

VI. How to cool faster?

Key Question: How to cool things faster?



Student name:

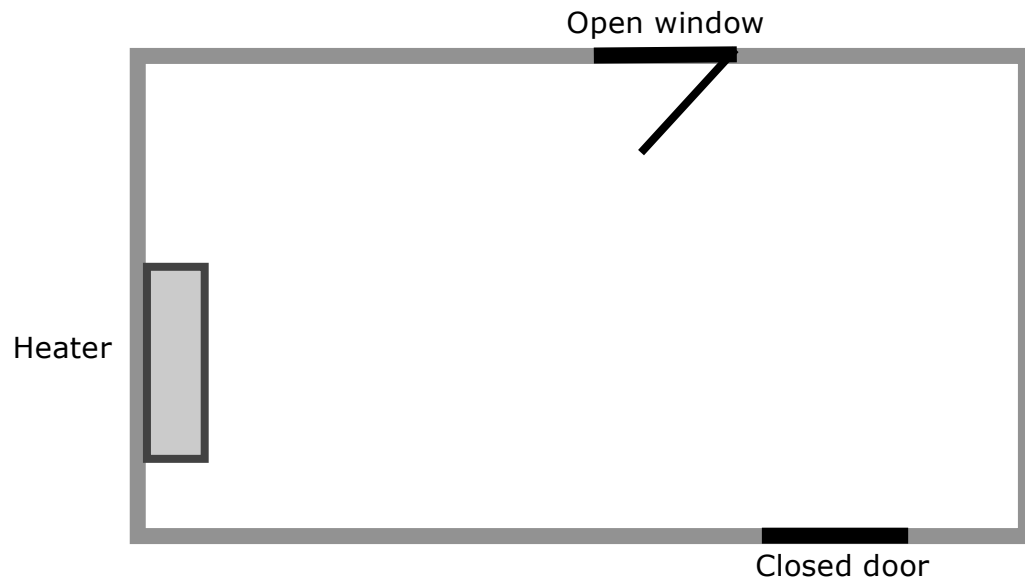
Class:



<http://www.cma-science.nl>

Activity 1 – How does heat flow?

1. What happens to the temperature in the heated room when you open the window in a cold winter day? Draw a thermal map of the room sketched below. With different colors indicate where you think are areas of cold air (use blue color), less-cold air (use light blue color) and warm air (use red color)



2. If you will leave the window open longer what do you think will happen over time?

3. Place a wooden spoon and a metal spoon in hot water. Which spoon feels warmer?

4. Why do you think one spoon feels warmer than the other?

5. You have a beaker of really hot chocolate. You would like to drink it as soon as possible. What will you do to help your drink cool faster? (Give at least two ways of cooling).

- a. _____
- b. _____
- c. _____
- d. _____

Activity 2 – The best way of cooling

Now you will perform a test to find the best way of cooling. The lowest temperature after 2 minutes measurement wins. The chocolate drink consists mostly of water that is why you can use water in your experiments.

- Design and describe a fair test to find out which way of cooling will be the best.

6. What will you measure in your test?

7. Which factor will you change in your test?

8. What will you keep the same?

- Choose three ways of cooling the hot water.
List them in the table on the next page.
- Notice that the first measurement in the table is the temperature measurement of cooling without any extra help. This measurement is used to compare other measurements to.
- Predict which cooling method you think will be the best (1 means the fastest cooling).



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- Start the measurement and let the water cool down without any extra help. Write the measurement results in the table.
- Repeat the temperature measurements for other cooling methods.

WAY OF COOLING DOWN	PREDICTED RANK	BEGIN TEMPERATURE (°C)	TEMPERATURE AFTER 2 MINUTES (°C)	ACTUAL RANK
Cooling without any help (used for comparison)				

9. What is the fastest way of cooling your hot drink? How do you know?

10. Explain, for each of your cooling methods, how the heat was transferred from the hot drink? (What happen to the heat energy of the hot drink?)

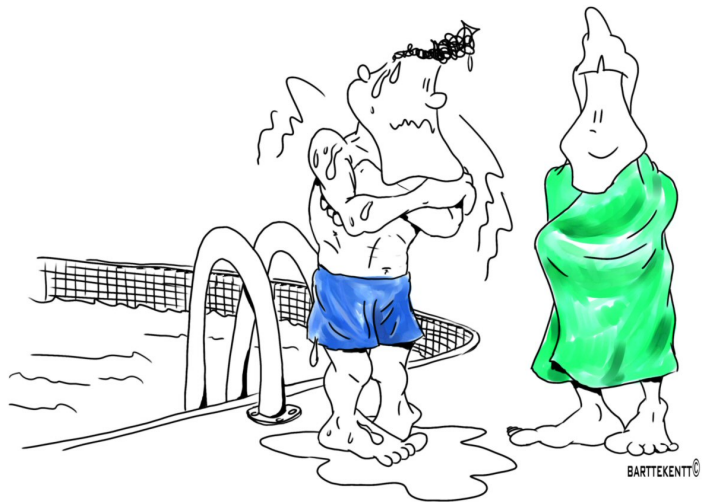
Activity 3 – Can water cool you down?

When the water is warm and the air is warm, why do you feel cold when you come out of the water?

- Spread some water on the back of your right hand.
- Wave both your hands in the air. Which hand feels colder?

☐ Right hand (wet)

☐ Left hand (dry)

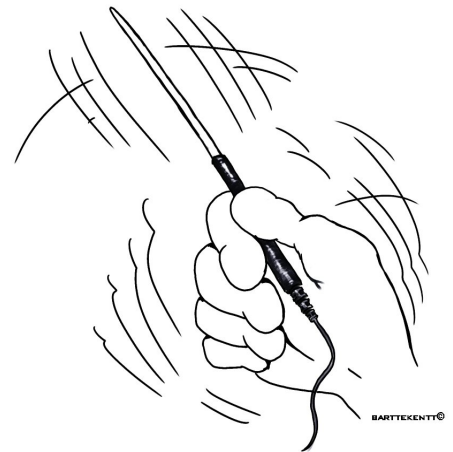


- Hold the sensor in the air and measure its temperature. Write the results in the table below.
- Then wave the sensor and measure its temperature. Write the results.

Warning:

Do not swing with the temperature sensor cable because it can break!

- Now make a metal part of the temperature sensor wet and repeat the last two measurements. Each time wait a little until the temperature does not change much anymore. Write the results in the table.



SENSOR	TEMPERATURE °C WITHOUT WAVING	TEMPERATURE °C WITH WAVING
Dry		
Wet		

11. What was the best way of cooling the sensor?

Activity 4 – Do all liquids cool in the same way as water?

If you spread some water on the back of your hand, the water evaporates. It changes into a gas called water vapor. As the water evaporates, your hand is cooled. This is because energy is needed to change liquid water into water vapor, and the water takes the energy (heat) from your hand. If you blow on your hand when it is wet, this speeds up the evaporation, so your hand feels even colder then before.

Now you are going to investigate whether other liquids can also cool by evaporation.

- Collect different liquids; use for example water, alcohol (perfume or after-shave), oil, acid.
- Dip the metal tip of the sensor into a liquid and lift it out to allow evaporation.
- Start the measurement.

12. Which liquid cools the most?

13. Which liquid dries the fastest?

14. Would blowing on the liquid (i.e. drying it faster) make the temperature go up or go down?

Questions

- A.** Place your right hand in the plastic bag. Close the bag around your hand and keep the hand 1 minute in the bag. Then take your hand out and wave your hand in the air. How does this feel? Why?

- B.** Why do you feel so cold when wear wet clothes?

- C.** When you do anything energetic, like running round the school field, you get warm or even really hot. How does your body cool down?

- D.** Do you know how elephants keep cool?
They use the surface area of their large ears as heat radiators.
Think about how you could investigate this problem.
Do you remember what did you do when you investigated cooling of a baby and adult animals? How could you add "ears"?



