IGCSE PHYSICS • EXERCISE SHEET

2.3 Transfer of thermal energy

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

Objective

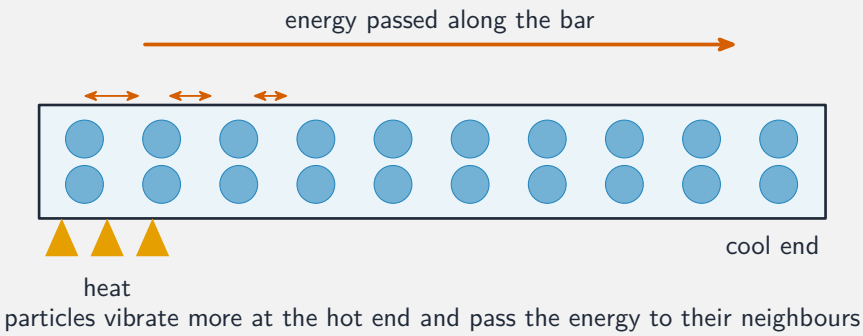
Build the skills to answer exam questions on the **transfer of thermal energy** 热能传递—**conduction** 热传导, **convection** 对流 and **radiation** 热辐射.

You must be able to:

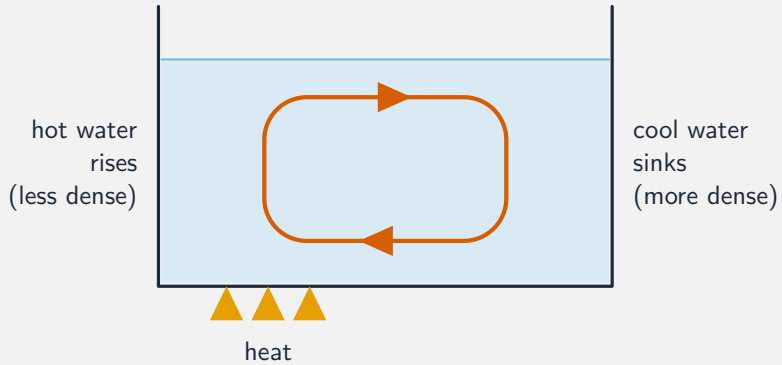
- explain conduction (and why metals are good conductors)
- explain convection currents in fluids
- describe thermal radiation and good/poor emitters

1 Worked examples

Three transfer methods



Conduction: vibrating particles (and free electrons in metals) pass energy along



Convection: heated fluid expands, becomes less dense and rises; cooler fluid sinks

- **conduction:** energy passed by vibrating particles; metals conduct best (free electrons).
- **radiation:** infrared waves, no material needed; dull-black surfaces emit/absorb best.

2 Practice

2.1 State why metals are good conductors of thermal energy. [1]

2.2 State which surface is the best emitter of infrared radiation. [1]

3 Exam-style questions

3.1 Convection cannot take place in a solid because: [1]

- **A** solids have no particles
- **B** the particles cannot move from place to place
- **C** solids are too cold
- **D** solids do not conduct

3.2 A beaker of water is heated at the bottom.

(a) Explain how a convection current forms. [3]

(b) State why heating at the top would not set up a convection current. [1]

3.3 Two metal cans are filled with hot water; one is dull black and one is shiny silver. State and explain which cools faster. [2]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **2.3 Transfer of thermal energy** past-paper sheet in the Library, or try these in **Practice mode**:

- 0625/21 N25 —Q14 (convection)
- 0625/21 N25 —Q15 (conduction)
- 0625/21 N25 —Q16 (radiation)

Solutions

2.1 they contain free (delocalised) electrons that carry energy quickly.

2.2 a dull, black surface.

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.