

9.3 Thermal Energy Transfer and Equilibrium

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

KEY WORDS thermal equilibrium 热平衡 • heat 热量 • conduction 传导 • convection 对流
• radiation 辐射

Objective

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

You must be able to:

- describe thermal energy transfer by **conduction** 传导, **convection** 对流, and **radiation** 辐射
- explain that objects in contact reach **thermal equilibrium** 热平衡 at a common temperature
- relate the direction of **heat** 热量 flow to the temperature difference

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Three ways heat moves

- Conduction** — through a solid, by particle collisions passing on energy.
- Convection** — bulk currents in a fluid, as warm fluid rises and cool fluid sinks.
- Radiation** — electromagnetic waves; needs **no** medium (how the Sun's energy reaches us).

■ Thermal equilibrium

Two objects in contact exchange heat until they reach a **common temperature**; then the net heat flow is zero.

■ Direction of heat flow

Heat always flows from **hotter** to **colder**.

2 Practice

2.1 Name the three methods of thermal energy transfer. [2]

2.2 State the direction heat flows between a hot object and a cold object in contact. [1]

2.3 Two objects have reached thermal equilibrium. State what is true about their temperatures. [1]

3 Exam-style questions

3.1 The method of heat transfer that needs no medium is [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** conduction
B convection
C radiation
D none of these

3.2 When two objects reach thermal equilibrium, the net heat flow between them is [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** from hot to cold
B from cold to hot
C zero
D at its maximum

3.3 A hot metal spoon is placed in a cup of cold water.

(a) State the direction of the heat flow. [1]

(b) Name the main method of transfer within the metal spoon. [1]

(c) Describe the final state of the spoon and water. [1]