

Endothermic and Ectothermic Organisms

Lesson Overview

During this lesson, they will explore the terms endothermic and ectothermic as they investigate the effect a change in water temperature has on goldfish.

Standards Addressed

- SC 2005 6-3.3: Compare the response that a warm-blooded (endothermic) animal makes to a fluctuation in environmental temperature with the response that a cold-blooded (ectothermic) animal makes to such a fluctuation.
- SC 2014 6.L.4B.5 Analyze and interpret data to compare how endothermic and ectothermic animals respond to changes in environmental temperature.

Disciplinary Literacy Best Practices

Notebooking
Cooperative Groups
Graphic Organizer

Lesson Plan

Time Required: Three 55-minute class periods

Disciplinary Vocabulary: ectothermic, endothermic

Materials Needed:

Paper	Bowls
Markers	Temperature Graphs
Fever Thermometer	Ice
Goldfish	Warm water
Beakers	

Breathing Behaviors of Goldfish <http://www.jdenuno.com/PDFfiles/FishResp.pdf> (site provides a detailed set up for Goldfish investigation.)

Preparation for the Lesson:

- Gather materials.
- Set up a goldfish habitat with room temperature water. (If possible, provide a small container and goldfish for each cooperative group.)

Engage

- Ask five students to volunteer and come to the front of the class.
- Take their temperatures. Record the temperature data on the board. Ask the class to analyze the data. What do you observe about the data?
- Tell the students: We've taken and recorded the temperature of "5" of your classmates. Ask: What would you predict the temperature of your other classmates would be if we took all of their temperatures? Why?
- Ask: Can our body temperature change? When and Why?
- Ask them how the temperatures recorded confirms "normal" body temperature for humans (98.6°F).
- Tell them that our temperature remains nearly the same because we are warm-blooded animals.
- Ask them what warm-blooded means. Have them recall and give the term for warm blooded animals. (endothermic)
- Tell them that today and in the next several days they will be investigating how other animals respond to the temperature of their environment.

Explore

PART 1:

- Ask students to respond to the following in their notebooks: What time of year are we most likely to see reptiles outside? Why? (snakes, etc. more likely to see in summer)
- Have each cooperative group use three sheets of paper and draw a picture of a reptile on each sheet. Each group should use the same reptile on each sheet of paper. For example: If a group chooses snakes, then they will have 3 sheets of paper each containing a drawing of a snake.
- Provide each group with three thermometers. Have them tape the thermometer to each sheet of paper.
- Have cooperative groups take the three reptile pictures with the thermometer attached outside and place them in three different locations: asphalt, grassy area, and shady area.
- After ten minutes have students take the temperature from the three thermometers. Record the data and return inside.

Explain

PART 1:

- Discuss the data and how it relates to reptiles in their natural habitats. How does the environmental temperature affect the internal temperature of reptiles?
- Explain/Remind the students that reptiles are **ectothermic**.
- Ask: What other animal groups might be ectothermic? Cite evidence for your responses. (Animals, including fish, amphibians)

- Tell them that our next investigation will allow us to collect data on how fish respond to a temperature change in their environment.

Explore

PART 2:

- Tell students that they will design an experiment to determine how temperatures affect the behavior of goldfish.
- Give the students time to set up their notebooks for this investigation.
- Ask students how they think the temperature of the water will affect a goldfish's behavior. Give them time to write their predictions in their notebooks.
- Help students write a hypothesis by giving them the following statement to develop into a hypothesis statement for this investigation:
- If the temperature *increases* or *decreases* then the goldfish will.....
- Make sure each group includes measuring the respiration rate as a behavior they will observe.
- Cooperative groups will present their plan prior to starting the investigation. Each group will begin by checking the temperature of the water and recording the number of breaths a fish takes as well as other observed behaviors at room temperature. Find a class average for respiration rate of fish in room temperature water. Record this for later use. Prepare a data chart to record data.

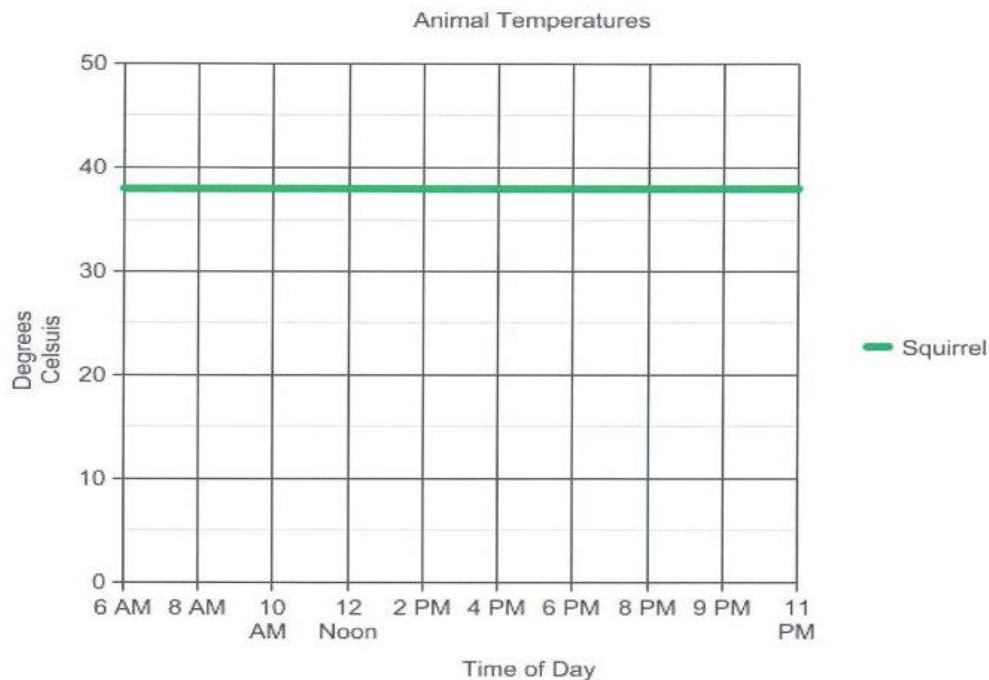
○ Water Temperature	○ Respiration Rate	○ Other Behaviors
○	○	○
○	○	○
○	○	○

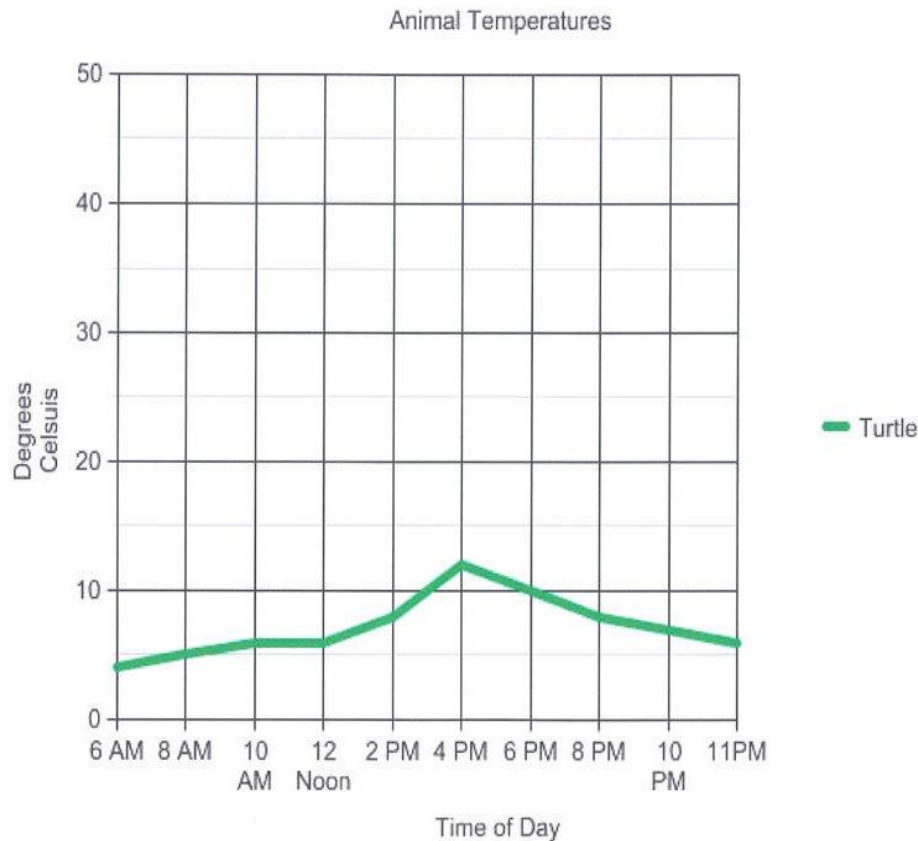
- Have students use an empty bowl holding the beaker to add ice or warm water. Temperature for the goldfish must remain in the range of 10-30⁰ C for the protection of the fish.
- Have students measure the temperature after every time interval (number of seconds agreed upon in the cooperative group plan).
- Place a thermometer in the fish's beaker/bowl and watch as the temperature slowly changes. Record the temperature of the water, the fish's respiration rate and other behaviors of the fish on the data chart.
- Collect data until the temperature reaches within the range of 10-30⁰ C.
- Discuss the data collected during the investigation with cooperative group members.
- Graph the data change (change in temperature should be shown with line graph because it is change over time).
- Compare the results with the hypothesis and write a conclusion.

Explain

PART 2:

- Discuss results with students
- Create a class double line graph to illustrate the respiration data collected. Include a line for warm water data and one for cold water data to compare the findings.
- Questions for class discussion:
 - How was the fish's swimming and breathing behavior and respiration rate affected by the temperature? What evidence supports your response?
 - What other factors may have affected the breathing rate?
 - How did the change in respiration rate compare to the average respiration rate at room temperature?
 - In what ways did your results support or refute your hypothesis? Were you surprised? Why?
- Propose an explanation for your experimental results: Why do you think fish react this way as their environmental temperature changes?
- Share the temperature graphs for the squirrel and turtle. Have students make observations and inferences using the graphs





- Have the students decide which graph represents the graph for an ectothermic animal and which one represents an endothermic animal. Ask for explanations for their choice.
- Ask students to compare their graphs with these graphs and talk about similarities and differences. Which graph best matches theirs from the Goldfish investigation? Why?
- Have them complete a claims and evidence statement for whether their data supports a goldfish being ectothermic or endothermic. "I think goldfish are (ectothermic/endothermic) because during our investigation....."
- Allow groups to share their statements and listen to assess understanding of the terms ectothermic and endothermic. Have students write a summary of the investigation.

Teacher Reflections and Biographical Information

Good multi-day lesson that assists students with collecting data, comparing data, and sharing information with their group and also writing results with a summary in their notebooks.

This lesson originally appeared in the SC Standards Support System (S3) curriculum. It has been adapted to include disciplinary literacy strategies.

Lesson Author: Gaye Irick is an Educational Specialist with S²TEM Centers SC.