

How heat moves and how to measure temperature

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

Name: _____ Date: _____ Class: _____

These 20 problems train you to tell heat from temperature, read thermometers, calculate temperature changes and cooling rates, and decide which method of heat transfer is at work. They also ask you to analyse insulation data and plan a fair test.

They suit Grade 7 science students, NGSS middle school classes, Year 8 in the UK and Class 7 in India. Write units in every calculation and give a reason for each explanation.

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

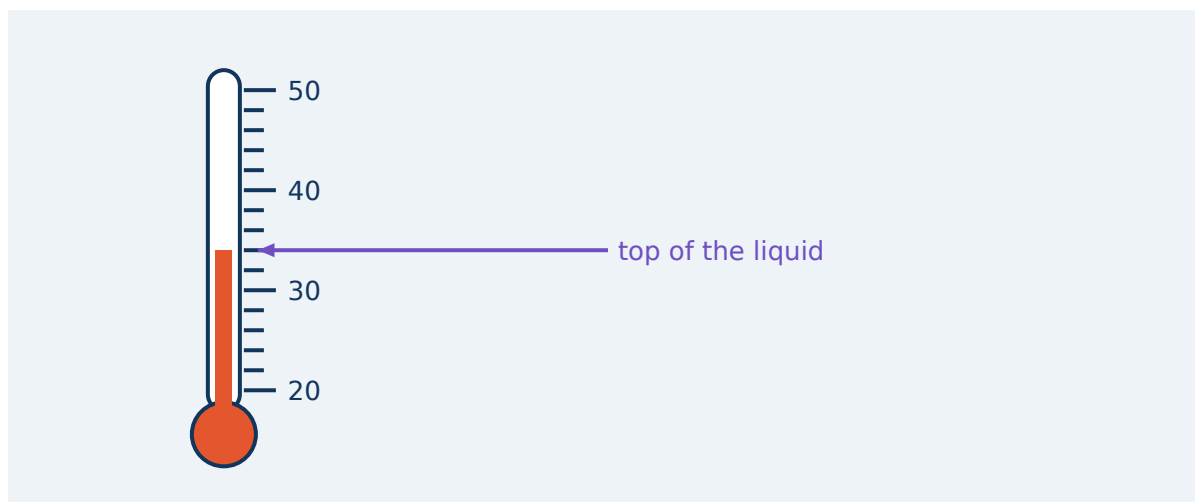
Problem 1 Heat or temperature (easy)

Decide whether each phrase describes heat (energy transfer) or temperature (how hot something is).

1. The tea is at 70 °C.
2. Energy flows from the stove into the pan.
3. The room is at 24 °C.
4. Energy leaves your hand and goes into an ice cube.

Problem 2 Read the thermometer (easy)

Use the thermometer in the figure.



Thermometer for Problem 2.

1. Read the temperature shown.

2. State the size of one small division on the scale.
3. State where the top of the liquid would be if the temperature rose by 6 °C.

Problem 3 Name the method (easy)

Name the main method of heat transfer in each case: conduction, convection or radiation.

1. The Sun warms your face.
2. The handle of a metal spoon gets hot in a soup.
3. Warm air rises above a candle.
4. A hot pan heats the hand placed on its side.

Problem 4 Conductor or insulator (easy)

Sort these into conductors and insulators: copper, wool, aluminium foil, plastic, iron nail, polystyrene.

1. List the conductors.
2. List the insulators.
3. Name the property that makes saucepans have plastic handles.

Problem 5 Fixed points (easy)

The Celsius scale uses two fixed points.

1. State the temperature of melting ice.
2. State the temperature of boiling pure water at sea level.
3. Calculate the number of degrees between these two fixed points.

Problem 6 Which way does heat flow? (easy)

Aisha puts a warm hand on a cold glass of water.

1. State the direction of heat flow.
2. State what happens to the temperature of her hand.
3. State what happens when the two reach the same temperature.

Problem 7 Temperature changes (medium)

Calculate the change in temperature, and say whether it is a rise or a fall.

1. Water heated from 18 °C to 74 °C.
2. Juice chilled from 25 °C to 4 °C.
3. Soup cooling from 88 °C to 47 °C.
4. A winter morning that warms from -3 °C to 17 °C.

Problem 8 Cooling rate of soup (medium)

Ngozi in Abuja measures the temperature of soup falling from 96 °C to 60 °C in 24 minutes.

1. Calculate the total fall in temperature.

2. Calculate the average cooling rate in °C per minute.
3. Predict the temperature after 8 more minutes at the same rate.

Problem 9 Saucepan design (medium)

A saucepan has an aluminium body and a plastic handle.

1. Explain why the body is made of metal.
2. Explain why the handle is made of plastic.
3. Name the method of heat transfer through the base of the pan.

Problem 10 Sea breeze (medium)

In the afternoon in Mombasa the land is hotter than the sea, and a cool breeze blows from the sea to the shore.

1. Name the process that causes the breeze.
2. Explain what happens to the air above the hot land.
3. Describe what happens to the cooler air over the sea.

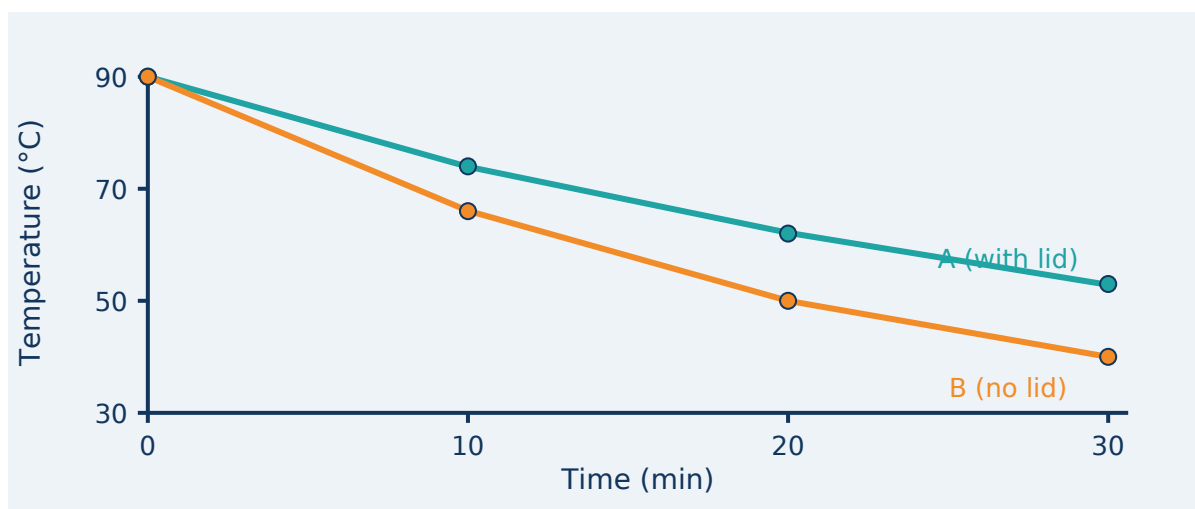
Problem 11 White roofs (medium)

A school in Lagos paints its roof white. A neighbour has a dark roof of the same size.

1. Predict which building is hotter inside in the afternoon.
2. Explain your prediction using radiation.
3. Name another colour surface that radiates and absorbs well.

Problem 12 Cooling curves (medium)

Use the figure showing the cooling of two cups, A with a lid and B without.



Cooling of cups A and B.

1. Read the temperature of cup A at 20 min.
2. Calculate the fall in temperature of cup B in 30 min.

- Identify which cup loses heat faster and suggest why.

Problem 13 Heat in a bath (medium)

A cup of tea and a bathtub of water are both at 40 °C.

- Compare their temperatures.
- Explain which contains more thermal energy.
- Explain which would melt more ice if you added it.

Problem 14 Spot the error (medium)

Chen says: 'My duvet makes heat, and when I put ice in the juice the ice passes cold to the juice.'

- Identify the mistake about the duvet.
- Identify the mistake about the ice.
- Rewrite both statements correctly.

Problem 15 Testing insulators (hard)

Emma wraps four identical cups of 80 °C water in different materials and records the temperature after 20 minutes:

Wrapping	Final temperature (°C)
None	38
Newspaper	52
Cotton wool	56
Bubble wrap	49

- Calculate the fall in temperature for each cup.
- Rank the wrappings from best to worst insulator.
- Explain why trapped air makes a good insulator.
- State how much less heat the cotton wool cup lost than the cup with no wrapping, as a percentage of the fall for no wrapping.

Problem 16 Fair test plan (hard)

Kofi wants to find out which curtain material keeps a model room warmer.

- Identify the independent and the dependent variable.
- List four variables he must keep the same.
- Describe how he would reduce the effect of reading errors.
- Predict the result for a thick, fluffy material.

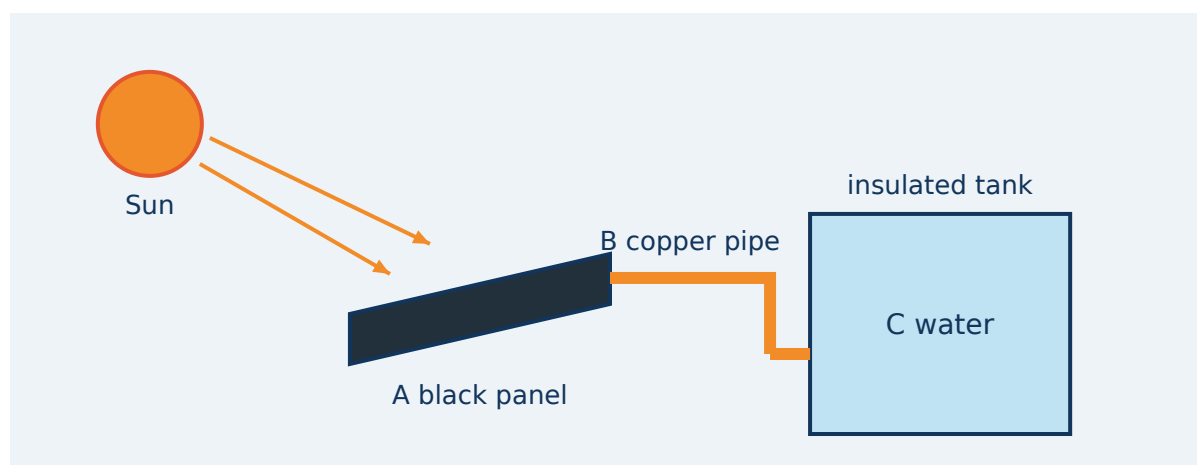
Problem 17 Hot-air balloon (hard)

Diego's team at a festival in Texas heats the air inside a balloon with a burner.

1. Explain, using particles, why the warm air inside the balloon is less dense.
2. Explain why the balloon rises.
3. Name the process that brings cool air in at the bottom and moves warm air to the top.
4. Explain why the balloon sinks slowly when the burner is switched off.

Problem 18 Solar water heater (hard)

The figure shows a solar water heater on a roof in Pune.



Solar water heater on a roof.

1. Name the method of heat transfer at A.
2. Name the method of heat transfer at B.
3. Name the method of heat transfer in the water at C.
4. Explain why the panel is black and the tank is insulated.

Problem 19 Cooling data (hard)

A mug of coffee at 80 °C stands in a room at 20 °C. Its temperature is recorded:

Time (min)	0	5	10	15	20
Temperature (°C)	80	62	50	42	36

1. Calculate the fall in temperature in each 5-minute interval.
2. Describe how the fall changes with time.
3. Explain why using the idea of the difference between the coffee and the room.
4. Predict the lowest temperature the coffee will reach.

Problem 20 Layers of clothing (hard)

On a cold morning in Leeds, Hana wears three thin jumpers instead of one thick jumper.

1. Explain how clothes slow heat loss.
2. Explain why layers of thin jumpers can be as warm as one thick jumper.
3. Name the three methods of heat transfer and say which one clothes mainly reduce.
4. Suggest why a shiny emergency blanket is used after a marathon.