Exercise walk-through

Energy Diagrams ▪ 6.2

eXercise

You must be able to

- draw/read an energy diagram showing reactants, products, and E_a
- show ΔH as products minus reactants
- compare exothermic and endothermic diagrams

Method — The exothermic diagram

Reactants start **high**, climb over the activation-energy barrier, and end **lower** as products. Energy is released, so $\Delta H < 0$ (the arrow points down from reactants to products).

Method — The endothermic diagram

Reactants start **low**, climb the barrier, and end **higher** as products. Energy is absorbed, so $\Delta H > 0$ (the arrow points up).

Method — Reading E_a and ΔH

E_a = height of the peak above the **reactants**. ΔH = (product level) − (reactant level).

Method — A worked comparison

Same E_a but different ΔH: an exothermic reaction's products sit below the reactants; an endothermic reaction's products sit above. The barrier position is the same idea in both.

Practice 2.1 ▪ 1 mark

On an energy diagram, how is ΔH found?

Solution 2.1

Worked steps

Products' energy minus reactants' energy B1.

Practice 2.2 ▪ 1 mark

For an exothermic reaction, are the products higher or lower than the reactants?

Solution 2.2

Worked steps

Lower B1.

Practice 2.3 ▪ 1 mark

Where is E_a measured to on the diagram?

Solution 2.3

Worked steps

From the reactants up to the peak B1.

Exam-style 3.1 ▪ 1 mark

On an **endothermic** energy diagram, the products are

A lower than the reactants

B higher than the reactants

C at the same level

D at the peak

Solution 3.1

Method: The endothermic diagram

A lower than the reactants

B higher than the reactants ✓

C at the same level

D at the peak

Worked steps

B — higher than the reactants.

Exam-style 3.2 ▪ 1 mark

An energy diagram shows reactants at 30 kJ, peak at 110 kJ, products at 70 kJ.
(a) Find E_a.
(b) Find ΔH and classify the reaction.

Solution 3.2

Worked steps

(a) $E_a = 110 - 30 = 80$ kJ B1. (b) $\Delta H = 70 - 30 = +40$ kJ, endothermic M1 A1.

Exam-style 3.3 ▪ 2 marks

Two reactions have the same ΔH but different E_a. Explain which reacts faster and why.

Solution 3.3

Method: A worked comparison

Worked steps

The one with the **lower** E_a reacts faster, because a larger fraction of collisions exceed the smaller barrier M1 A1.