Spring 2013 Student Performance Analysis with Instructional Guidance

Biology
Standards of Learning

Presentation may be paused and resumed using the arrow keys or the mouse.

VIRGINIA DEPARTMENT OF EDUCATION

Investigation Practices and Skills

BIO.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a) observations of living organisms are recorded in the lab and in the field;

b) hypotheses are formulated based on direct observations and information from scientific literature;

c) variables are defined and investigations are designed to test hypotheses;

d) graphing and arithmetic calculations are used as tools in data analysis;

e) conclusions are formed based on recorded quantitative and qualitative data;

f) sources of error inherent in experimental design are identified and discussed;

g) validity of data is determined;

h) chemicals and equipment are used in a safe manner;

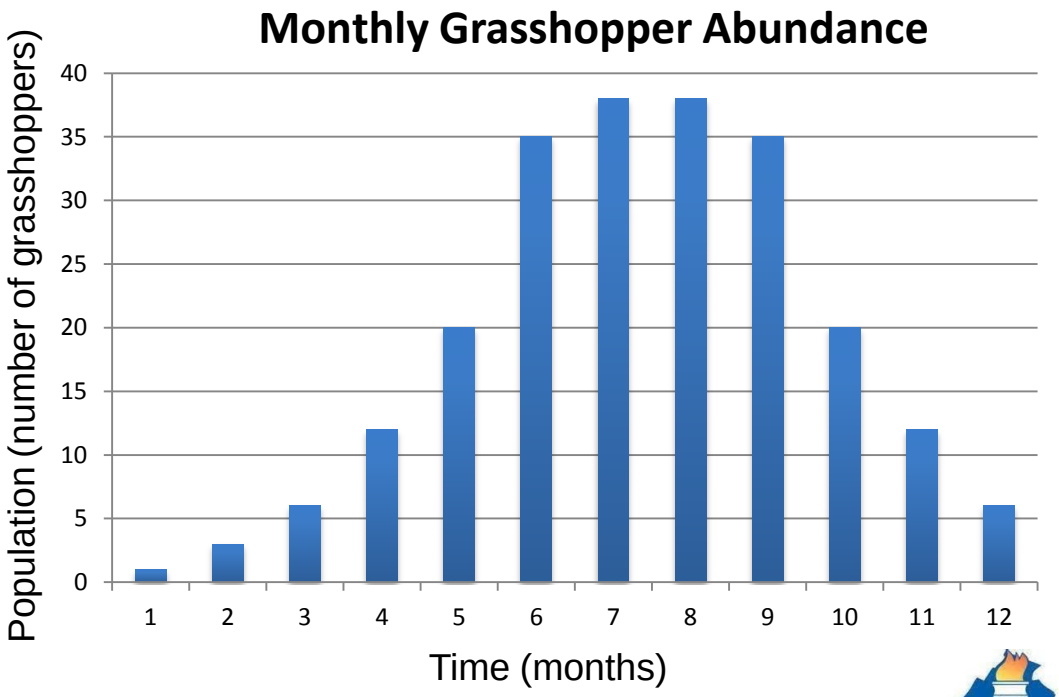
Students need more experience with basic and integrated investigative practices and skills, such as graphing and performing arithmetic calculations, using the context of biological concepts.

Instructional Guidance BIO. 1d

Investigation Practices and Skills: Use graphing and arithmetic calculations in data analysis

Graph the information presented in the table.

Time (months)	Population (number of grasshoppers)
1	1
2	3
3	6
4	12
5	20
6	35
7	38
8	38
9	35
10	20
11	12
12	6



Instructional Guidance BIO.1h

Investigation Practices and Skills:
Use chemicals and equipment in a safe manner

Ask the student to describe the safe use of chemicals and equipment prior to the laboratory.

A lab activity requires students to insert potassium hydroxide (KOH) pellets into a narrow tube to absorb carbon dioxide (CO_2). Pellets of KOH are very caustic and alkaline. How would you do this safely?

Sample Answer: With goggles, lab apron, and latex gloves; use large tweezers to remove pellet from container of KOH provided by the teacher and place in a weight boat. Then use tweezers to insert pellets into the tube.

Instructional Guidance BIO.1h

Investigation Practices and Skills:
Use chemicals and equipment in a safe manner

What is the safest and most correct way to apply a cover slip to prepare a slide? What equipment would you need?

Sample Answer: With goggles, lab apron, latex gloves, hold the slide cover by touching only the top and bottom; place a side of the cover on the slide and drop.

Connect and Apply Concepts : Effect of surface area to volume ratio on life processes

BIO.3 The student will investigate and understand relationships between cell structure and function. Key concepts include

a) **evidence supporting the cell theory;**

b) **characteristics of prokaryotic and eukaryotic cells;**

c) **similarities between the activities of the organelles in a single cell and a whole organism;**

d) **the cell membrane model; and**

e) **the impact of surface area to volume ratio on cell division, material transport, and other life processes.**

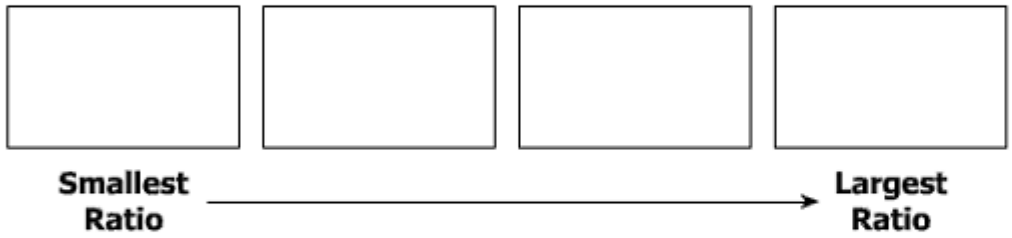
Students should be provided opportunities to investigate surface to volume ratio and the rate of movement of materials from the outside to the center of the cell.

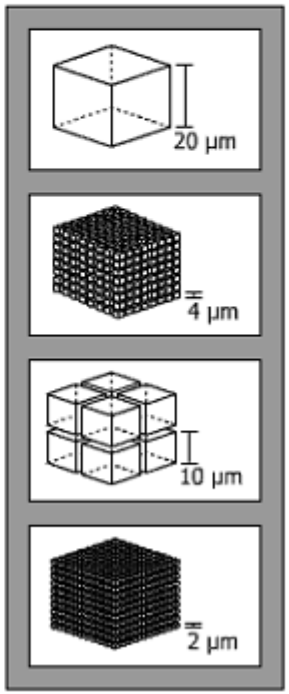
Connect and Apply Concepts: Effect of surface area to volume ratio on life processes (BIO.3e)

Directions: Click on the model you wish to select. Drag the model to the appropriate box.

These cell models represent a few surface-to-volume ratios. Arrange these models in order from smallest surface-to-volume ratio to the largest surface-to-volume ratio.

Cell Size Models



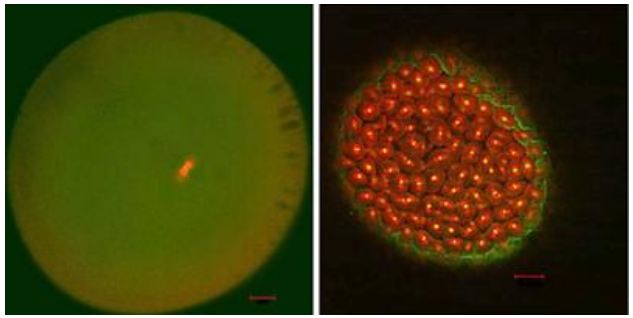


Answer: From left to right: *20 µm model, 10 µm model, 4 µm model,* and *2 µm model.*

Instructional Guidance BIO.3e

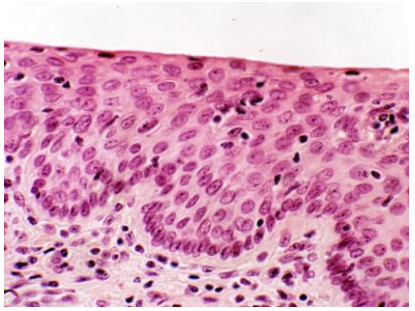
Connect and Apply Concepts:
Effect of surface to volume ratio on life processes

Microvilli of small intestine epithelium increase surface area



***Xenopus* rapid mitosis**

Squamus cells can flatten into a thin film



Writing prompt: *"Why is the Xenopus zygote so large? How does the subsequent rapid mitosis take place in such a small portion of the cell?*

Connecting and Applying Concepts: Historical development of the structural model of DNA

BIO.5 The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include

a) cell growth and division;

b) gamete formation;

c) cell specialization;

d) prediction of inheritance of traits based on the Mendelian laws of heredity;

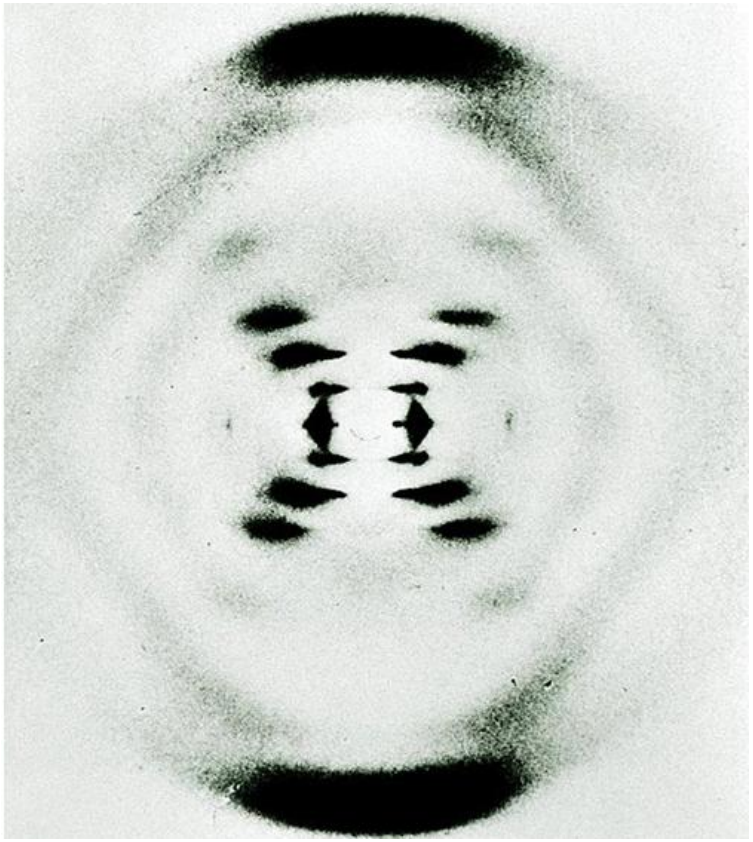
e) historical development of the structural model of DNA;

Students need more practice understanding the scientists and technologies that enhanced our knowledge of DNA.

Instructional Guidance BIO.5e

Connect and Apply Concepts:
Historical development of the structural model of DNA

B-Form



Rosalind Franklin and Maurice Wilkins

Two researchers, Maurice Wilkins and Rosalind Franklin, used X-ray crystallography to make pictures of DNA such as the one shown above. This type of image helps show that DNA-

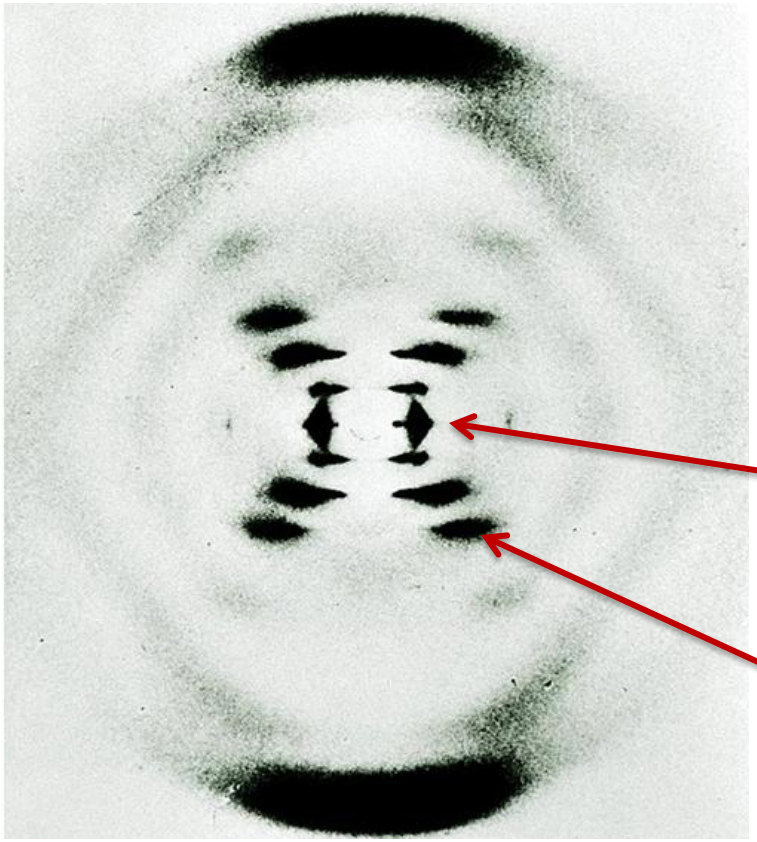
Sample Answer:
This image helps show that DNA has a helical shape.

Instructional Guidance BIO.5e

Connect and Apply Concepts:

Historical development of the structural model of DNA

B-Form



Rosalind Franklin and Maurice Wilkins

How did scientists determine the shape of DNA from this image? Point to the structures in the image that provide evidence.

Sample Answer: The distinctive "X" in this X-ray photo is the telltale pattern of a helix. Because the X-ray pattern is so regular, the dimensions of the helix must also be consistent.

Connect and Apply Concepts: Comparison of Developmental Stages

BIO.6 The student will investigate and understand bases for modern classification systems. Key concepts include

a) structural similarities among organisms;

b) fossil record interpretation;

c) comparison of developmental stages in different organisms;

Students should have experiences comparing structural characteristics of an extinct organism, as evidenced by its fossil record, with present, familiar organisms.

Connect and Apply Concepts: Comparison of Developmental Stages (BIO.6c)

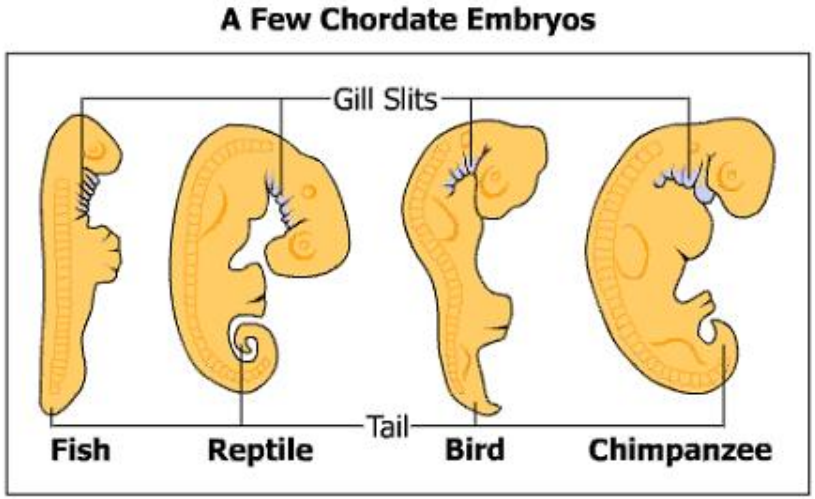
Ascidians are sac-like marine organisms. Their larvae have well-developed brains and dorsal nerve cords. This suggests that ascidians should be classified with the-

A. chordates
B. annelids
C. cnidarians
D. sponges

Instructional Guidance BIO.6c

Connect and Apply Concepts: Comparison of Developmental Stages

Students should be asked to make inferences from their observations.



Sample Inference: Organisms with common ancestors have similar structures during development.

Aspects of evolution through time

BIO.7 The student will investigate and understand how populations change through time. Key concepts include

a) evidence found in fossil records;

b) how genetic variation, reproductive strategies, and environmental pressures impact the survival of populations;

c) how natural selection leads to adaptations;

d) emergence of new species; and

e) scientific evidence and explanations for biological evolution.

Students need more practice analyzing how populations change through time by investigating evidence for biological evolution.

Aspects of evolution through time (BIO.7e)

Scientists hypothesize that oxygen began to accumulate in Earth's atmosphere after the appearance of living things that photosynthesize.

Which element in Earth's atmosphere is essential for human life and is extremely rare or nonexistent in the atmospheres of other planets in our solar system?

A. Carbon Dioxide
B. Hydrogen
C. Nitrogen
D. Oxygen

Population dynamics

BIO.8 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include

a) interactions within and among populations including carrying capacities, limiting factors, and growth curves;

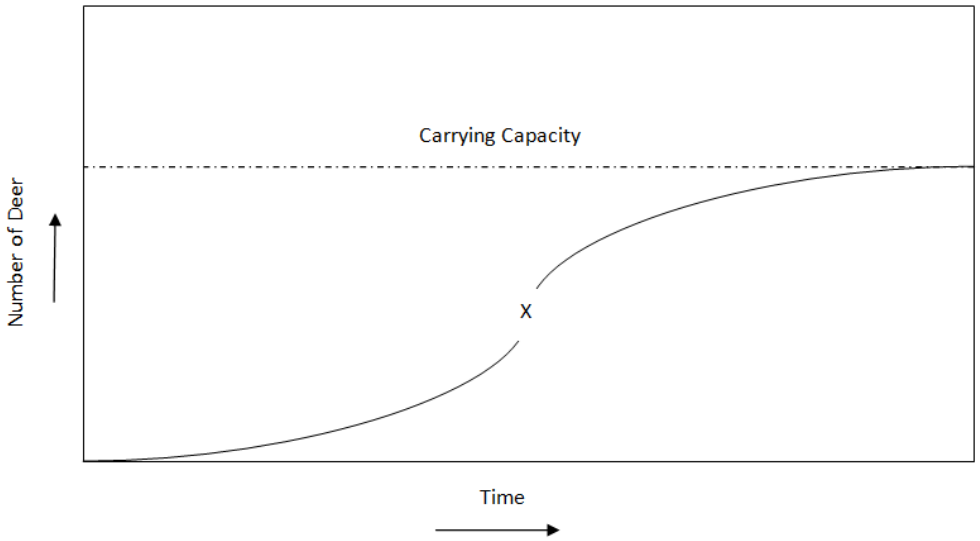
Students need more practice analyzing factors that affect populations, communities, and ecosystems.

Population dynamics (BIO.8a)

Wild cats such as cheetahs, lions, and tigers experience decreased genetic diversity as their populations decline and become fragmented due to habitat destruction. Decreased genetic diversity leads to populations with-

A. disproportionate gender ratios
B. decreased disease resistance
C. increased immigration rates
D. increased birthrates

Population dynamics (BIO.8a)



If this population of deer had exhibited a higher degree of exponential growth than the curve shown here, which of these would be most likely?

A. Plants for foraging would increase
B. The deer would face a decreased chance of disease
C. The population would reach carrying capacity sooner
D. Predators would decrease

Population dynamics

1. A biology class studies the concept of carrying capacity. On a field trip, the students measure a pond and calculate the surface area to be 240 m^2. Previous research shows that each frog in a pond requires about 2 m^2 of space to survive. Approximately how many frogs can this pond support?

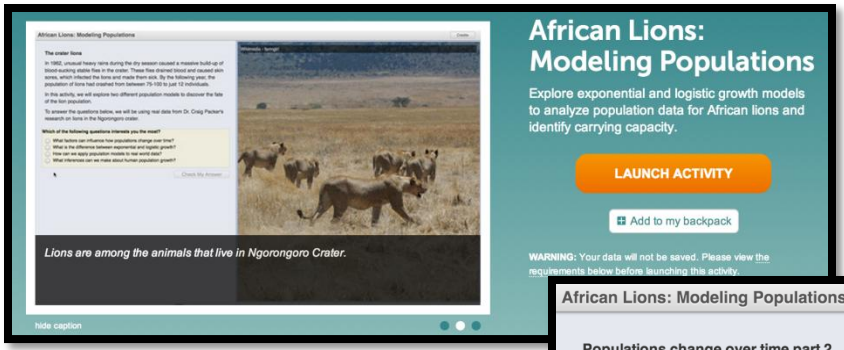
Answer: Approximately 120 frogs

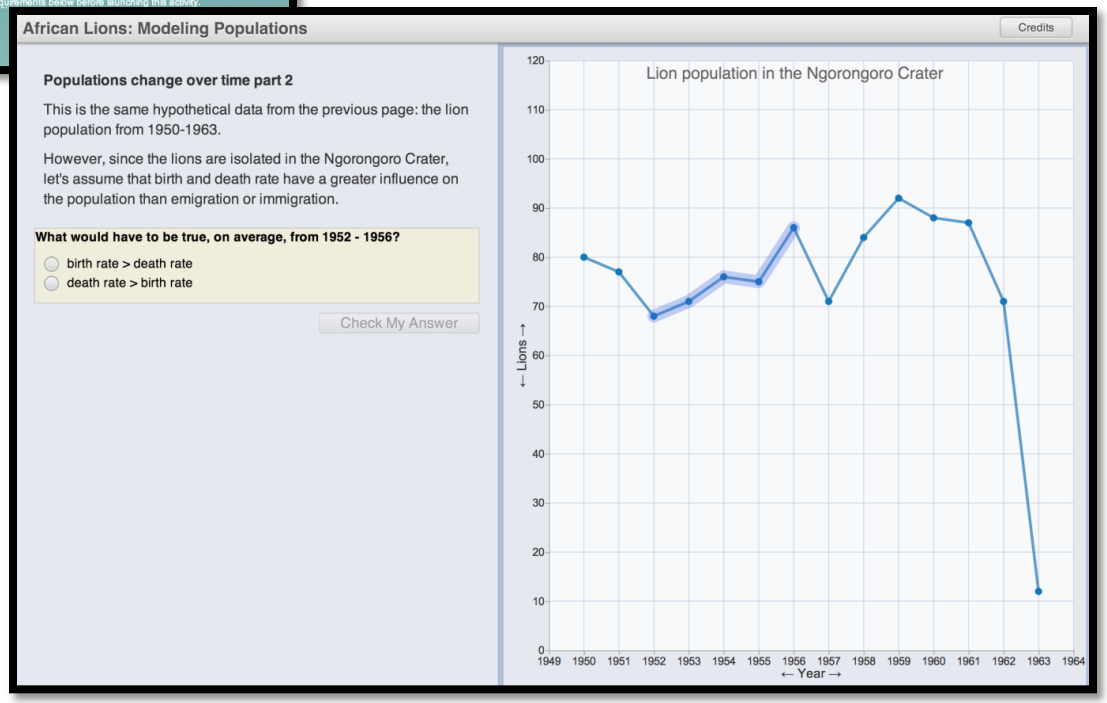
2. Draw a graph to show a prediction of what happens to the population over time as the number of frogs increase in the pond.

Answer: The graph should show that the frog population increases until it stabilizes at carrying capacity.

Instructional Guidance BIO.8a

Population dynamics





http://www.doe.virginia.gov/instruction/science/resources/sams/index.shtml

http://concord.org/stem-resources/african-lions-modeling-populations

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Practice Items

This concludes the student performance information for the spring 2013 Biology SOL test.

Additionally, test preparation practice items for Biology can be found on the Virginia Department of Education Web site at:

http://www.doe.virginia.gov/testing/sol/practice_items/index.shtml#science

Contact Information

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