

14.1 Thermal equilibrium

Name: _____ Class: _____ Date: _____

Total: 9 marks

Objective

Build the skills to answer exam questions on **thermal equilibrium**.

You must be able to:

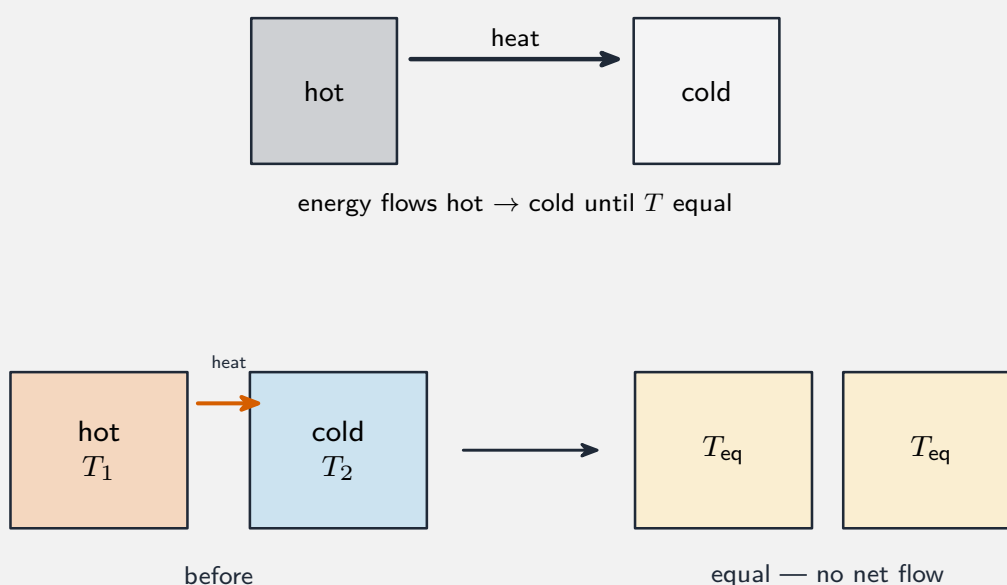
- state that thermal energy flows from **higher** to **lower** temperature
- explain **thermal equilibrium** and that temperature is not the same as thermal energy

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ Heat flow and equilibrium

Thermal energy flows from **hot to cold**. When two bodies touch, energy moves until their temperatures are equal —**thermal equilibrium**, with **no net** energy flow:



Heat flows until thermal equilibrium

Temperature decides the **direction** of flow —it is **not** how much thermal energy a

body holds. A cup of boiling water holds far less energy than a warm swimming pool, but heat still flows **from** the cup **to** a cooler object.

2 Practice

Now apply the methods above.

2.1 State the direction in which thermal energy flows. [1]

2.2 State what is meant by **thermal equilibrium**. [2]

2.3 Two objects at the **same temperature** are in contact. State the **net** flow of energy between them. [1]

3 Exam-style questions

3.1 State what is meant by two objects being in **thermal equilibrium**. [2]

3.2 Explain why a small cup of boiling water (100 °C) may hold **less** thermal energy than a swimming pool at 25 °C. [2]

3.3 Thermal energy flows from object A to object B. This tells you that: [1]

- **A** A is at a higher temperature than B
- **B** B is at a higher temperature than A
- **C** A and B are at the same temperature
- **D** A contains more thermal energy than B

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **14.1 Thermal equilibrium** past-paper sheet in the Library, or try these in **Practice mode**:

- 9702/42 M25 —Q3 (temperature and internal energy)
- 9702/44 J25 —Q2 (thermal energy and equilibrium)

Solutions

2.1 From a region of **higher temperature** to a region of **lower temperature**.

2.2 Two bodies are at the **same temperature**, so there is **no net flow** of thermal energy between them.

2.3 Zero (no net flow).

3.1 They are at the **same temperature**, so there is **no net transfer** of thermal energy between them.

3.2 Temperature shows the **direction** of heat flow, not the amount of energy stored; the pool has a far greater **mass**, so it can hold more total thermal energy despite its lower temperature.

3.3 A —A is at a higher temperature than B.