

Heat Loss from a Fur-Insulated Animal

Strands Life Systems; Ecosystems

Topic Investigating adaptation and change

Primary SOL LS.9 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include

- differences between ecosystems and biomes;
- characteristics of land, marine, and freshwater ecosystems; and
- adaptations that enable organisms to survive within a specific ecosystem.

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

- data are organized into tables showing repeated trials and means;
- triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and probeware are used to gather data;
- data are organized, communicated through graphical representation, interpreted, and used to make predictions.

LS.4 The student will investigate and understand how organisms can be classified. Key concepts include

- the distinguishing characteristics of major animal phyla and plant divisions.

Background Information

As students investigate adaptations, they can observe how fur insulates. Fur or feathers are an adaptation possessed by warm-blooded animals to protect against too hot or too cold ambient temperatures and help maintain constant body temperature. This experiment shows how fur protects against a too cold ambient temperature by preventing/delaying heat loss. The experiment also provides students with continuous data, which can be used to create graphs that, in turn, can be used to practice extrapolation. *CAUTION: Be sure the hot water used in this experiment is not boiling or too hot. As students pour the hot water into the cylinders, caution them to be very careful and not spill the hot water on themselves.*

Materials

- 50-ml plastic graduated cylinders
- Pieces of fake fur/material, cut to fit as tube-shaped “gloves” for cylinders
- Rubber bands
- Hot water
- Thermometers
- Thermometer keeps, or paper clips if short thermometers are used
- Clock or timers
- Copies of “The Effect of Fur Insulation on Heat Loss” lab sheet (attached)
- Graph paper

- Colored pencils

Vocabulary

abiotic, adaptation, behaviors, biotic, ecosystem, functions, meniscus, structures, survival

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

1. Group students into lab teams; you may wish to assign heterogeneous grouping with specific roles to assure all students are actively participating. Distribute lab supplies, including two graduated cylinders, to each team.
2. Have each lab team wrap a piece of fake fur around one graduated cylinder and secure it with rubber bands. The wrapped cylinder will simulate a warm-blooded, furry animal. Have teams place their fur-wrapped cylinder beside their unwrapped cylinder.
3. Take a moment and explain safety procedures for working with hot water. This is also a good time to review how to read a graduated cylinder (meniscus). Have the teams fill both cylinders with hot water, being careful not to spill the water. Students should fill both cylinders with the same amount of water.
4. Have students immediately place a thermometer into each cylinder. If short thermometers are used, they can be hung from the lip of the cylinder by a paper clip. Allow the thermometers to equilibrate, and when their readings reach the highest point (time zero), begin timing.
5. Direct teams to read and record the temperature of the water in each cylinder every two minutes for 20 minutes. (The time can be extended, but 20 minutes should be long enough to collect useful data.)
6. After 20 minutes, have students remove thermometers and pour out the water.
7. Have students plot on graph paper a double-line graph of the collected data.

Assessment

- **Questions**
 - What effect did the fur have on the temperature of the water?
 - How did the temperature change over time?
- **Journal/Writing Prompts**
 - Explain how fur can help an animal survive in a cold climate.
 - Describe other adaptations that could help an animal survive in a cold climate, besides skin covering.
- **Other**
 - Create a drawing of an animal with multiple adaptations to help it survive in a particular ecosystem. Label each adaptation and its purpose.

Extensions and Connections (for all students)

- Have students design and complete an experiment to test another animal's adaptations, such as feathers.
- Have students design and complete an experiment that tests different thicknesses of furry material.

The Effect of Fur Insulation on Heat Loss

Name: _____ Date: _____

In this experiment, you will compare heat loss from a furry (insulated) mammal with heat loss from a nonfurry (uninsulated) mammal. A hot-water-filled, fur-wrapped graduated cylinder will represent the furry mammal, and a hot-water-filled, unwrapped cylinder will represent the non-furry mammal.

Hypothesis

Independent variable:

Control:

Dependent variable:

Constants:

Data

Time (minutes)	Temperature (° Celsius) unwrapped cylinder	Temperature (° Celsius) fur-wrapped cylinder
0		
2		
4		
6		
8		
10		
12		
14		
16		
18		
20		

On a piece of graph paper, plot a double-line graph of the data, using two different colors. Attach your graph to this worksheet for assessment.

Conclusion