WJEC (Eduqas) Chemistry A-level

C2 - Chemical Change

Definitions and Concepts

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C2.1 - Simple Equilibria and Acid-Base Reactions

Acid: Proton donors. These species release hydrogen ions in solution.

Base: Proton acceptors. These species release hydroxide ions in solution.

Dynamic equilibrium: Reached when the rate of the forward reaction of a reversible reaction equals the rate of the backward reaction. The concentrations of the reactants and products remain constant.

Effect of changing 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 changing pressure on equilibrium: If pressure is increased, the position of equilibrium shifts towards the side with the fewest number of molecules. If the pressure is decreased, the position of equilibrium shifts towards the side with the greatest number of molecules to oppose this change.

Effect of changing temperature on equilibrium: If the temperature of a system in equilibrium is increased, there will be an increase in the relative amount of products for an endothermic reaction and a decrease for an exothermic reaction.

K_c: A value that relates the concentrations of products and reactants present at equilibrium in a reversible reaction at a specific temperature. The equilibrium constant that is equal to the concentration of products raised to their stoichiometric coefficients divided by the concentration of reactants raised to the power of their stoichiometric coefficients.

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.

pH: A value that represents the acidity or alkalinity of a solution. Acidic solutions have a pH of less than 7 while alkali solutions have a pH of greater than 7. Neutral solutions have a pH of 7.

$$pH = -log[H^+]$$

$$[H^+] = 10^{-pH}$$

Reversible reaction: A reaction in which the products from the reaction can react together to form the original reactants. The direction of reversible reactions can be changed by changing the conditions.

Strong acid: An acid which dissociates/ionises almost completely in water. This means nearly all the H^+ ions will be released. E.g. HCl.

Strong base: A base which dissociates/ionises almost completely in water. E.g. NaOH.

Titration: An experimental technique used to determine the concentration of an unknown solution by using a second solution with a known concentration.

Weak acid: Acids which only dissociate/ionise very slightly in water so that only a small number of H^+ ions are released. E.g. Ethanoic acid.

Weak base: A base which only slightly dissociates/ionises in water. E.g. NH_3.

C2.2 - Thermochemistry

Bond enthalpy: The amount of energy required to break one mole of the stated bond in the gas phase.

Enthalpy change (ΔH): The heat energy change measured under a constant pressure.

Enthalpy change of reaction: The enthalpy change when quantities of substances in standard states react completely.

Enthalpy of combustion: The enthalpy change when one mole of a substance is burned in excess oxygen.

Hess's law: The enthalpy change of a reaction is independent of the route taken.

Mean bond enthalpy: The enthalpy change when one mole of a specified covalent bond is broken averaged out across the range of compounds.

Standard enthalpy of formation ($\Delta_f H^{\ominus}$): The enthalpy change when one mole of a substance in its standard state under standard conditions is formed from its elements under standard conditions.

C2.3 - Rates of Reaction

Activation energy: The minimum amount of energy for particles to collide with for a successful reaction to take place.

Catalysts: Provide a lower activation energy for a reaction to occur by providing an alternative reaction route. A catalyst does not affect the equilibrium constant since it increases the rate of the forward and backward reaction equally.

Collision theory: Reactions can only occur when collisions take place between particles that have sufficient energy.

Colorimetry: This method is used to calculate the concentration of a specific coloured compound in a solution by measuring the extent to which it absorbs certain wavelengths of light. This is measured with a colorimeter.

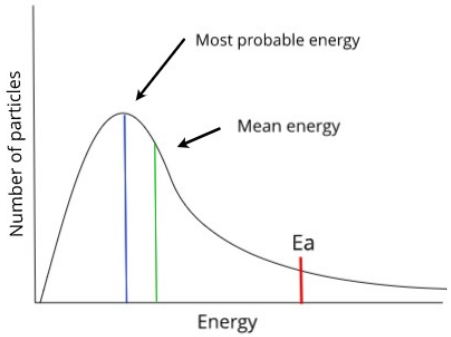
Effect of concentration on reaction rate: As the concentration of reactants increases, the reacting particles get closer together meaning they will collide more often. As a result, there will be a higher rate of successful collisions and a faster rate of reaction.

Effect of pressure on reaction rate: As the pressure of gaseous reactants increases, the reacting particles get closer together meaning they will collide more often. As a result, there will be a higher rate of successful collisions and a faster rate of reaction.

Effect of temperature on reaction rate: Increasing the temperature means 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.

Energy profile: A graph used to show the relative energy levels of reaction species (including reactants and products) as a reaction proceeds.

Maxwell-Boltzmann distribution: Shows the distribution of the molecular energies in a gas at a constant temperature. The area under the curve indicates the total number of particles present.



C2.4 - The Wider Impact of Chemistry

Biofuels: Fuels made from once-living organic matter. These fuels are renewable and sustainable and are an alternative to fossil fuels.

Green chemistry: Chemistry that aims to be sustainable in terms of energy and resources and restricts pollution.

Synthesis: The process of combining different elements and compounds to build new molecules.

Sustainability: The process of using resources at a rate that allows their supply to be maintained.