# 6.4 Heat Capacity and Calorimetry

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

**KEY WORDS** specific heat • calorimetry • heat • exothermic • endothermic

## Objective

Build the skills to answer exam questions on **heat capacity and calorimetry**.

**You must be able to:**

- use $q = mc\Delta T$
- carry out a **calorimetry** calculation
- find a specific heat or a heat of reaction from data

## 1 Key knowledge and 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.

### ■ The heat equation

$$q = mc\Delta T,$$

where $q$ is heat (J), $m$ mass (g), $c$ **specific heat** (J g$^{-1}$°C$^{-1}$), and $\Delta T = T_{\text{final}} - T_{\text{initial}}$.

### ■ A worked heat

Heat 50 g of water ($c = 4.18$) from 20 to 30°C:

$$q = (50)(4.18)(10) = 2090 \text{ J}.$$

### ■ Calorimetry

In a calorimeter, the heat released by a reaction is absorbed by the water: $q_{\text{reaction}} = -q_{\text{water}} = -mc\Delta T$. Measure the water's temperature change to find the reaction's heat.

■ **Heat of reaction per mole**

Divide the total heat by the moles reacted to get $\Delta H$ **per mole**: $\Delta H = \frac{q}{n}$ (with the right sign – negative if the water warmed).

## 2 Practice

Now apply the methods above.

**2.1** Write the equation $q = mc\Delta T$ and name each symbol. [2]

**2.2** Find the heat to warm 100 g of water ($c = 4.18$) by 5.0°C. [2]

**2.3** In a calorimeter the water warms. Was the reaction exo- or endothermic? [1]

## 3 Exam-style questions

**3.1** In $q = mc\Delta T$, $\Delta T$ is [1]

- ☐ **A** $T_{\text{initial}} - T_{\text{final}}$
- **B** $T_{\text{final}} - T_{\text{initial}}$
- **C** the average temperature
- **D** always positive

**3.2** A reaction in a calorimeter warms 200 g of water ($c = 4.18$) by 6.0°C.

(a) Find the heat absorbed by the water. [2]

(b) State $q$ for the reaction (sign and value). [2]

**3.3** Burning 0.50 g of a fuel raises 100 g of water ($c = 4.18$) by 10.0°C. Find the heat released per gram of fuel. [4]