

Exercise walk-through

4.2

Energy transfers by particles

OxfordAQA · International GCSE · Physics

1. The particle model of matter

The particle model of matter

Their energy, separation and motion explain the states of matter, heating and cooling, and why bridges need gaps

OxfordAQA's fourth topic builds the model and quantifies it: specific heat capacity, the (P) latent heats, evaporation, energy-transfer design and thermal expansion

3. Energy transfers and particle motion

Energy transfers and particle motion

Conduction passes energy along a solid by particle vibration, helped by free electrons in metals; insulators lack both

Convection circulates fluid: particles gain energy, move apart, the fluid becomes less dense and rises, cooler fluid sinks

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.