

Exercise walk-through

4.2

Energy transfers by particles

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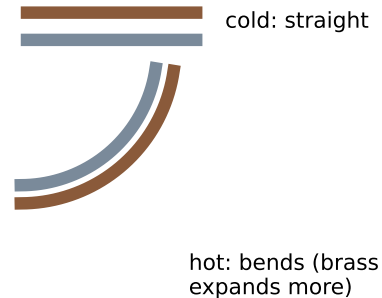
The method

Method — Transfers by particles

Conduction: vibration + free electrons (metals). Convection: warmed fluid expands, is less dense, rises. Evaporation cools: the fastest molecules leave.

faster evaporation with:

- higher temperature
- larger surface area
- air movement (draught)
- lower humidity



Evaporation factors and the bending bimetallic strip.

Method — Design and expansion

Bigger temperature difference $\rightarrow$ faster transfer; big surface area $\rightarrow$ faster transfer (cooling fins; desert rabbits' large ears). Expansion: hazard (bridges need gaps), use (bimetallic thermostat).

Exercises 2.1·2.3

2.1 Name the two particle carriers of conduction in a metal. [2]

2.2 Explain why a convection current forms in warming water. [3]

2.3 Explain why evaporation cools a liquid. [2]

Exercises 2.1·2.3

2.1 Name the two particle carriers of conduction in a metal. [2]

2.1 Vibrating particles (ions/lattice) and free electrons.

2.2 Explain why a convection current forms in warming water. [3]

2.2 Heated water expands – particles move apart – becoming less dense; the less dense warm water rises; cooler, denser water sinks to replace it, forming the circulating current.

2.3 Explain why evaporation cools a liquid. [2]

2.3 Only the fastest molecules have enough energy to escape the surface; the molecules left behind have lower average kinetic energy, so the liquid's temperature falls.

Exercises 2.4·3.1

2.4 State three factors that speed up evaporation. [3]

2.5 State one hazard and one use of thermal expansion. [2]

3.1 Explain how a metal spoon heats up in soup, naming the energy transfer. [3]

Exercises 2.4·3.1

2.4 State three factors that speed up evaporation. [3]

2.4 Higher temperature, larger surface area, air movement (draught) over the surface; also lower humidity (any three).

2.5 State one hazard and one use of thermal expansion. [2]

2.5 Hazard – bridges/rocks cracking as they expand (gaps needed); use – the bending bimetallic strip in a thermostat.

3.1 Explain how a metal spoon heats up in soup, naming the energy transfer. [3]

3.1 The soup's fast-moving particles collide with the spoon's particles at the interface and transfer kinetic energy to them; the lattice vibrations and free electrons pass the energy along the spoon to the far end; this is conduction.

Exercises 3.2·3.3

3.2 A sea breeze blows from sea to land on a hot day. Explain, using convection. [3]

3.3 Explain how a bimetallic strip can switch off a heater, naming the mechanism. [3]

Exercises 3.2·3.3

3.2 A sea breeze blows from sea to land on a hot day. Explain, using convection. [3]

3.2 The land warms faster than the sea, heating the air above it; the warm air expands, becomes less dense and rises; cooler air from over the sea flows in to replace it – a convection current felt as the sea breeze.

3.3 Explain how a bimetallic strip can switch off a heater, naming the mechanism. [3]

3.3 The strip is two metals bonded together; on heating one expands more, bending the strip; the bend breaks (or makes) an electrical contact, switching the heater off – a thermostat.