

# How does **BLUBBER** Work?

TEACHER



## Activity Overview

### *How are pinnipeds adapted to living in cold water?*

Students appreciate how California sea lions and northern elephant seals stay warm by performing an experiment in which blubber is simulated with shortening, heat loss data is collected with Temperature Sensors, and data comparisons are shown using the TI-73 Explorer™.

Students feel the effects of blubber by placing one hand in a shortening mitt (simulating blubber) and the other hand in an air-filled mitt (simulating skin) and then putting both into ice water.

Next, students measure and graph the temperature changes they felt with their hands by putting the mitts back in the ice water with a Temperature Sensor in each. The Temperature Sensors are connected to a CBL 2™ and the data is graphed on a TI-73 Explorer™.

Conclusion: Blubber acts as an insulator and keeps pinnipeds warm as they live in cold ocean waters.

## Concept Background

- A pinniped's body, except for its flippers and head, is enveloped in a thick layer of blubber. For a large male elephant seal, that blubber could be a third of their weight — well over 450 kilograms (1000 pounds)!
- Blubber is less dense than muscle or other body tissue which helps keep pinnipeds buoyant in the sea. Blubber floats.
- Blubber is a very poor conductor of heat which makes it a very efficient insulator.

- Pinnipeds were hunted almost to extinction, in part for their blubber that was turned into oil. Populations have been increasing steadily since the Marine Mammal Protection Act was passed in 1972.



## Activity at a Glance

Grade: 4-9

Subject: Science

Category: Physical Science, Life Science

Topic: Heat, Physical Properties, Animals  
Living Things, Adaptation

## Time required

- One 45-minute period

## Level of complexity

- Medium

## National Education Standards

*Science Standard A: Science As Inquiry*

Students should understand scientific inquiry and develop abilities necessary to perform it.

*Science Standard C: Life Science*

Students should develop an understanding about the structure and function of living systems, reproduction and heredity, regulation and behavior, populations and ecosystems, and the diversity and adaptations of organisms.

*Math Standard: Data Analysis & Probability*

Students should develop an understanding about how to collect, organize, display, and interpret data.

*Math Standard: Measurement*

Students should develop an understanding of different units of measure, be able to convert among systems, and become proficient in selecting the appropriate size and type of measure for a given situation.

*English Language Arts Standard 3*

Students should apply strategy to comprehend interpret, evaluate, and appreciate text.

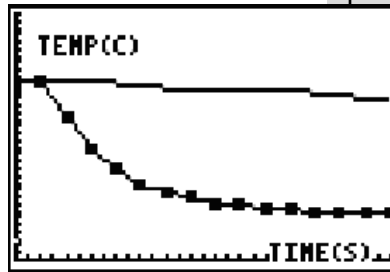
## Materials

- TI-73 Explorer™
- TI CBL 2™
- TI-73 DataMate
- 2 Temperature Sensors
- "Blubber" mitt
- "Skin" mitt
- Ice water bath

# How does **BLUBBER** Work?

## Preparation

- 1 **Make the mitts.**
  - a. “Blubber” mitt: Fill a plastic Ziploc® bag 1/3 full of shortening. Turn a second plastic Ziploc® bag of the same size inside out and insert it into the bag with shortening. Align the Ziploc® tops and zip the two bags together (or use duct tape to seal the seam) trapping the shortening between the two bags.
  - b. “Skin” mitt: Using two plastic Ziploc® bags of the same size, repeat the above procedure without the shortening, trapping only a bit of air between the two bags.
- 2 **Get the ice water ready.**
  - a. Fill a plastic tub about 1' X 2' with ice and enough water to dip in the blubber and skin mitts at the same time.
- 3 **Set up the temperature probes and the CBL 2™.**
  - a. Plug the temperature probe for the “Blubber” mitt into Channel 1 of the CBL 2™.
  - b. Plug the temperature probe for the “Skin” mitt into Channel 2 of the CBL 2™.
  - c. Use the link cable to connect the CBL 2™ to the TI-73 Explorer™. Firmly press in the cable ends.
- 4 **Set up the TI-73 Explorer™.**
  - a. Turn on TI-73 Explorer™ and start DATAMATE. Press **CLEAR** to reset the program.
  - b. Select SETUP from the main screen.
  - c. Select MODE. Use **▲** to move the cursor to MODE and press **ENTER**.
  - d. Select TIME GRAPH from the SELECT MODE menu.
  - e. Select CHANGE TIME SETTINGS from the GRAPH SETTINGS menu.
  - f. Enter “2” as the time between samples in seconds.
  - g. Enter “60” as the number of samples. (Data will be collected for 120 seconds.)
  - h. To adjust the scale on the TIME GRAPH, select ADVANCED from the GRAPH SETTINGS menu.
  - i. Select CHANGE GRAPH SETTINGS from the ADVANCED GRAPH SETTINGS menu.
  - j. Select CH1-TEMP and enter -5 for Ymin=?, enter 30 for Ymax=?, and enter 1 for Ysc1=?.
  - k. Repeat the same steps for CH2-TEMP.
  - l. Select OK to return to TIME GRAPH SETTINGS.
  - m. Select OK to return to the setup screen.
  - n. Select OK again to return to the main screen.



See Appendix A for more information on equipment setup.

## Classroom Management Tips

- Distribute the shortening evenly between the inner and outer bag.
- Students may enjoy preparing the mitts themselves.
- Caution students not to puncture the mitts with the temperature probes.
- Caution students to keep the temperature probe in the middle of the shortening mitt.
- This activity works well as a hands-on experiment and as a demonstration.

## Observations & Conclusions

- A. **Which mitt had the greatest change in temperature?**

The “Skin” mitt had the greatest change in temperature. Although air is a good insulator, it does not work as well as blubber.
- B. **How are pinnipeds adapted to living in cold water?**

A pinniped’s body is enveloped in a thick layer of blubber. Blubber is a very poor conductor of heat, which makes it a very good insulator. It keeps pinnipeds warm.
- C. **How are other animals protected from the cold?**

Many animals have fur to help them conserve body heat. Fur traps air and that serves as an insulator.

## TEACHER

### Vocabulary

*Adaptation n.* A physical feature or ability, developed over many generations that helps a species survive in its environment.

*Carnivore n.* A flesh-eating animal.

*Double migration n.* Two annual round trips made by the northern elephant seal between its feeding grounds in the north Pacific and the Channel Islands.

*Molt v.* To shed the skin, fur, or feathers periodically. Northern elephant seals are said to do “radical molting” because their skin comes off in sheets.

*Otariid n.* Any of approximately 14 species of pinnipeds, including the California sea lion, that have outer ear flaps and hind flippers that can be rotated underneath the body.

*Phocid n.* Any of approximately 19 species of pinnipeds known as “true seals,” including the northern elephant seal. Phocids do not have extended earflaps. They do not use their flippers for moving on land. Instead they wriggle from side to side or hunch their bodies like caterpillars.

*Pinniped n.* A walrus, sea lion, or seal.

*Taxonomy n.* The science of classification and categorization of living things. Linnean taxonomy categorizes all plants and animals into the following seven subgroups, each more specific than the one before: kingdom, phylum, class, order, family, genus, species.

