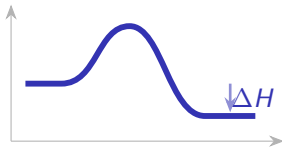


Chemical Energetics

IGCSE Chemistry ■ Topic 5

IGCSE Chemistry



What we will cover

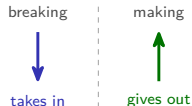
1 Exothermic vs endothermic

2 Enthalpy change ΔH

3 Activation energy

4 Reaction pathway diagrams

5 Bonds & energy



bonds and energy

Exothermic vs endothermic



temperature
rises

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



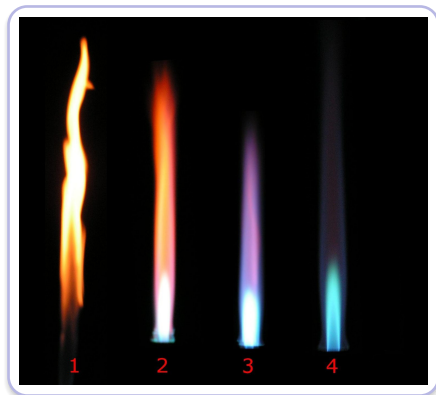
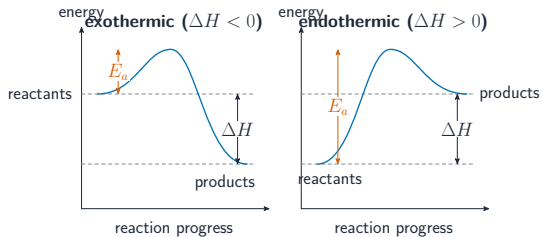
temperature
falls

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



Heating transfers energy into a system

Reaction pathway diagrams



Enthalpy changes show heat of reaction

Bonds and energy

bond breaking 断键

takes energy in – endothermic

bond

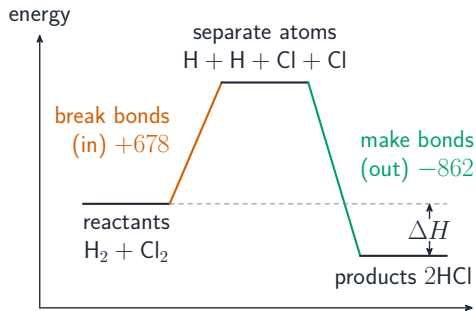
gives energy

$\Delta H = (\text{energy to break bonds}) - (\text{energy released making bonds})$. More out than in $\Rightarrow$ exothermic.



Exothermic reactions release energy as heat

Worked example: $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$



Bond energies (kJ/mol)

broken: $\text{H}-\text{H} + \text{Cl}-\text{Cl} = 436 + 242 = 678$

made: $2 \times \text{H}-\text{Cl} = 862$

$\Delta H = 678 - 862 = -184$

negative $\Rightarrow$ exothermic

net: $\Delta H = 678 - 862 = -184 \text{ kJ/mol}$ (exothermic)

Topic 5 – key takeaways

1 Exo & endo

out warms ($\Delta H < 0$); in cools ($\Delta H > 0$)

2 Pathway

hill = E_a ; reactant-product gap = ΔH

3 Bonds

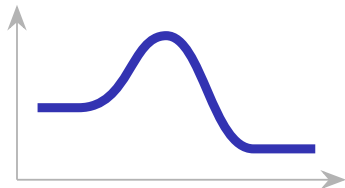
breaking takes in, making gives out

4 ΔH

break minus make energy

Check yourself

- 1 What sign is ΔH for an exothermic reaction?
- 2 What does the hill height represent?
- 3 Is bond breaking endothermic or exothermic?
- 4 If 678 kJ goes in and 862 kJ comes out, what is ΔH ?



Answers 1. negative 2. the activation energy E_a 3. endothermic 4. -184 kJ/mol (exothermic)