Hypothermia

You need
- the recording table (see copymaster)
- scales that measure in grams (g)
- 8 ice cubes (all the same size)
- aluminium foil
- cling film
- a glove (for example, a wool glove or ski mitten)
- paper towels
- a timer or watch
- a computer spreadsheet
- classmates

Activity

Henry and his friends are planning their next tramp.

> I got really cold last time on those exposed ridges! But if I take a thick jacket, I'll use up lots of energy carrying it when I don't need to wear it.

> How can we avoid hypothermia if we don't take heavy clothes?

> If you're outside too long in conditions such as cold wind or rain, your body temperature starts to drop. **Hypothermia** is when your body temperature goes below 35 degrees Celsius. As you get colder, you lose co-ordination, strength, brain function, and consciousness. If you don't get warm, you'll die.

1. With a classmate, do this four-part experiment to help you test ways of reducing loss of body heat. Enter your measurements into your copy of the recording table or a spreadsheet.

    a. How much heat is lost from exposed skin?

        i. Weigh 2 ice cubes. (Most ice cubes have a mass of about 20 g.)

        ii. Hold 2 ice cubes in your hand for 3 minutes.

        iii. Weigh what is left of the ice cubes and calculate how much of the mass (in grams) has melted away.

b. What happens if you wear thick clothing?

    i. Weigh a glove and record its mass.

    ii. Put on the glove and repeat the 3-minute experiment with 2 fresh ice cubes.

c. What happens if you use a plastic survival blanket with a reflective coating?

    i. Wrap a bare hand in cling film and then cover it with aluminium foil.

This survival blanket feels very light!

    ii. Repeat the experiment with fresh ice cubes. Record your result.

    iii. Weigh your "survival blanket" and record its mass.

d. What happens if you wear multiple layers of clothing?

    i. Wrap a bare hand with a layer of dry paper towels and then a layer of cling film.

    ii. Repeat the experiment with fresh ice cubes. Record your result.

    iii. Weigh the paper towels and cling film.
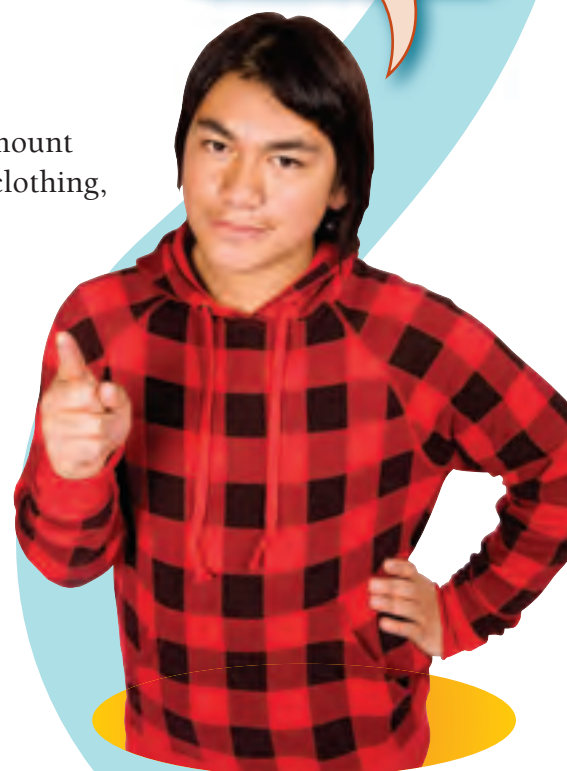
Don't forget to enter these results in your table!

2. For each of the three kinds of insulation, calculate the amount of heat saved by the different protective methods (thick clothing, survival blanket, or layers) by:

a. comparing the loss of ice-cube mass with the loss of mass on the unprotected skin (the control)

b. calculating the joules (J) of heat saved (355 J melts 1 g of ice).

3. Based on your experiment, what kind of clothing would you recommend that Henry and his friends pack to avoid hypothermia? Provide convincing evidence.

4. Would a snowman melt faster with or without a coat? Discuss with a classmate. How could you find out?

Focus   Calculating heat energy efficiency by mass