Worksheet 1.1: Reversible Reactions & Equilibrium

ChemistrySheets

Specification: GCSE Chemistry (AQA 5.6.2 / Edexcel SC17)

Core Concepts: Understand that some reactions are reversible and reach dynamic equilibrium. Explain Le Chatelier's Principle and predict the effect of changing temperature, pressure, and concentration on the position of equilibrium.

Section A: Key Terms & Concepts

A1. Match the following key terms to their correct definitions.

(i) A reaction where products can react to reform reactants.

_____

(ii) A state where the rate of the forward reaction equals the rate of the reverse reaction, and the concentrations of reactants and products remain constant.

_____

(iii) When conditions are changed in a system at equilibrium, the system will shift in a direction that counteracts the change.

_____

(iv) A reaction that releases energy to the surroundings, usually as heat.

_____

(v) A reaction that absorbs energy from the surroundings, usually as heat.

_____

A2. Complete the following sentences using the most appropriate scientific terms.

(i) For a reversible reaction to reach equilibrium, it must be carried out in a _____ system.

(ii) At dynamic equilibrium, the _____ of the forward and reverse reactions are equal.

(iii) Increasing the concentration of a reactant will shift the equilibrium to the _____ (towards products) to reduce the concentration of that reactant.

(iv) A catalyst _____ the position of equilibrium, but it _____ the rate at which equilibrium is reached.

Section B: Core Explanations

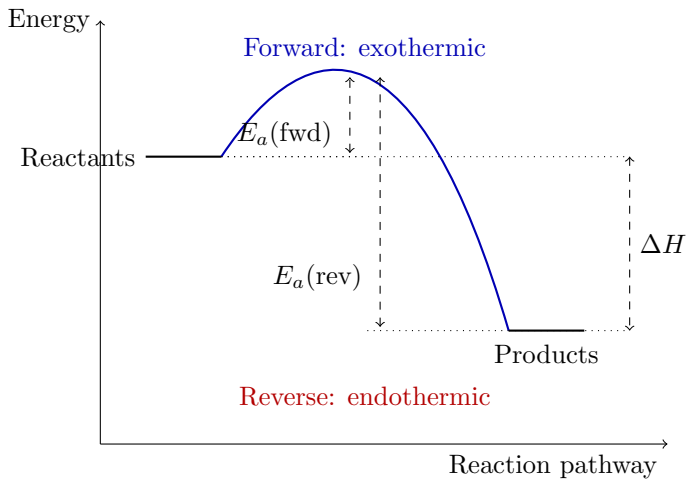

Figure 1: Energy profile for a reversible reaction (exothermic forward)

B1. Define what is meant by a reversible reaction and provide a chemical example.

_____

_____

B2. Explain what is meant by the term 'dynamic equilibrium' in the context of a reversible reaction.

B3. State Le Chatelier's Principle.

B4. Using Figure 1, describe the effect of increasing the temperature on an exothermic reversible reaction at equilibrium.

Section C: Exam Application

C1. Consider the reversible reaction: $N_2O_4(g) \rightleftharpoons 2NO_2(g)$. Nitrogen dioxide ($NO_2$) is a brown gas, and dinitrogen tetroxide (N_2O_4) is colourless. If more NO_2 is added to the system at equilibrium, what visible change would occur and why?

C2. The Haber process for ammonia production is a reversible reaction: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ ($\Delta H = -92$ kJ/mol) Explain how changing the temperature and pressure affects the yield of ammonia, justifying your answer using Le Chatelier's Principle. (6 marks)