6 Heat, enthalpy, and calorimetry – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	**Write it 3 times** (English)		
Thermochemistry			
exothermic			
endothermic			
specific heat			
Calorimetry			
phase change			

Recall

You have already noticed that reactions involve energy:

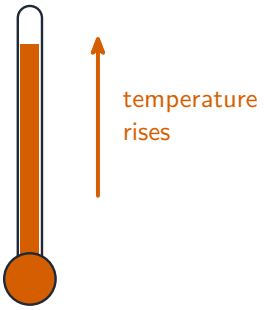
- Some reactions release heat and feel hot (like burning fuel).
- Some absorb heat and feel cold (like a cold pack).
- You have used $q = mc\,\Delta T$ to work out heat.

This sheet lines up how chemists measure reaction energy. Each idea has a worked example.

New ideas

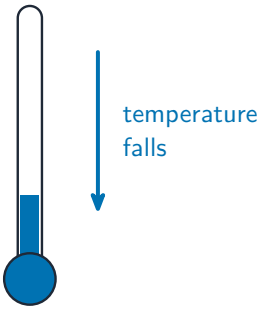
1 Exothermic and endothermic

Thermochemistry tracks the energy of reactions. A reaction is **exothermic** if it releases energy (feels hot, $\Delta H < 0$) and **endothermic** if it absorbs energy (feels cold, $\Delta H > 0$).



exothermic

heat given out, so the surroundings get hotter ($\Delta H < 0$)



endothermic

heat taken in, so the surroundings get colder ($\Delta H > 0$)

2 Heat and specific heat

The heat to change a substance's temperature is

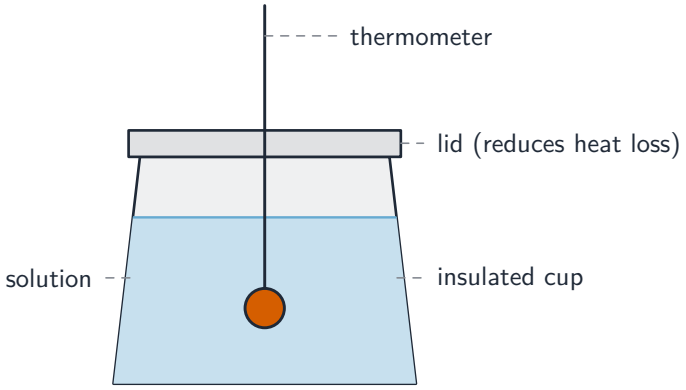
$$q = mc\,\Delta T,$$

where c is the **specific heat** (energy per gram per degree).

Worked example. Warming 50 g of water ($c = 4.18$) by 10 °C takes $q = mc\,\Delta T = 50 \times 4.18 \times 10 = 2.1 \times 10^3$ J.

3 Calorimetry

Calorimetry measures a reaction's heat by tracking the temperature change of the surrounding water: the heat the water gains equals the heat the reaction releases.



Worked example. A reaction warms 100 g of water by 8.0 °C: the water gains $q = 100 \times 4.18 \times 8.0 = 3.3 \times 10^3$ J, so the reaction **released** 3.3 kJ (exothermic).

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■ 4 Phase changes

During a **phase change** (melting or boiling) the temperature stays **constant** – the heat goes into pulling the particles apart, not into raising their temperature.

Watch out: an exothermic reaction has a **negative** ΔH (it loses energy to the surroundings); an endothermic one has a **positive** ΔH. Getting the sign right is essential.

Practice

Try these in order. The methods are all above.

2.1 State whether an exothermic reaction has a positive or negative ΔH, and whether it feels hot or cold. [2]

2.2 Find the heat needed to warm 200 g of water by 5.0 °C ($c = 4.18$). [2]

2.3 A reaction warms 150 g of water by 6.0 °C. Find the heat released ($c = 4.18$). [3]

2.4 State what happens to the temperature of a substance while it is melting, and why. [2]

2.5 A cold pack gets cold when activated. State whether the reaction inside is exothermic or endothermic. [1]

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