3.1 Energetics

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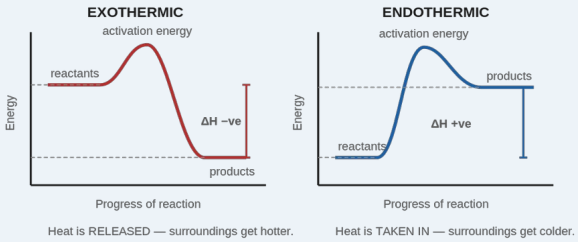
1. KEY VOCABULARY

TERM	MEANING
Exothermic	A reaction that transfers heat OUT to the surroundings.
Endothermic	A reaction that takes heat IN from the surroundings.
Activation energy	The minimum energy needed for a reaction to start.
ΔH (enthalpy change)	The overall energy change of a reaction.
Calorimetry	Measuring an energy change by recording a temperature change.

2. ENERGY PROFILES



Heat is RELEASED — surroundings get hotter.

Heat is TAKEN IN — surroundings get colder.

3. EXOTHERMIC vs ENDOTHERMIC

	EXOTHERMIC	ENDOTHERMIC
Heat	Released	Taken in
Surroundings	Get hotter	Get colder
ΔH sign	Negative	Positive
Examples	Combustion, neutralisation	Thermal decomposition

4. BOND BREAKING & BOND MAKING

Breaking bonds takes IN energy (endothermic).
Making bonds RELEASES energy (exothermic).
Exothermic overall: more energy released making bonds than taken in breaking them. Endothermic is the reverse.

5. MEASURING ENERGY CHANGE

Calorimetry: burn a fuel (or mix reactants) and measure the temperature change of a known mass of water.
Energy transferred = m × c × ΔT
Bigger temperature rise → more energy released.

6. THE WHY

Why a reaction is exothermic: the bonds in the products are stronger (release more energy) than the bonds broken in the reactants.
Why ΔH is negative for exothermic: the products end up with LESS energy than the reactants — the difference is released as heat.

7. COMMON EXAM MISTAKES

✗ "Exothermic means the reaction gets colder."
✓ Exothermic releases heat — the surroundings get HOTTER.
✗ "Breaking bonds releases energy."
✓ Breaking bonds takes IN energy; making bonds releases it.
✗ "Endothermic reactions have negative ΔH."
✓ Endothermic ΔH is positive; exothermic is negative.

8. SELF-CHECK · cover & quiz

Can you…

1. Define exothermic and endothermic?
2. Sketch and label an exothermic and endothermic energy profile?
3. State the ΔH sign for each type?
4. Say whether bond breaking/making is endo or exothermic?
5. Explain, using bonds, why a reaction is exothermic?
6. Describe how calorimetry measures an energy change?