

Exercise walk-through

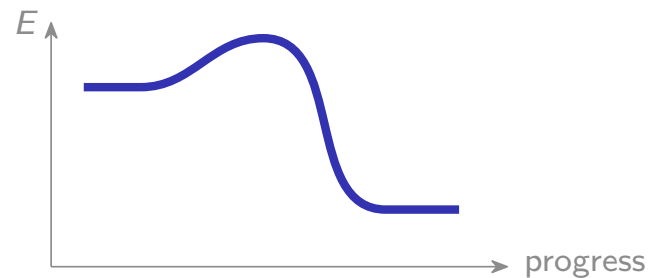
6.1

Endothermic and Exothermic Processes

AP Chemistry

What we will cover

- 1 Endothermic and exothermic
- 2 Energy diagrams and ΔH
- 3 Calorimetry
- 4 Phase changes
- 5 Bond enthalpies
- 6 Enthalpy of formation
- 7 Hess's law



Endothermic and exothermic

Energy flows between the
system and its
surroundings :

exothermic : releases energy (warms)

endothermic : absorbs energy (cools)



*Endothermic packs absorb heat from
surroundings*

Exam tips

- An **exothermic** reaction has $\Delta H < 0$ (feels hot); endothermic has $\Delta H > 0$ – always give ΔH a sign and units.
- In calorimetry use $q = mc\Delta T$ with the mass of the **water/solution**; the reaction releases what the water gains.
- Bond enthalpies: $\Delta H \approx \sum(\text{bonds broken}) - \sum(\text{bonds made})$ – breaking is endothermic, making is exothermic (the classic sign trap).
- **Hess's law**: the total ΔH is the sum of the steps' – reverse a step and flip the sign, scale a step and scale ΔH .
- During a **phase change** the temperature stays constant while energy goes into the forces between particles.

Exercises 2.1-2.3

2.1 State the sign of ΔH for an exothermic reaction.

[1]

2.2 A reaction makes the beaker feel cold. Classify it.

[1]

2.3 Does breaking a bond absorb or release energy?

[1]

Exercises 2.1·2.3

2.1 State the sign of ΔH for an exothermic reaction. [1]

2.1

- Negative ($\Delta H < 0$)
-

2.2 A reaction makes the beaker feel cold. Classify it. [1]

2.2

- Endothermic
-

2.3 Does breaking a bond absorb or release energy? [1]

2.3

- Absorbs energy

Exercise 3.1

3.1 An endothermic reaction has

[1]

☐

A $\Delta H < 0$ and releases heat

B $\Delta H > 0$ and absorbs heat

C $\Delta H = 0$

D no energy change

Exercise 3.1

3.1 An endothermic reaction has

[1]

☐

A $\Delta H < 0$ and releases heat

B $\Delta H > 0$ and absorbs heat

C $\Delta H = 0$

D no energy change

3.1 B

- $\Delta H > 0$ and absorbs heat

Exercise 3.2 (a)

3.2 When ammonium nitrate dissolves in water, the solution gets colder.

(a) Classify the process and give the sign of ΔH .

[2]

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[2]

(a)

- Endothermic; $\Delta H > 0$

Exercise 3.2 (b)

3.2 When ammonium nitrate dissolves in water, the solution gets colder.

(b) State the direction of heat flow (system $\leftrightarrow$ surroundings).

[1]

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(b) State the direction of heat flow (system $\leftrightarrow$ surroundings).

[1]

(b)

- Heat flows from the surroundings into the system

Exercise 3.3

3.3 Explain, in terms of bond breaking and forming, why combustion is exothermic. [2]

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3.3

- Combustion forms strong bonds in CO_2 and H_2O , releasing more energy than is absorbed breaking the fuel and O_2 bonds, so the net ΔH is negative