Diploma Programme Course Outline		
Name of the DP subject	**Chemistry**	
Level	**Higher** ☐ **Standard** ☐	
YEAR 1		
UNIT	**TOPIC/CONCEPT**	**ASSESSMENT COMPONENTS**
11. Measurement and data processing and analysis (Part 1) • Part 2 will be done after chapter 10	<u>Core:</u> **11. 1 Qualitative and quantitative data** **11. 2 Uncertainties and errors in measurement and results** • Random uncertainties and systematic errors • Uncertainties in calculated results • Reducing the effect of random uncertainty • Significant figures **11. 3 Graphical techniques** • Constructing graphs • Fitting a line to a graph • Measuring the intercept, gradient and area under a graph • Sketching graphs	**Formative assessment** • Students practice using physical data and appropriate units of measurement in calculations • Propagation of uncertainties in processed data, including the use of percentage uncertainties **Peer and self- assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers

1. Stoichiometric relationships	<u>**Core:**</u> **1.1 The particulate nature of matter and chemical change** • States of matter • Elements , compounds and mixtures • Molecular kinetic theory • Changes of state • Chemical symbols, chemical formulae and chemical equations, ionic equations **1.2 The mole concept** • The mole concept and Avogadro constant • Formulas (relative atomic mass, relative formula mass, molar mass) • Molecular and empirical formula **1.3 Reacting masses and volumes** • Calculating theoretical yields • The limiting reactant and the reactant in excess • Percentage and experimental yields • Percentage purity • Reacting volumes of gases, molar volume of a gas • Relationship between temperature, pressure, and volume of a gas	**Formative Assessment** • Observation of practical skills and ability to follow steps and show working • Questioning • Discussion of the methodology of the calculations and what working is necessary: class, small group, pair, individual, teacher-led, student-led. • Think, pair, share • Quiz • Worksheets and past paper questions **Summative Assessment- Test** • Multiple choice and free response questions on stoichiometric relationships and measurement and data processing analysis **Peer and self-assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers **PSOW**

	• Kinetic theory of gases • The gas laws (Boyle's, Charles' law, the pressure law, combined gas law) • The ideal gas equation • Solutions • Volumetric analysis (acid-base titrations, primary standard solutions, back titration, redox titration, precipitation titrations)	• Determining the formula of a hydrate/Determining the M_r of an unknown gas/acid-base titrations/analysis of aspirin tablets/$CaCO_3$ in egg shells
2. Atomic Structure	<u>**Core:**</u> **2.1 The nuclear atom** • Atomic structure • Relative masses and relative charges of protons, neutrons and electrons • Mass number, atomic number and isotopes • Radioactivity and the uses of radioisotopes • Calculations involving non-integer relative atomic masses and abundance of isotopes from given data , including mass spectra **2.2 Electron configuration** • Light as waves and particles (relationship between colour, wavelength, frequency and energy across the electromagnetic spectrum) • Spectra (continuous spectrum and line spectrum) • Energy levels and spectra	**Formative Assessment:** • A quiz will be used to identify strengths and weaknesses before the test. **Summative assessment** • Students will sit an end of unit test based on past paper questions once the unit is complete. **Peer and self -assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers

	• The electron arrangement of atoms and ions • Orbitals and energy levels • Shapes of orbitals , filling atomic orbitals • Electronic configuration of atoms and ions • The octet rule **HL:** **12.1 Electrons in atoms** • The Bohr model • Determination of ionization energy from atomic emission spectrum • Solving problems using E =*hv* • Ionization energy	
UNIT	**TOPIC/CONCEPT**	**ASSESSMENT COMPONENTS**
3. Periodicity	**Core:** **3.1 The periodic table** • The arrangement of elements in the periodic table • Electron arrangement and the periodic table • Development of the periodic table • The period number • Types of elements	**Formative assessments** • Questioning • Discussion of the methodology of the calculations and what working is necessary: class, small group, pair, individual, teacher-led, student-led. • Think, pair, share • Quiz

	3.2 Periodic trends • Trends in the properties of the elements in group 1 and group 17 • Trends in elements across period 3 • Trends in electronegativity values • Trends in electron affinity • Metallic character • Similarities and differences in the properties of the elements in group 1 and group 17 • Reactions of the halogens and reaction of halide ions • Trends in properties of the oxides in period 3 **HL:** **3.1 First-row d-block elements** • The d-block metals • Physical and atomic properties • Chemical properties • Complex ions • Ligand replacement reactions • Valence bond (VB) theory **3.2 Coloured complexes** • The colours of complex ions • Effect of the identity of the metal ion, its oxidation number and the identity of the ligand on the colour of transition metal ion complex • Chemistry of selected d-block metals • Transition metals as catalysts	• Worksheets and past paper questions **Summative assessment** • There will be an end of unit test based on past paper questions. **Peer and self- assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers

4 Chemical bonding and structure	<u>**Core:**</u> **4.1 Ionic bonding and structure** • Ionic bonding • Formation of ions by electron transfer • Predicting the type of bonding from electronegativity values • Polyatomic ions • Naming ionic compounds • Structure of giant ionic compounds • Physical properties of ionic compounds **4.2. Covalent bonding** • Covalent bond formation • Multiple bonding • Bond polarity and dipole moment • Naming inorganic compounds **4.2 Covalent structures** • Using Lewis structures to describe the formation of covalent bonds (draw Lewis structures for molecules and ions, coordinate (dative) bonding, resonance structures) • Valence shell electron pair repulsion theory (VSEPR)- **shapes of molecules with up to 4 electron domains** • Giant covalent lattices **4.3 Intermolecular forces** • London (dispersion) forces • Dipole-dipole forces • Hydrogen bonding (effect of hydrogen bonding on physical properties,	**Formative Assessment** • Questioning • Presentations: individual, paired, group • Think, pair, share • Quiz • Worksheets and past paper questions **Summative assessment:** • Multiple choice and free response questions on the topic. **Peer and self -assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers

	hydrogen bonding in biological molecules, intramolecular hydrogen bonding) • Deducing the types of intermolecular force present in substances based on their structure and chemical formula **4.4 Metallic bonding** **HL:** 14.1 **Further aspects of covalent Bonding** • Shapes of molecules and ions with 5 or 6 electron domains (VSEPR) • Expansion of the octet and incomplete octet • Introduction to molecular orbital theory • Valence bond theory **14. 2 Hybridization** • Hybridization in carbon • Delocalization of electrons (resonance) • Molecular orbital theory (delocalization in benzene and in ions) • Ozone- a case study in bonding theory and international environmental concern • Formal charge • Molecular orbital theory (diatomic molecules) • Valence bond theory versus molecular orbital theory	

5 **Energetics/Thermochemistry**	<u>Core</u>: **5.1 Measuring energy changes** • Difference between heat and temperature • Conservation of energy • Exothermic and endothermic reactions • Calculating enthalpy changes • Evaluating the results of a laboratory calorimetry experiment to determine enthalpy change • Measuring enthalpy changes • Enthalpy change of combustion, neutralization, solution , formation **5.2 Hess's law** • Hess's law and enthalpy change • Enthalpy changes of reaction from enthalpy changes of formation • Enthalpy changes of reaction from enthalpy changes of combustion **5.3 Bond enthalpies** • Bond enthalpies • Using bond dissociation enthalpies to calculate enthalpy changes of reaction • Ozone depletion **<u>HL:</u>** **15.1 Energy cycles** • Enthalpy of atomization • Enthalpy of physical change • Born-Haber cycle	**Formative Assessment** • Observation of practical skills and ability to follow steps and show working • Questioning • Discussion of the methodology of the calculations and what working is necessary: class, small group, pair, individual, teacher-led, student-led. • Think, pair, share • Quiz • Worksheets and past paper questions **Summative Assessment** Multiple choice and free response questions on the topic **Peer and self- assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers **PSOW** Enthalpy changes

	• Lattice enthalpy of ionic compounds • Use Born-Haber cycles to calculate enthalpy changes • Construct Born-Haber cycles for group 1 and 2 oxides and chlorides • Dissolving ionic solids in water • Construct energy cycles from hydration, lattice and solution enthalpies **15.2 Entropy and spontaneity** • Entropy • Spontaneity and Gibbs free energy • Entropy and the direction of change	
6 Chemical Kinetics	**Core** **6.1 Collision theory and rates of reaction** • Collision theory • Factors affecting the rate of reaction (concentration, pressure, temperature, particle size, light, utilization of a catalyst) • The Maxwell-Boltzmann distribution • Reaction rates • Measuring rates of reaction **HL:** 16.1 **Rate expression and reaction Mechanism** • Rate expression and order of reaction • The rate constant • Experimental determination of the rate expression • Reaction mechanism	**Formative Assessment** • Observation of practical skills and ability to follow steps and show working • Questioning • Discussion of the methodology of the calculations and what working is necessary: class, small group, pair, individual, teacher-led, student-led. • Think, pair, share • Quiz • Worksheets and past paper questions **Peer and self -assessment** • Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their

	• Transition-state theory • Reactions involving a catalyst **16.2 Activation energy** • The effect of temperature • Arrhenius temperature dependence • Calculating activation energies graphically • Catalysis (homogeneous and heterogeneous catalysts)	answers and working and give and receive feedback from their peers **PSOW** • Reaction rates/rate-dependent factors/ determining E_a for a reaction
UNIT	**TOPIC/CONCEPT**	**ASSESSMENT COMPONENTS**
7 Equilibrium	<u>**Core:**</u> **7.1 Equilibrium** • Dynamic equilibrium • The position of equilibrium • The equilibrium constant (K_c) • Different values for the equilibrium constant for the same reaction (reversing the direction, changing the stoichiometry, reactions in sequence, the units of the equilibrium constant) • How far a reaction will go • The relationship between the equilibrium constant (K_c) and the reaction quotient (Q_c) • Le Chatelier's principle (changes in concentration, pressure ,temperature)	**Formative Assessment:** • Observation of practical skills and ability to follow steps and show working • Questioning • Discussion of the methodology of the calculations and what working is necessary: class, small group, pair, individual, teacher-led, student-led. • Think, pair, share • Quiz • Worksheets and past paper questions **Peer and self -assessment**

	• The role of catalysts • Equilibrium in industrial process (Haber process for ammonia manufacture, the Contact process for the manufacture of sulphuric acid) **<u>HL:</u>** **17.1 The equilibrium law** • Physical and chemical equilibria • The equilibrium law and changes in concentration • The relation of equilibrium composition to reaction rate • Calculating equilibrium constants from concentration data • Relationship between the equilibrium constant, spontaneity and Gibbs free energy • Coupled reactions • Homogeneous and heterogeneous equilibria	• Students will be expected to check their own work at times, marking themselves and making corrections. At other times, they will share their answers and working and give and receive feedback from their peers **Summative assessments** • Multiple choice and free response questions on the topic

All Diploma Programme courses are designed as two-year learning experiences.