Anglo-Chinese School (Independent)
International Baccalaureate Diploma Programme
Scheme Of Work – Year 5 Chemistry SL

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Topic
Stoichiometric relationships • Deduction of chemical equations when reactants and products are specified. • Application of the state symbols (s), (l), (g) and (aq) in equations. • Explanation of observable changes in physical properties and temperature during changes of state.
The mole concept • Calculation of the molar masses of atoms, ions, molecules and formula units. • Solution of problems involving the relationships between the number of particles, the amount of substance in moles and the mass in grams. • Interconversion of the percentage composition by mass and the empirical formula. • Determination of the molecular formula of a compound from its empirical formula and molar mass. • Obtaining and using experimental data for deriving empirical formulas from reactions involving mass changes.
Reacting masses and volumes • Solution of problems relating to reacting quantities, limiting and excess reactants, theoretical, experimental and percentage yields. • Calculation of reacting volumes of gases using Avogadro's law. • Solution of problems and analysis of graphs involving the relationship between temperature, pressure and volume for a fixed mass of an ideal gas. • Solution of problems relating to the ideal gas equation. • Explanation of the deviation of real gases from ideal behaviour at low temperature and high pressure. • Obtaining and using experimental values to calculate the molar mass of a gas from the ideal gas equation. • Solution of problems involving molar concentration, amount of solute and volume of solution. • Use of the experimental method of titration to calculate the concentration of a solution by reference to a standard solution.

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Atomic Structure **The nuclear atom** • Use of the nuclear symbol notation $^{A}_{Z}X$ to deduce the number of protons, neutrons and electrons in atoms and ions. • Calculations involving non-integer relative atomic masses and abundance of isotopes from given data, including mass spectra. **Electronic configuration** • Description of the relationship between colour, wavelength, frequency and energy across the electromagnetic spectrum. • Distinction between a continuous spectrum and a line spectrum. •Description of the emission spectrum of the hydrogen atom, including the relationships between the lines and energy transitions to the first, second and third energy levels. • Recognition of the shape of an s atomic orbital and the p_x, p_y and p_z atomic orbitals. • Application of the Aufbau principle, Hund's rule and the Pauli exclusion principle to write electron configurations for atoms and ions up to Z = 36. • The electron configurations of Cr and Cu as exceptions should be covered.
Chemical Bonding **Ionic bonding and structure** • Deduction of the formula and name of an ionic compound from its component ions, including polyatomic ions. • Explanation of the physical properties of ionic compounds (volatility, electrical conductivity and solubility) in terms of their structure. **Covalent bonding** • Deduction of the polar nature of a covalent bond from electronegativity values. • Deduction of Lewis (electron dot) structure of molecules and ions showing all valence electrons for up to four electron pairs on each atom. • The use of VSEPR theory to predict the electron domain geometry and the molecular geometry for species with two, three and four electron domains. • Prediction of bond angles from molecular geometry and presence of nonbonding pairs of electrons. • Prediction of molecular polarity from bond polarity and molecular geometry. • Deduction of resonance structures, examples include but are not limited to C_6H_6, CO_3^{2-} and O_3. •Explanation of the properties of giant covalent compounds in terms of their structures. **Intermolecular forces** • Deduction of the types of intermolecular force present in substances, based on their structure and chemical formula. • Explanation of the physical properties of covalent compounds (volatility, electrical conductivity and solubility) in terms of their structure and intermolecular forces. **Metallic bonding** • Explanation of electrical conductivity and malleability in metals. • Explanation of trends in melting points of metals. • Explanation of the properties of alloys in terms of non-directional bonding.

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Periodic table • Deduction of the electron configuration of an atom from the element's position on the periodic table, and vice versa. • Prediction and explanation of the metallic and non-metallic behaviour of an element based on its position in the periodic table. • Discussion of the similarities and differences in the properties of elements in the same group, with reference to alkali metals (group 1) and halogens (group 17). • Construction of equations to explain the pH changes for reactions of Na_2O,MgO, P_4O_{10}, and the oxides of nitrogen and sulfur with water.
Energetics/thermochemistry • Calculation of the heat change when the temperature of a pure substance is changed using $q = mc\Delta T$. • A calorimetry experiment for an enthalpy of reaction should be covered and the results evaluated. • Application of Hess's Law to calculate enthalpy changes. • Calculation of ΔH reactions using $\Delta H_f°$data. • Determination of the enthalpy change of a reaction that is the sum of multiple reactions with known enthalpy changes. • Calculation of the enthalpy changes from known bond enthalpy values and comparison of these to experimentally measured values. • Sketching and evaluation of potential energy profiles in determining whether reactants or products are more stable and if the reaction is exothermic or endothermic. • Discussion of the bond strength in ozone relative to oxygen in its importance to the atmosphere.
Chemical kinetics • Description of the kinetic theory in terms of the movement of particles whose average kinetic energy is proportional to temperature in Kelvin. • Analysis of graphical and numerical data from rate experiments. • Explanation of the effects of temperature, pressure/concentration and particle size on rate of reaction. • Construction of Maxwell–Boltzmann energy distribution curves to account for the probability of successful collisions and factors affecting these, including the effect of a catalyst. • Investigation of rates of reaction experimentally and evaluation of the results. • Sketching and explanation of energy profiles with and without catalysts.
Equilibrium • The characteristics of chemical and physical systems in a state of equilibrium. • Deduction of the equilibrium constant expression (K_c) from an equation for a homogeneous reaction. • Determination of the relationship between different equilibrium constants (K_c) for the same reaction at the same temperature. •Application of Le Châtelier's principle to predict the qualitative effects of changes of temperature, pressure and concentration on the position of equilibrium and on the value of the equilibrium constant.