Definitions and Concepts for CAIE Chemistry IGCSE

Topic 6 - Chemical Reactions

*Definitions in **bold** are for extended supplement only*

Definitions have been taken, or modified from the CAIE Cambridge IGCSE Chemistry 0620 syllabus for 2023, 2024 and 2025.

Anhydrous: Anhydrous substances do not have water molecules in its structure, e.g. anhydrous copper (II) sulfate

Biological catalyst (enzymes): Biological catalysts increase the rate of biological reactions, common biological catalysts are enzymes.

Catalyst: A catalyst increases the rate of a reaction and is unchanged (not used up) at the end of a reaction. **A catalyst decreases the activation energy, E_a , needed for the reaction to occur.**

Chemical change: Requires a chemical reaction and the products must have a different chemical composition to the reactants.

Collision theory: Describes how reactant particles, with sufficient activation energy E_a must collide with each other successfully for a chemical reaction to occur. Increasing the kinetic energy of the particles and increasing the number of particles per unit volume means more frequent collisions between the particles so the faster the rate of reaction.

Contact process: The Contact process consists of 3 stages, the second involving a reversible reaction that converts sulfur dioxide and oxygen into sulfur trioxide. The symbol equation for this is: $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$. The typical conditions for this reaction are 450°C, 200kPa (or 2 atm) and a vanadium (V) oxide catalyst

Effect of concentration on equilibrium: If the concentration of a reactant is increased, more products will be formed until equilibrium is reached again. If the concentration of a product is decreased, more reactants will react until equilibrium is reached again.

Effect of concentration on reaction rate: Increasing the concentration of reactants in solution means a faster rate of reaction. **Because there are more reactant particles per unit volume. This means they will collide more often so there will be a higher rate of successful collisions and a faster rate of reaction.**

Effect of pressure on equilibrium: **An increase in pressure causes the equilibrium position to shift towards the side with the smaller number of moles of gas. A decrease in pressure causes the equilibrium position to shift towards the side with the larger number of moles of gas.**

Effect of pressure on reaction rate: Increasing the pressure of gaseous reactants means a faster rate of reaction. **Because there are more reactant gas particles per unit volume. This means they will collide more often so there will be a higher rate of successful collisions and a faster rate of reaction.**

Effect of surface area on reaction rate: Increasing the surface area of the reactants means the rate of reaction increases. **Because there are more exposed reacting particles. This means there are more frequent successful collisions so the rate of reaction increases.**

Effect of temperature on equilibrium: **An increase in temperature will shift the equilibrium position in the direction of the endothermic reaction. A decrease in temperature will shift the equilibrium position in the direction of the exothermic reaction.**

Effect of temperature on reaction rate: Increasing the temperature means faster rate of reaction. **Because the particles will have more kinetic energy and so will move faster. If the molecules are moving faster they will collide more often and, since they've gained kinetic energy, a larger proportion of the particles will have at least the activation energy. For both these reasons the rate of reaction increases.**

Equilibrium: **Reached by a reversible reaction in a closed system when the rate of the forward reaction is equal to the rate of the backward reaction. At equilibrium, the concentration of reactants and products remains constant.**

Haber process: **Production of ammonia from hydrogen and nitrogen, the symbol equation for the Haber process is: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$. The typical conditions for the Haber process are 450°C, 200000kPa (or 200 atm) and an iron catalyst**

Le Chatelier's principle: **If a reaction at equilibrium is subjected to a change in concentration, temperature or pressure, the position of equilibrium will move to counteract the change.**

Oxidation: A reaction involving the gain of oxygen. **Oxidation is the loss of electrons, increasing its oxidation number**

Oxidation number: The charge of an element/ion in a compound which relates to the electrons gained or lost by the element/ion during the formation of the compound.

Oxidising agent: **A species which brings about oxidation by gaining electrons. The oxidising agent is itself reduced.**

Physical change: Requires energy and involves a change in state. The form of the chemical is changed but the chemical composition remains the same.

Rate of reaction: The measure of the amount of product formed or reactant used over time. The units of rate of reaction may be given as g/s or cm^3/s

Redox reaction: A reaction in which both oxidation and reduction occur simultaneously.

Reducing agent: **A species which brings about reduction by losing electrons. The reducing agent is itself oxidised.**

Reduction: A reaction involving the loss of oxygen. **Reduction is the gain of electrons, decreasing its oxidation number**

Reversible reaction: A reaction in which the products can react together to reform the reactants. Reversible reactions are denoted by the symbol ⇌.