

How heat moves and how to measure temperature

Grade 7 science (Year 8 · Class 7) · Lab

Name: _____ Date: _____ Class: _____

Which material keeps a hot drink warm for longest? In this lab you wrap four cups of hot water in different materials and record the temperature every five minutes. You then compare the temperature falls and explain the results using conduction, convection and radiation.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS3-3, MS-PS3-4

Aim

To find out which wrapping material is the best insulator by measuring how fast hot water cools in four cups.

Equipment

- 4 identical cups with lids
- Cotton wool, newspaper and aluminium foil
- Rubber bands
- 4 thermometers (0-110 °C)
- Stopwatch or phone timer
- Kettle and measuring jug

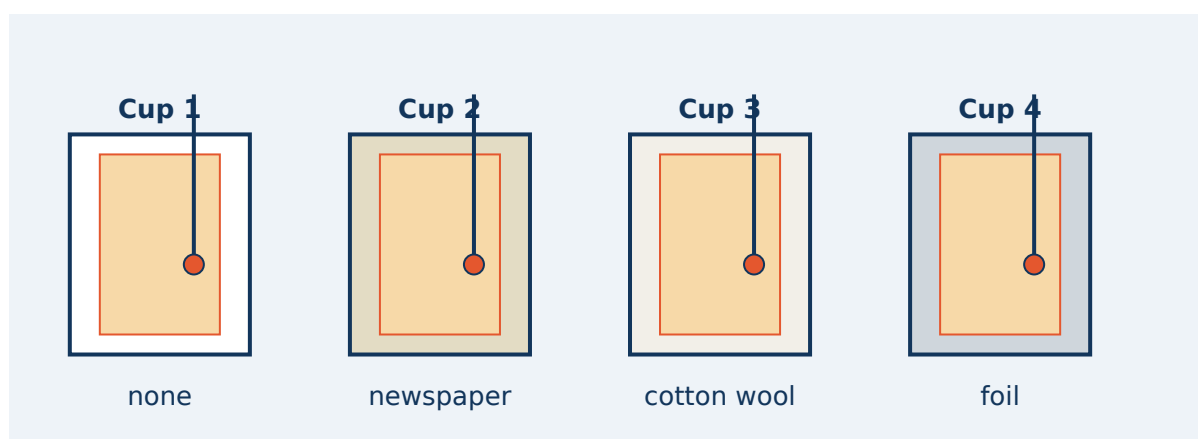
Safety

Safety

Hot water scalds. An adult should pour the water. Keep hands away from the kettle and steam, place cups on a flat mat, and wipe spills immediately.

Method

1. Wrap three cups in a layer of newspaper, cotton wool and foil, and hold each wrapping on with a rubber band. Leave cup 1 bare.
2. Pour 150 mL of hot water into each cup and put on the lids with thermometers through them.
3. Record the starting temperature, about 80 °C, for each cup.
4. Record the temperature of each cup every 5 minutes for 20 minutes.



Set-up for the insulation lab.

Results

Results from a class in Nairobi (temperature in °C):

Time (min)	Cup 1 bare	Cup 2 newspaper	Cup 3 cotton wool	Cup 4 foil
0	80	80	80	80
5	66	71	73	70
10	56	64	67	62
15	49	58	62	56
20	44	54	58	51

Analysis questions

Question 1 Total fall in temperature

Calculate the fall in temperature in 20 minutes for each cup.

Question 2 Rank the insulators

Rank the materials from best to worst insulator.

Question 3 Cooling rate

Calculate the average cooling rate of cup 1 and cup 3 during the first 5 minutes in °C/min.

Question 4 Percentage improvement

Calculate by what percentage cotton wool reduced the temperature fall compared with the bare cup.

Question 5 Describe the graph

Describe how the cooling rate changes during the 20 minutes for cup 1 and explain why.

Question 6 Explain the best material

Explain why cotton wool was the best insulator.

Question 7 Foil and radiation

Foil is shiny. Explain why it did better than the bare cup but worse than cotton wool.

Question 8 Improve the lab

Suggest two improvements to make the results more reliable.