

5 Energetics – Part 1

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English	Write it 3 times (English)		
energy	_____	_____	_____
exothermic	_____	_____	_____
endothermic	_____	_____	_____
thermal energy	_____	_____	_____
combustion	_____	_____	_____
neutralisation	_____	_____	_____
decomposition	_____	_____	_____
enthalpy change	_____	_____	_____
activation energy	_____	_____	_____

Recall

Every chemical reaction transfers **energy** _____. The reaction is either **exothermic** or **endothermic** _____, depending on which way the heat moves.

- An exothermic reaction **gives out** heat (warms the surroundings).
- An endothermic reaction **takes in** heat (cools the surroundings).

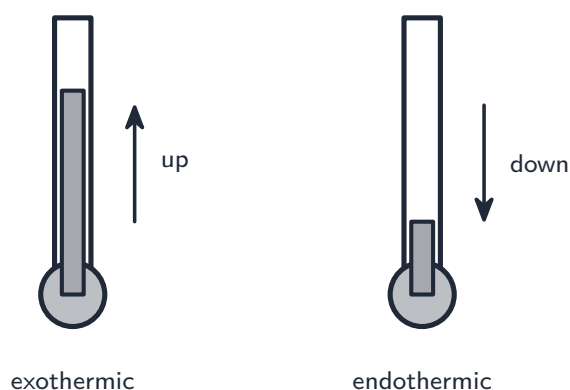
Nothing here is hard – it just adds a symbol and a diagram.

New ideas

Read these first, then do the Practice.

■ 1 Exothermic and endothermic

- **exothermic** – gives out **thermal energy**, so the surroundings warm **up**. Examples: **combustion**, **neutralisation**.
- **endothermic** – takes in thermal energy, so the surroundings cool **down**. Example: thermal **decomposition**.



■ 2 Enthalpy change, ΔH

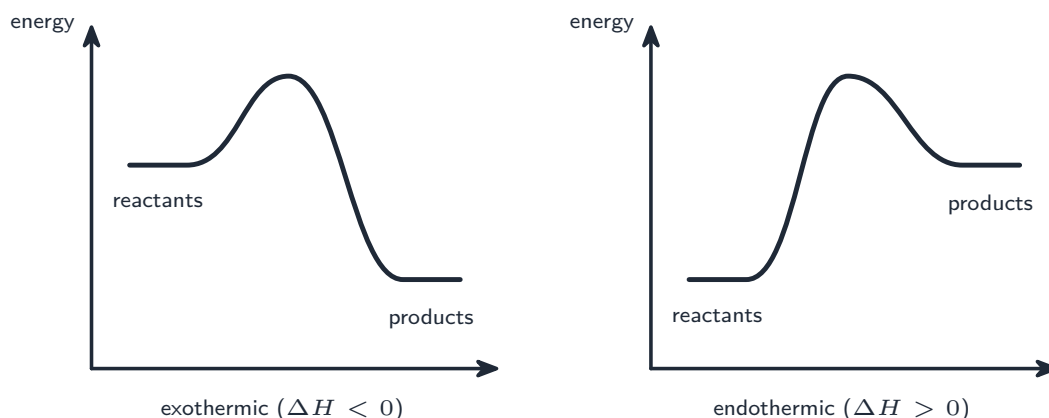
The thermal energy transferred is the **enthalpy change**, ΔH :

- ΔH is **negative** for exothermic (energy leaves the chemicals).
- ΔH is **positive** for endothermic (energy is taken in).

■ 3 Reaction pathway diagrams

The **activation energy** (E_a) is the least energy colliding particles need to react – a "hill" they must get over.

- **exothermic** – products **lower** than reactants ($\Delta H < 0$).
- **endothermic** – products **higher** than reactants ($\Delta H > 0$).



Watch out: match the sign to the direction – exothermic **gives out** heat so ΔH is **negative** (products lower); endothermic **takes in** heat so ΔH is **positive** (products higher). The activation energy is a *hill* every reaction must climb, exo or endo.

Practice

Try these in order.

5.1 What happens to the temperature of the surroundings in (a) an exothermic, (b) an endothermic reaction? [2]

5.2 Give the sign of ΔH for (a) an exothermic, (b) an endothermic reaction. [2]

5.3 Give one example of an exothermic reaction. [1]

5.4 What is meant by the *activation energy*? [1]

5.5 On a reaction pathway diagram, where are the products (compared with the reactants) for an exothermic reaction? [1]

5.6 Challenge. On a pathway diagram the products lie **above** the reactants. State (a) whether the reaction is exothermic or endothermic, (b) the sign of ΔH , and (c) what the surroundings do. [3]