

Biology Toolkit: Indicator 3.2.2

Goal 3.0 Concepts Of Biology

Expectation 3.2 The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms

Indicator 3.2.2 The student will explain processes and the function of related structures found in unicellular and multicellular organisms.

Assessment Limits:

- pH
- temperature
- light
- water
- oxygen
- carbon dioxide
- radiation (role in cancer or mutations)
- toxic substances (natural, synthetic)

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Public Release #1 - Selected Response Item - Released in 2004

Biology Indicator 3.2.2

Use the information and the table below to answer the following.

The breathing rate of a goldfish can be measured by the number of times the goldfish opens its

mouth. In an experiment, students placed a goldfish in a container of water at 26°C and counted the number of times the fish opened its mouth. They gradually lowered the water temperature and counted the number of times the fish opened its mouth at 20°C, 14°C, 8°C, and 2°C. The results are shown in the table below.

BREATHING RATES OF GOLDFISH

Trial	Water Temperature				
	26°C	20°C	14°C	8°C	2°C
1	101	80	54	30	2
2	98	75	52	27	3
3	102	81	53	29	2
4	103	78	55	28	4

Which of these descriptions best explains the decrease in the breathing rate of the goldfish?

- A. The demand for oxygen increased.
- B. The rate of metabolic activity decreased.
- C. The demand for carbon dioxide decreased.
- D. The fish's activity levels increased.

Public Release #2 - Selected Response Item - Released in 2004

Biology Indicator 3.2.2

Use the description of the experiment below to answer the following.

A student washes her hands with antibacterial soap and water. Then she touches the agar in a petri dish with her thumb. The agar contains nutrients that support the growth of bacteria. Other students repeat the procedure after washing their hands with three different kinds of antibacterial soap. The petri dishes are kept warm overnight to allow bacteria to grow. The next day the students count the number of bacterial colonies in each dish.

What should be the effect of the soap in this experiment?

- A. It should be toxic to the bacteria.
- B. It should help the bacteria to grow.
- C. It should change the pH of the agar.
- D. It should destroy the nutrients in the agar.

Public Release #3 - Selected Response Item - Released in 2003

Biology Indicator 3.2.2

Use the information and the graph below to answer the following.

Scientists wanted to study the effect of water temperature on the swimming speed of goldfish. They set up an experiment in which they raised populations of goldfish in two different aquariums. Population 1 was raised at 5°C. Population 2 was raised at 25°C. All other variables were constant in both aquariums. The results of this experiment are shown in the graph below.



If the temperature of the water increases from 5°C to 10°C, the goldfish in Population 1 would most likely

- A. produce less carbon dioxide
- B. eat less food

- C. use more oxygen
- D. excrete more salt

Public Release #4 - Selected Response Item - Released in 2003

Biology Indicator 3.2.2

Which of these is an environmental factor that causes damage to chromosomes?

- A. acid rain
- B. lead paint
- C. methane gas
- D. ultraviolet light

Public Release #5 - Selected Response Item - Released in 2003

Biology Indicator 3.2.2

Botulism, a type of food poisoning, is caused when bacteria release a poisonous substance. Eating even a small amount of food that contains the poisonous substance can cause death.

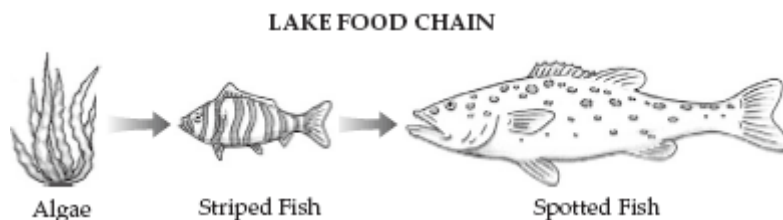
This poisonous substance is called

- A. a virus
- B. a toxin
- C. a parasite
- D. a scavenger

Public Release #6 - Selected Response Item - Released in 2005

Biology Indicator 3.2.2

A summer camp was built near a lake in the mountains. The campers used the lake for swimming, fishing, and boating. The relationships between three organisms found in the lake are shown below.



Which of these fish cell structures would be most directly affected by a change in the oxygen level of the lake?

- A. mitochondrion
- B. chloroplast
- C. golgi apparatus
- D. endoplasmic reticulum

Public Release #7 - Selected Response Item - Released in 2009

Biology Indicator 3.2.2

Depending on the environmental conditions, *Euglena*, a unicellular protist, can act as either a producer or a consumer. *Euglena* will most likely act as a consumer when placed in which of these environments?

- A. cool
- B. acidic
- C. low-oxygen
- D. no-light

Public Release #8 - Selected Response Item - Released in 2009

Biology Indicator 3.2.2

As a response to cellular damage caused by injury, body tissue becomes inflamed, appears red, and feels warm. These changes are the result of blood circulating to the inflamed tissue.

In response to the increase in temperature, which of the following is most likely to occur in cells surrounding the damaged tissue?

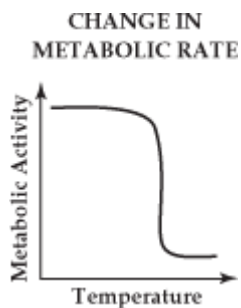
- A. increase in the mutation rate of the tissue
- B. decrease in oxygen flow through the tissue
- C. increase in the metabolic rate of the tissue
- D. decrease in carbon dioxide use by the tissue

Public Release #9 - Selected Response Item - Released in 2006

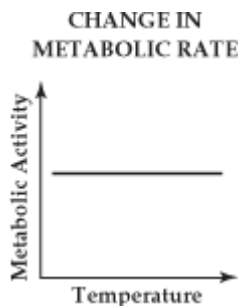
Biology Indicator 3.2.2

In crickets, the rate of chirping is related to the temperature of the air. The rate of chirping can be used to describe their metabolic activity. Which of these graphs most likely shows how temperature affects metabolic activity in crickets?

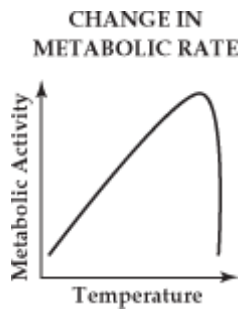
A.



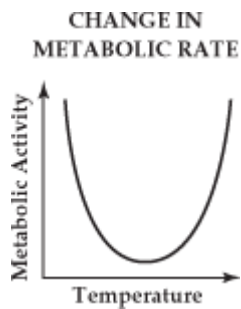
B.



C.



D.



Public Release #10 - Selected Response Item - Released in 2006

Biology Indicator 3.2.2

In the fall, the leaves of many plants change color. Which of the following abiotic factors is primarily responsible for causing this change?

- A. increased pH
- B. increased water
- C. decreased acidity
- D. decreased light

Public Release #11 - Selected Response Item - Released in 2007

Biology Indicator 3.2.2

Sea grasses grow on the ocean floor in shallow areas. Runoff from the land into the ocean can cause the waters to become cloudy. Cloudy water affects the sea grasses' ability to make their own food because there is not enough

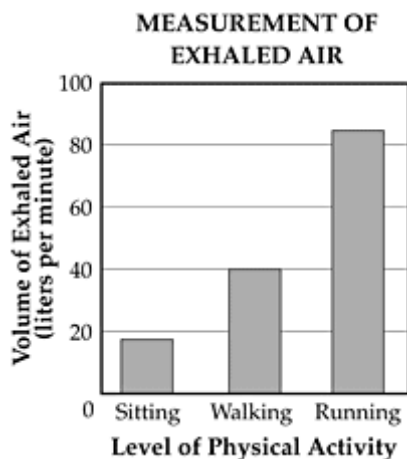
- A. oxygen
- B. water
- C. light
- D. carbon

Public Release #12 - Selected Response Item - Released in 2008

Biology Indicator 3.2.2

Use the information and the graph below to answer the following item.

A group of students measured the volume of air they exhaled during three different activities: sitting, walking, and running. The volume of exhaled air is directly related to the amount of carbon dioxide produced. The data the students collected are summarized in the graph below.



Which of these statements best explains the data?

- A. As metabolism increases, the amount of carbon dioxide produced decreases.
- B. As metabolism increases, the amount of carbon dioxide produced increases.
- C. The rate of metabolism depends on the amount of carbon dioxide produced.
- D. The amount of carbon dioxide production remains constant as metabolism increases

Public Release #13 - Selected Response Item - Released in 2008

Biology Indicator 3.2.2

Anna conducted an experiment using green algae. She put equal amounts of water into two identical containers and maintained the water level throughout the experiment. Next she added equal amounts of green algae to both containers. Container 1 received full sunlight while Container 2 was placed in the dark.

After two weeks, what will Anna most likely find in Containers 1 and 2?

- A. no algae in either container
- B. abundant algae in both containers
- C. no algae in Container 1 and abundant algae in Container 2
- D. abundant algae in Container 1 and no algae in Container 2

Public Release #14 - Selected Response Item - Released in 2008

Biology Indicator 3.2.2

Doctors lower a patient's body temperature during some surgical procedures. Which of these is the most likely benefit of lowering body temperature for surgery?

- A. a decrease in blood circulation
- B. an increase in metabolism
- C. an increase in blood circulation
- D. a decrease in pH

Public Release #15 - Brief Constructed Response Item - Released in 2003

Biology Indicator 3.2.2

A student is studying the relationship between a leafy plant and a species of beetle. He divided 20 plants into two groups. He planted each group in a separate planter box. He then released 50 beetles into one of the planter boxes. The beetles fed on the leaves and left a white substance around the plant, changing the pH of the soil. He recorded the average height of the plants at the

end of three months. His data are shown below.



- How did the substance probably affect the growth of the plants in Group 1?
- Describe how changes in pH may affect the metabolic rates of cells.
- Describe how other environmental factors could affect growth in plants.

Write your answer in your Answer Book.

The following 8 Anchor Papers represent a range of score points and are used in conjunction with the rubric to assess student responses.

Anchor Paper #1



Score for Anchor Paper #1: Rubric Score 1

Annotation: This response contains evidence of some understanding of the question. The student provides minimally effective supporting details to identify a few environmental factors that could affect the growth in plants (sunlight, water).

Anchor Paper #2



Score for Anchor Paper #2: Rubric Score 1

Annotation: This response contains evidence of some understanding of the question. The student provides minimally effective supporting details when describing plant growth (releasing the beetles into the plant box slowed down the growing rate) and environmental factors that affect plant growth (not enough light and not enough water). An attempt to describe the effect of changes in pH (the cells need to have their pH at a certain level to work properly) does not adequately address how pH affects metabolic rate.

Anchor Paper #3



Score for Anchor Paper #3: Rubric Score 2

Annotation: This response contains evidence of a basic understanding. The student recognizes the effects of changes in the pH (metabolism may have speeded up or slowed down because the pH was too high or low) and provides a list of environmental factors (water, sunlight, or fertilizer). The appropriate use of some scientific terminology (acid, basic variables) helps strengthen the response.

Anchor Paper #4



Score for Anchor Paper #4: Rubric Score 2

Annotation: This response contains evidence of a basic understanding of the question. The student provides adequate supporting details, regarding the growth of the plant (caused a stunting of growth; not grow as tall) and a list of environmental factors that could affect plant growth (temperature, water exposure, air conditions, and soil pH). The effect of pH change on plant growth is recognized (probably slowed the plants metabolic rate).

Anchor Paper #5



Score for Anchor Paper #5: Rubric Score 3

Annotation: This response contains evidence of a good understanding of the question. The student demonstrates some synthesis of information by using the "PLANT DATA" to draw conclusions about how the white substance affects plant growth (one-third as tall as the plant group with no beetles, the substance left behind by the beetles slows down the growth). Generally complete supporting details strengthen the response (change in pH probably slowed down the metabolic rate). Listing and elaborating on the environmental factors that affect plant growth strengthens this response (sunlight, temperature, and nutrients; if it is too hot or too cold, a plant cannot survive).

Anchor Paper #6



Score for Anchor Paper #6: Rubric Score 3

Annotation: This response contains evidence of a good understanding of the question through the use of generally complete supporting details (changed the pH...made it more acidic or basic...affect the metabolic rate of cells). Some effective elaboration occurs in the specific explanations of how environmental factors affect plant growth (plants need water to survive; without sunlight plants can't perform photosynthesis). Accurate scientific terminology (acidic, base, photosynthesis, and glucose) strengthens the response.

Anchor Paper #7



Score for Anchor Paper #7: Rubric Score 3

Annotation: This response contains evidence of a good understanding of the question. The student gives generally complete supporting details throughout the response, and the section about how the substance affects growth is somewhat elaborated (The white substance changed the environment...metabolic rates were slowed...could not produce as many photosynthesis...cell division was slowed). Scientific terminology strengthens the response (acidic, photosynthesis, cell division, and consumers). More elaboration and synthesis of information, particularly in the part of the response that deals with the effect of environmental factors on the growth of plants, is needed to achieve a higher score.

Anchor Paper #8



Score for Anchor Paper #8: Rubric Score 4

Annotation: This response contains evidence of a full and complete understanding of the question. The student demonstrates a synthesis of ideas through a detailed discussion of enzymes and the use of pertinent and complete supporting details (pH can effect the polarity of the substrate to the enzyme so they will not lock and key fit...could effect the enzymes used in growth). The accurate use of scientific terminology (polarity, substrate, and lock and key) enhances, rather than just strengthens, the response.

Biology Indicator 3.2.2

Answer Key

Public Release Item #1 - Selected Response (SR) - 2004

B. The rate of metabolic activity decreased.

Public Release Item #2 - Selected Response (SR) - 2004

A. It should be toxic to the bacteria.

Public Release Item #3 - Selected Response (SR) - 2003

C. use more oxygen

Public Release Item #4 - Selected Response (SR) - 2003

D. ultraviolet light

Public Release Item #5 - Selected Response (SR) - 2003

B. a toxin

Public Release Item #6 - Selected Response (SR) - 2005

A. mitochondrion

Public Release Item #7 - Selected Response (SR) - 2009

D. no-light

Public Release Item #8 - Selected Response (SR) - 2009

C. increase in the metabolic rate of the tissue

Public Release Item #9 - Selected Response (SR) - 2006

C.

Public Release Item #10 - Selected Response (SR) - 2006

D. decreased light

Public Release Item #11 - Selected Response (SR) - 2007

C. light

Public Release Item #12 - Selected Response (SR) - 2008

B. As metabolism increases, the amount of carbon dioxide produced increases.

Public Release Item #13 - Selected Response (SR) - 2008

D. abundant algae in Container 1 and no algae in Container 2

Public Release Item #14 - Selected Response (SR) - 2008

A. a decrease in blood circulation

Public Release Item #15 - Brief Constructed Response (BCR) - 2003

Refer to Annotated Student Responses and Scoring Rubric

Rubric - Constructed Response (ECR)

Score 4

There is evidence in this response that the student has a *full and complete understanding* of the question or problem.

- Pertinent and complete supporting details demonstrate an integration of ideas.
- The use of accurate scientific terminology enhances the response.
- An effective application of the concept to a practical problem or real-world situation reveals an insight into scientific principles.*
- The response reflects a complete synthesis of information.

Score 3

There is evidence in this response that the student has a *good understanding* of the question or problem.

- The supporting details are generally complete.
- The use of accurate scientific terminology strengthens the response.
- The concept has been applied to a practical problem or real-world situation.*
- The response reflects some synthesis of information.

Score 2

There is evidence in this response that the student has a *basic understanding* of the question or problem.

- The supporting details are adequate.
- The use of accurate scientific terminology may be present in the response.
- The application of the concept to a practical problem or real-world situation is inadequate.*
- The response provides little or no synthesis of information.

Score 1

There is evidence in this response that the student has *some understanding* of the question or problem.

- The supporting details are only minimally effective.
- The use of accurate scientific terminology is not present in the response.
- The application, if attempted, is irrelevant.*
- The response addresses the question.

Score 0

There is evidence that the student has *no understanding* of the question or problem.

- The response is completely incorrect or irrelevant or there is no response.