

## 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** ( $\text{J g}^{-1}\text{°C}^{-1}$ ), 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]

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

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

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### 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  $10.0^{\circ}\text{C}$ . Find the heat released per gram of fuel. <sup>[4]</sup>