Molecules and Cells

1. A
2. C
3. Rubric:

2 points	Two key elements
1 point	One key element
0 points	Other

Key Elements:

Identification that muscle cells would have more mitochondria than fat cells.

AND

Explanation contains any of the following:

- Mitochondria transform energy in the cell, and muscle cells require more energy to function than fat cells do.
- Muscle cells require more energy to function than fat cells, and mitochondria convert food energy to ATP for the cell, so the muscle cells would have greater mitochondria than fat cells.
- Muscle cells contain more mitochondria because they require a great deal of energy to do cellular work.

4. Rubric:

3 points	Three correct descriptions of functions
2 points	Two correct descriptions of functions
1 point	One correct descriptions of a function
0 points	Other

Key Elements:

- Proteins – function as enzymes, hormones, connective and supportive tissue
- Lipids – store energy, structural support, and specific reactants in metabolic reactions, cell membrane component
- Carbohydrates – store and transport energy
- Nucleic acids – store genetic information

Developmental and Organismal Biology

1. B
2. B
3. Rubric:

2 points	Two key elements (One from Part A and one from Part B)
1 point	One key element from Part A or Part B
0 points	Other

Key Elements:

Explanation includes that:

- Individual cells and single-celled organisms reproduce through division.

Genetics

1. B
2. C
3. Rubric:

2 points	Two key elements (One from Part A and one from Part B)
1 point	One key element from Part A or Part B
0 points	Other

Key Elements:

Part A

- A female offspring inherits a second X chromosome from her mother. In order for a female to inherit a recessive trait, she must receive a recessive trait from both her father and her mother.

Part B

- The mother must be either heterozygous or homozygous for the recessive trait.

Evolution and Historical Perspectives

1. D
2. D
3. Rubric:

2 points Two key elements
1 point One key element
0 points Other

Key Elements:

A. Any one of the following probable changes in the rabbit population:

- Some rabbits had a genetic immunity.
- Some rabbits had a genetic mutation that made them immune to the virus.
- Natural selection selected for the rabbits that were able to survive the virus and then pass that immunity to their offspring.
- Any other plausible reason for the change in the immunity of the rabbit population.

NOTE: Do not award key element for the term *Natural Selection* if there is no accompanying explanation.

AND

B. Any one probable change in the *myxoma* virus:

- Only the less deadly strains of the virus were able to survive and reproduce within the rabbit population.
- The virus mutated to a less deadly strain.
- Natural selection selected for only the less deadly strains of the virus.
- Any other plausible reason for the change in the *myxoma* virus.

4. Rubric:

2 points Two key elements
1 point One key element
0 points Other

Key Elements:

- An inherited characteristic (trait) is determined by the combination of a pair of hereditary factors (genes).
- For each trait, offspring receive one version of the gene (allele) from each of the parents' reproductive cells.
- Different offspring of the same parents receive different sets of alleles.
- During fertilization, gametes randomly pair to produce four combinations of alleles.
- Inherited traits are dominant or recessive.

- Hybrids do not breed true.
- Many traits are inherited in pairs.
- The law of independent assortment (the emergence of one trait will not affect the emergence of another)
- The law of segregation
- Keeping meticulous records
- The study of only one trait at a time
- Any other significant contribution

Ecology

1. C
2. B
3. C