

9.5 Specific Heat and Thermal Conductivity

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS thermal conductivity 热导率 • specific heat 比热容 • temperature 温度 • heat 热量

Objective

Build the skills to answer exam questions on **specific heat and thermal conductivity**.**You must be able to:**

- use $Q = mc\Delta T$ with **specific heat** 比热容 to find the heat needed for a temperature change
- explain how **thermal conductivity** 热导率 governs the rate of heat transfer
- compare how different materials store and conduct thermal energy

1 Worked examples

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

■ Specific heat

$Q = mc\Delta T$, where c is in $\text{J kg}^{-1} \text{K}^{-1}$. Water's large $c \approx 4200$ means it takes a lot of heat to warm up.

■ Thermal conductivity

A **high** conductivity (metals) transfers heat quickly; a **low** conductivity (wood, air, foam) makes a good insulator.

■ Example

To warm 2.0 kg of water by 10 K: $Q = 2.0 \times 4200 \times 10 = 8.4 \times 10^4 \text{ J}$.

2 Practice

2.1 Find the heat needed to raise 0.50 kg of water by 20 K (take $c = 4200 \text{ J kg}^{-1} \text{K}^{-1}$).^[2]

2.2 State what a high thermal conductivity means for the rate of heat transfer. [1]

2.3 Two blocks receive the same heat. State which has the greater temperature rise — the one with the larger or smaller specific heat. [1]

3 Exam-style questions

3.1 The equation $Q = mc\Delta T$ gives the [1]

A	B
C	D

- A** power
- B** heat transferred
- C** temperature
- D** conductivity

3.2 A good thermal insulator has a [1]

A	B
C	D

- A** high thermal conductivity
- B** low thermal conductivity
- C** high specific heat only
- D** zero mass

3.3 A 0.30 kg metal block ($c = 900 \text{ J kg}^{-1} \text{ K}^{-1}$) is heated from 20°C to 70°C .

(a) Find the heat needed. [3]

(b) State the heat needed if the mass were doubled. [1]