STUDENT SHEET 3

KEEPING WARM UNDERWATER

PART 1

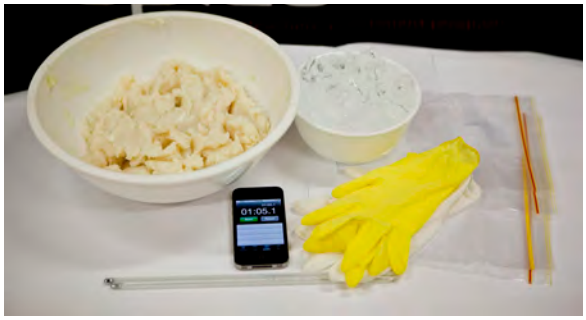
Emperor penguins find and catch their food in waters around Antarctica where the temperature is a freezing -1.9˚C. To stop their internal organs from freezing they have a thick layer of fat beneath the surface of their skin. Fat acts as an insulator; this means it prevents heat from escaping, so the body heat of emperor penguins isn't lost to the frigid water.

Aim

Using vegetable shortening investigate how a thick layer of fat helps emperor penguins stay warm when they dive underwater for food.

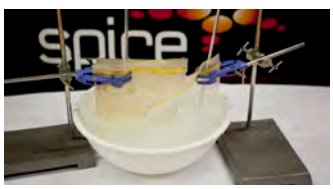
What you will need

- 4 plastic or zip-lock bags
- masking tape
- vegetable shortening (softened)
- basin/bucket of cold water
- ice cubes
- 2 thermometers
- stopwatch/timer
- gloves



What to do

1. Predict which will stay warmest in icy water: a plastic bag insulated with vegetable shortening or an empty plastic bag? Write your answer in your workbook or investigation planner.
2. Fill a plastic bag with vegetable shortening.
3. Place a second plastic bag inside this bag. Spread the shortening evenly. Place a thermometer inside the inner bag.
4. Place another two plastic bags inside one another, with no shortening. Place a thermometer inside the inner bag.
5. Fill basin with cold water. Place a thermometer in the basin.
6. Add ice until the temperature reaches 10°C.
7. Record water temperature and remove thermometer.
8. Secure each pair of bags with masking tape or using zip-lock feature. It's important water doesn't enter bags.
9. Place both plastic bags into the icy water basin.
10. Record temperatures inside the bags after two minutes, and again after four minutes.
11. Record your observations in your workbook or investigation planner.



STUDENT SHEET 4

KEEPING WARM UNDERWATER

PART 2

Aim

Use vegetable shortening to discover how insulation protects your own skin from icy water.

What you will need

- 2 plastic or zip-lock bags (extra bags may be required)
- masking tape
- vegetable shortening (softened)
- basin/bucket cold water
- ice cubes
- disposable gloves, 1 pair per student
- stopwatch
- thermometer

What to do

1. Predict which hand will stay warmest in icy water: the one insulated with vegetable shortening or the one inside a glove with no shortening? Write your answer in your workbook or investigation planner.
2. Put on your disposable gloves.
3. Fill basin with cold water. Place a thermometer in the basin.
4. Add ice until the temperature reaches 10°C.
5. Record temperature of water.
6. Fill a plastic bag with vegetable shortening.

7. Place one hand inside the bag containing vegetable shortening. Spread the shortening evenly around your hand. Seal the bag around your hand to prevent water entering.

8. Place your other hand inside the empty glove. Seal the bag around your hand to prevent water entering.
9. Place both hands into the basin of icy water.

10. Observe how long it takes before your hands begin to feel cold. Remove your hand immediately.
11. Record your observations in your workbook or investigation planner.

Note: Do not put your hands in cold water for longer than one minute.