

Heat in and out of reactions

Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test lasts 45 minutes and is worth 20 marks. Answer every question. Show each step of a calculation, give units, and write the sign of ΔH . The atomic masses and bond energies you need are given in the questions.

Level: Chemistry grades 9-10 (GCSE · IGCSE · O Level · Class 9-10) · **Curriculum:** HS-PS1-4

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Hand warmers and cold packs (2 marks)

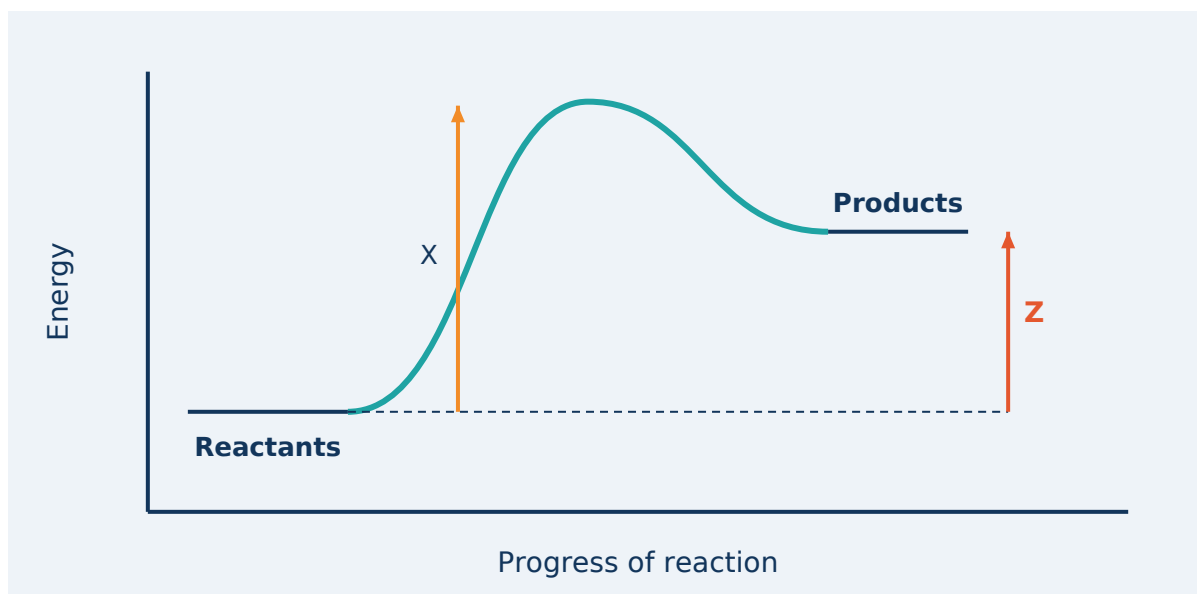
A hand warmer becomes hot and an instant cold pack becomes cold.

- State which reaction is exothermic. (1 mark)
- State what happens to the temperature of the surroundings in an endothermic reaction. (1 mark)

Question 2 Reading a reaction profile (3 marks)

The figure shows the profile for a reaction.

- Name the energy shown by arrow X. (1 mark)
- State the sign of the energy change shown by arrow Z. (1 mark)
- State whether the reaction is exothermic or endothermic. (1 mark)



A reaction profile with two arrows labelled.

Question 3 Hydrogen fluoride (3 marks)

$\text{H}_2 + \text{F}_2 \rightarrow 2\text{HF}$. Bond energies: H-H 436, F-F 158, H-F 568 kJ/mol.

- Calculate the energy needed to break the bonds. (1 mark)
- Calculate the energy released when the bonds form. (1 mark)
- Calculate ΔH . (1 mark)

Question 4 Energy from a temperature rise (3 marks)

A reaction in 200 g of water raises its temperature by 8.5 °C ($c = 4.2 \text{ J/g/}^\circ\text{C}$). The reaction used 0.050 mol of reactant.

- Calculate the energy transferred in kJ. (2 marks)
- Calculate ΔH in kJ/mol. (1 mark)

Question 5 Starting a fire (2 marks)

Wood burns exothermically, yet it does not catch fire by itself in air. Explain why a flame must first be applied. (2 marks)

Question 6 Bond breaking (2 marks)

Explain why breaking bonds is endothermic and making bonds is exothermic. (2 marks)

Question 7 Self-heating can (3 marks)

A self-heating can of soup contains calcium oxide and water: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$.

- State whether the reaction is exothermic or endothermic. (1 mark)
- Describe where the products lie compared with the reactants on a reaction profile. (1 mark)
- Explain how it heats the soup. (1 mark)

Question 8 Energy per mole (2 marks)

A fuel releases 125 kJ when 0.25 mol burns. Calculate ΔH per mole, including the sign. (2 marks)