

Solutions

Each answer shows the steps, then the **result**.

2.1

- they contain free (delocalised) electrons that carry energy quickly

2.2

- a dull, black surface

2.3

- fix a drawing pin to one end of each rod with wax
- heat the other ends equally
- the pin on the better conductor falls first, because energy reaches its end sooner

2.4

- heated water expands, so the same mass occupies a larger volume and its density falls
- the less dense water floats up through the denser water around it

2.5

- a higher surface temperature
- and a larger surface area
- (*a duller, blacker surface also emits faster*)

3.1 B

- in a solid the particles vibrate in fixed positions and cannot move from place to place

3.2

(a) the water at the bottom is heated, expands and becomes less dense

- it rises, and cooler, denser water sinks to replace it
- this circulation is a convection current

(b) hot (less dense) water would already be at the top, so there is nothing to make it rise — no current forms

3.3

- the dull black can cools faster
- because a dull, black surface is a better emitter of infrared radiation

3.4

(a) conduction and convection both need particles

- the vacuum has almost none, so neither can carry energy across the gap

(b) shiny silver surfaces are poor emitters, so little infrared leaves the inner wall

- they are good reflectors, so radiation crossing the gap is reflected back
- (c) plastic is a poor conductor, so little energy is conducted out through the stopper
- a metal stopper would conduct energy away quickly
- (d) evaporation from the surface, or convection of the warm air above it
- put a lid on the mug

3.5

- (a) it absorbs energy at the same rate as it emits it
- (b) greenhouse gases absorb some of the infrared emitted by the Earth
- and re-emit part of it back towards the surface, so less energy escapes and the Earth warms until the rates balance again
- (c) the road absorbs radiation from the Sun, and a dull black surface is a good absorber, so its temperature rises
- the air touching the road is warmed by conduction
 - that warmed air expands, becomes less dense and rises, carrying energy upwards by convection while cooler air moves in