**Two-year course overview**

**IBDP (CHEMISTRY) SL/HL 2023-2025**

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| **IB DP1 (YEAR 1 – AUGUST 2023 - JUNE 2024)** | | | | | | |
| **Title of unit/course component + duration** | **Essential Questions** | **Content, skills, concepts**  **and links to the IB Learner Profile** | **Assessment types and tasks** | **Summative assessment task(s)** | **Resources** | **TOK Links** |
| **Skills in the study of chemistry**  **2 weeks** | What must we take into account while evaluating experimental results? | **Contents**  Uncertainties and errors in measurement and results  Graphical techniques  **Skills**  **-**Distinction between random errors and systematic errors. **-**Record uncertainties in all measurements as a range (+) to an appropriate precision.  **-**Discussion of ways to reduce uncertainties in an experiment.  -Propagation of uncertainties in processed data, including the use of percentage uncertainties.  -Discussion of systematic errors in all experimental work, their impact on the results and how they can be reduced.  -Estimation of whether a particular source of error is likely to have a major or minor effect on the final result.  -Calculation of percentage error when the experimental result can be compared with a theoretical or accepted result.  -Distinction between accuracy and precision in evaluating results.  -Drawing graphs of experimental results including the correct choice of axes and scale. -Interpretation of graphs in terms of the relationships of dependent and independent variables.  -Calculation of quantities from graphs by measuring slope (gradient) and intercept, including appropriate signs  **ATL -Thinking - Communication** | Formative  Labs:   * measuring the density of water   densities lab  Tests/Worksheets/Quizzes on covered concept(s) | The summative task will be assessed through the reports of compulsory labs/PSOW and IA. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | Science has been described as a self-correcting and communal public  endeavour. To what extent do these characteristics also apply to the other  areas of knowledge? |
| **Structure 1.1**  **& Reactions 2.1**  **SL 4 Weeks**  **Structure 1.5 (HL only)**  **1 week** | How can we model the particulate nature of matter?  How can we correlate the number of particles with the mass?  How can we calculate the reacting ratios by mass and gaseous volume?  How do we quantify matter on the atomic scale?  How are chemical equations used to calculate reacting ratios? | **Contents**  1.1.1 —Elements are the primary constituents of matter, which cannot be chemically broken down into simpler substances  2.2.10—Chromatography is a technique used to separate the components of a mixture based on their relative attractions involving intermolecular forces to mobile and stationary phases.  1.1.2 —The kinetic molecular theory is a model to explain physical properties of matter (solids, liquids and gases) and changes of state  1.1.3 —The temperature, T, in Kelvin (K) is a measure of average kinetic energy Ek of particles  1.4.1—Counting particles by mass: The mole  1.4.2—Masses of atoms are compared on a scale relative to 12C  1.4.3—Molar mass M  1.4.4—The empirical formula of a compound  1.4.5—The molar concentration is determined by the amount of solute and the volume of solution  2.1.1—Chemical equations show the ratio of reactants and products in a reaction  2.1.3—The limiting reactant  2.1.4—The percentage yield  2.1.5—The atom economy  **(AHL ONLY)**  1.5.1—An ideal gas consists of moving particles with negligible volume and no intermolecular forces.  1.5.2—Real gases deviate from the ideal gas model, particularly at low temperature and high pressure.  1.5.3—The molar volume of an ideal gas is a constant at a specific temperature and pressure.  1.5.4—The relationship between the pressure, volume, temperature and amount of an ideal gas  **Skills**  Deduction of chemical equations when reactants and products are specified.  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.  **Concept (s)** Mole, Equilibrium, Change  **ATL-** Communication, Thinking  -Students will write a detailed lab report with special emphasis on communicating uncertainties in the calculated values based on stoichiometric relationships.  **Learner Profile**  Inquirer, Knowledgeable, Thinker, Communicator | **Formative**  Labs Reports:   * empirical formula of magnesium oxide * formula of a hydrate * measurement and uncertainty * finding the limiting reagent * preparing solutions   Worksheets/Quizzes | **Unit Test**    MCQ+ Database questions, Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | The magnitude of Avogadro’s constant is beyond the scale of our everyday  experience. How does our everyday experience limit our intuition? |
| **Structure 1.2—The nuclear atom**  **Structure 1.3—Electron configurations**  **SL 2 weeks**  **Structure 1.2-3**  **(AHL only)**  **1 week** | How do the nuclei of atoms differ?  What determines the quantized nature of energy transition?  How can we model the energy states of electrons in atoms? | 1.2.1—Atoms contain a positively charged, dense nucleus composed of protons and neutrons (nucleons). Negatively charged electrons occupy the space outside the nucleus.  1.2.2—Isotopes are atoms of the same element with different numbers of neutrons.  1.3.1—Emission spectra are produced by atoms emitting photons when electrons in excited states return to lower energy levels.  1.3.2—The line emission spectrum of hydrogen provides evidence for the existence of electrons in discrete energy levels, which converge at higher energies.  1.3.3—The main energy level is given an integer number, n,  1.3.4—A more detailed model of the atom describes the division of the main energy level into s, p, d and f sublevels of successively higher energies  1.3.5—Each orbital has a defined energy state for a given electron configuration and chemical environment, and can hold two electrons of opposite spin.  **(Additional Higher Level)**  1.2.3—Mass spectra are used to determine the relative atomic masses of elements from their isotopic composition  1.3.6—In an emission spectrum, the limit of convergence at higher frequency corresponds to ionization.  1.3.7—Successive ionization energy (IE) data for an element give information about its  electron configuration.  **Skills**  Use of the nuclear symbol notation 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.  Description of the relationship between colour, wavelength, frequency and energy across the electromagnetic spectrum.  Distinction between a continuous spectrum and a line spectrum.  **Concept**  Change, Atomic Structure, Electron arrangement  **ATL-Thinking** , **Social** **Research**  When creating models students will be working collaboratively in teams to research on Bohr's model of the atom.  **Learner Profile**  Inquirer, Knowledgeable, Thinker | Formative:  Lab:  flame tests  Tests/Worksheets/Quizzes  on covered concept(s) | **Unit Test**  MCQ+ Database questions, Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | What is the significance of the model of the atom in the different areas of knowledge?  Are the models and theories that scientists create accurate descriptions of the natural world, or are they primarily useful interpretations for prediction, explanation and control of the natural world? |
| **Structure 3.1 Periodicity**  **SL 2 weeks**  **AHL**  **1 week** | How does the periodic table help us to predict patterns and trends in the properties of elements? | 3.1.1—The periodic table consists of periods, groups and blocks  3.1.2—The period number shows the outer energy level that is occupied by electrons. Elements in a group have a common number of valence electrons.  3.1.3—Periodicity refers to trends in properties of elements across a period and down a group.  3.1.4—Trends in properties of elements down a group include the increasing metallic character of group 1 elements and decreasing non-metallic character of group 17 elements.  3.1.5—Metallic and non-metallic properties show a continuum. This includes the trend  from basic metal oxides through amphoteric to acidic non-metal oxides.  2.1.1—When metal atoms lose electrons, they form positive ions called cations. When non-metal atoms gain electrons, they form negative ions called anions.  Structure 3.1.6—The oxidation state is a number assigned to an atom to show the number of electrons transferred in forming a bond.  **(Additional higher Level)**  3.1.7—Discontinuities occur in the trend of increasing first ionization energy across a period  3.1.8—Transition elements have incomplete d-sublevels that give them characteristic  properties.  3.1.9—The formation of variable oxidation states in transition elements can be explained by the fact that their successive ionization energies are close in value.  3.4.8—Coordination bonds are formed when ligands donate an electron pair to transition element cations, forming complex ions.  3.1.10—Transition element complexes are coloured due to the absorption of light when an electron is promoted between the orbitals in the split d-sublevels. The colour absorbed is complementary to the colour observed.  **Skills**  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).  **Concept**  Periodicity, Mole  **ATL Thinking Social Communication Self-Management Research** | Labs:   * trends in atomic radius and ionization energy * reactivity of halogens * complex ions * practice design lab - volume of a drop   Tests/Worksheets/Quizzes on covered concept(s) | Unit Test  MCQ+ Database question+ Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | The elements allowed chemistry to make great steps with limited apparatus, often derived from the pseudoscience of alchemy.  Lavoisier’s work with oxygen, which overturned the phlogiston theory of heat, could be discussed as an example of a paradigm shift. |
| **Structure 2. Models of bonding and structure**  **SL 4 weeks**  **AHL**  **2 weeks** | How are ionic compounds held together?  How are covalent compounds formed?    How can we predict the nature of a compound?  How do we predict the molecular shapes?  What determines the physical properties of molecular substances?  How do the metallic bonds form?  What is hybridization of atomic orbitals? | **Structure 2.1—The ionic model**  2.1.2—The ionic bond is formed by electrostatic attractions between oppositely charged ions.  2.1.3—Ionic compounds exist as three-dimensional lattice structures, represented by empirical formulas  **Structure 2.2—The covalent model**  2.2.1—A covalent bond is formed by the electrostatic attraction between a shared pair of electrons and the positively charged nuclei.  2.2.2—Single, double and triple bonds involve one, two and three shared pairs of electrons respectively  2.2.3—A coordination bond is a covalent bond in which both the electrons of the shared pair originate from the same atom.  2.2.4—The valence shell electron pair repulsion (VSEPR) model enables the shapes of molecules to be predicted from the repulsion of electron domains around a central atom.  2.2.5—Bond polarity  2.2.6—Molecular polarity  2.2.8—Intermolecular forces  2.2.9—Relative strengths of intermolecular forces  2.2.7—Covalent network structures.  2.3.1,2,3 —The metallic bond  2.4.3—Alloys  2.4.2,2 —The bonding triangle.  **(Additional higher level)**  2.2.15—Sigma bonds σ & Pi bonds π  2.2.11—Resonance structures  2.2.12—Benzene,  2.2.13—Expanded octet of electrons.  2.2.14—Formal charge  e 2.2.16—Hybridization  **Skills**  -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. -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 C6H6, CO32-and O3.  Deduction of the types of intermolecular force present in substances, based on their structure and chemical formula.  **Concepts**  Bonding,  **ATL**  **THINKING-** students will have to apply theoretical knowledge to lab work  **SOCIAL-** students work in group during the lab work  **COMMUNICATION-** students will write a lab report  **SELF MANAGEMENT-** students will have a set time to complete the lab work  **RESEARCH-** they will get into details of how periodic table was developed  **Learner Profile**  Inquirer. Knowledgeable, Thinker, Communicator | Labs:   * modeling molecules using molymolds * meting point experiments * properties of ionic and covalent compounds   Tests/Worksheets/Quizzes | Unit Test  MCQ+ Database question+ Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | Is hybridization a real process or a mathematical device?  Kekule claimed that the inspiration for the cyclic structure of benzene came from a dream.  What role do the less rational ways of knowing play in the acquisition of scientific knowledge?  What distinguishes a scientific from a non-scientific hypothesis: its origins or how it is tested? |
| **Reactivity 1.1—Measuring enthalpy changes.**  **SL 4 weeks**  **AHL**  **1 week** | What can be deduced from the temperature change that accompanies chemical or physical change?  How does application of the law of conservation of energy help us to predict energy changes during reactions?  What are the challenges of using chemical energy to address our energy needs?  What determines the direction of chemical change? | 1.1.1—Chemical reactions involve a transfer of energy between the system and the surroundings  1.1.2—Reactions are described as endothermic or exothermic  1.1.3—The relative stability of reactants and products  1.1.4—The standard enthalpy change for a chemical reaction.  1.2.1—Bond-breaking absorbs and bond-forming releases energy  1.2.2—Hess’s law.  1.3.1,2—Energy from fuels  1.3.3—Fossil fuels advantages and disadvantages  1.3.4—Biofuels  1.3.5—Fuel cells.  **Additional higher level:**  1.2.3—Thermodynamic calculations.  1.2.4—An application of Hess’s law  1.2.5—Born–Haber cycles.  1.4.1—Entropy  1.4.2,3,4—Gibbs free energy  **Skills**  Calculation of the heat change when the temperature of a pure substance is changed using 𝑞 =𝑚cΔ𝑇.  A calorimetry experiment for an enthalpy of reaction should be covered and the results evaluated.  Calculation of Δ𝐻𝐻 reactions using ΔHf ° data.  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.  **Concept**  Enthalpy, Entropy, Energy Conservation  **ATL Thinking** **Social** **Research**  Determining energy content of important substances in food and fuels.  **Learner Profile**  Caring Knowledgeable, Inquirer | Labs:   * heat of combustion of ethanol * determining the enthalpy change for the thermal decomposition of potassium hydrogen carbonate by Hess’ Law * using bond enthalpies to calculate the enthalpy of combustion for alcohols using a spreadsheet   Tests/Worksheets/Quizzes | Unit Test  MCQ+ Database question+ Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | What criteria do we use in judging whether discrepancies between experimental and theoretical values are due to experimental limitations or theoretical assumptions?  As an example of the conservation of energy, enthalpy cycles illustrate the unification of ideas from different areas of science. |
| **Reactivity 2. How fast?**  **SL 3 weeks**  **AHL**  **2 weeks** | How can the rate of a reaction be controlled? | 2.2.1—The rate of reaction  2.2.2—Species react as a result of collisions  2.2.3—Factors that influence the rate of a reaction  2.2.4—Activation energy  2.2.5—Catalysts  **Additional higher level**:  2.2.6—Many reactions occur in a series of elementary steps.  2.2.7—Energy profiles  2.2.8—The molecularity of an elementary step  2.2.9—Rate equations  2.2.10—The order of a reaction.  2.2.11—The rate constant, k  2.2.12—The Arrhenius equation  2.2.13—The Arrhenius factor  **Skills**  Calculation of the heat change when the temperature of a pure substance is changed using 𝑞 =𝑚cΔ𝑇.  A calorimetry experiment for an enthalpy of reaction should be covered and the results evaluated.  Calculation of Δ𝐻𝐻 reactions using ΔHf ° data.  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.  **Concept**  Enthalpy, Entropy, Energy Conservation  **ATL Thinking** **Social** **Research**  Determining energy content of important substances in food and fuels.  **Learner Profile**  Inquirer Knowledgeable Thinker Communicator. | Labs:   * iodine clock experiment virtual lab * on-line science simulation - marble chip * rate of reaction design lab * determining Ea for a reaction   Tests/Worksheets/Quizzes on covered concept(s)- | Unit Test  MCQ+ Database question+ Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | Experimental results can support a theory but cannot prove it.  Agreement between rate equation and a suggested mechanism only provides evidence to support a reaction mechanism.  Disagreement disproves the mechanism. |
| **IB DP2 (YEAR 2 – AUGUST 2024 - JUNE 2025)** | | | | | | |
| **Title of unit/course component + duration** | **Essential Questions** | **Content, skills, concepts**  **and links to the IB Learner Profile** | **Assessment types and tasks** | **Summative assessment task(s)** | **Resources** | **TOK Links** |
| **Reactivity 2. How far?**  **SL 2 weeks**  **AHL 1 week** | How can the extent of a reversible reaction be influenced? | 2.3.1—Dynamic equilibrium  2.3.2—The equilibrium law  2.3.3—The equilibrium constant  2.3.4—Le Châtelier’s principle  **Additional higher level:**  2.3.5—The reaction quotient, Q  2.3.6—Equilibrium calculations  2.3.7—The equilibrium constant and Gibbs energy change.  **Skills**  Deduction of the equilibrium constant expression (*Kc*) 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.  **Concept**  Equilibrium, Rate of chemical reaction  **ATL: Thinking,** **Communication**  Think how the following can be applied to a balanced equation at equilibrium-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.  **Learner Profile**  Inquirer Knowledgeable Thinker Communicator. | Labs:   * equilibrium simulation * Le Châtelier’s Principle   Tests/Worksheets/Quizzes on covered concept(s)- | Unit Test  MCQ+ Database questions + Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | -Scientists investigate the world at different scales; the macroscopic and  microscopic. Which ways of knowing allow us to move from the macroscopic to  the microscopic?  • Chemistry uses a specialized vocabulary: a closed system is one in which no  matter is exchanged with the surroundings. Does our vocabulary simply  communicate our knowledge; or does it shape what we can know? |
| **Reactivity 3.1—Proton transfer reactions (acids and Bases)**  **SL 3 weeks**  **AHL 1 week** | What happens when protons are transferred? | 3.2.4—Acids react with reactive metals to release hydrogen  3.1.1—Brønsted–Lowry  3.1.2—Conjugate acid–base pairs.  3.1.3—Amphiprotic species  3.1.4—The pH scale  3.1.5—The ion product constant of water, Kw,  3.1.6—Strong and weak acids and bases.  3.1.7—Neutralisation  3.1.8—pH curves strong acid vs base  3.4.6,7—A Lewis acid is an electron-pair acceptor and a Lewis base is an electron-pair donor.  **Additional higher level**:  3.1.9—The pOH scale  3.1.10—Ka , Kb, pKa or pKb values.  3.1.11—Ka × Kb = Kw  3.1.12—Salt hydrolysis  3.1.13—pH curves of different combinations of strong and weak monoprotic acids and bases  3.1.14,15—Acid–base indicators  3.1.16,17 —Buffer solutions  **Skills**  Deduction of the Brønsted–Lowry acid and base in a chemical reaction.  Deduction of the conjugate acid or conjugate base in a chemical reaction.  Balancing chemical equations for the reaction of acids.  Identification of the acid and base needed to make different salts.  Solving problems involving pH, [H+] and [OH−].  **Concept**  pH, Buffer  **ATL**  THINKING- students will have to apply theoretical knowledge to lab work | Labs:   * titration practice lab * analysis of aspirin tablets * ethanoic acid content in vinegar * CaCO3 in egg shells * determining pKa for a weak acid * virtual lab buffers * identification of carboxylic acid using titration curve * virtual titration lab * design lab - buffer or weak acid   Tests/Worksheets/Quizzes on covered concept(s) | Unit Test  MCQ+ Database questions + Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | Discuss the value of using different theories to explain the same phenomenon.  What is the relationship between depth and simplicity?  The distinction between artificial and natural scales could be discussed. |
| **Reactivity 3.2—Electron transfer reactions (REDOX)**  **SL 2 weeks**  **AHL 1 week** | What happens when electrons are transferred? | 3.2.1—Oxidation and reduction can be described in terms of electron transfer, change in oxidation state, oxygen gain/loss or hydrogen loss/gain  3.2.2—REDOX Half-equations  3.2.3—The relative ease of oxidation and reduction  3.2.5—Electrochemical cells  3.2.6—Voltaic cells  3.2.7—Secondary (rechargeable) cells  3.2.8—Electrolytic cells  **Additional higher level:**  3.2.12—The hydrogen half-cell  3.2.13—Standard cell potential  3.2.14—The relationship between standard change in Gibbs energy and standard cell potential.  3.2.15—During electrolysis of aqueous solutions, competing reactions can occur.  3.2.16—Electroplating.  **Skills**  Deduction of the oxidation states of an atom in an ion or a compound.  Deduction of the name of a transition metal compound from a given formula, applying oxidation numbers represented by Roman numerals.  Identification of the species oxidized and reduced and the oxidizing and reducing agents, in redox reactions.  Deduction of redox reactions using half-equations in acidic or neutral solutions.  Deduction of the feasibility of a redox reaction from the activity series or reaction data.  Solution of a range of redox titration problems.  Construction and annotation of both types of electrochemical cells  Performance of laboratory experiments involving a typical voltaic cell using two metal/metal-ion half-cells.  Explanation of the trends in boiling points of members of a homologous series.  Distinction between empirical, molecular and structural formulas.  **Concept:** Energy, Environment,  **ATL**  **thinking** - students will have to apply their theoretical knowledge to lab work  **social-** students will work in groups during the lab work  **communication-** students will write a lab report  **self-management-** students will have a set time to complete and hand in the lab work  **Research-** students will research how electrolysis is used in large-scale industrial processes.  **Learner Profile:** Inquirer Knowledgeable Thinker Communicator. | Labs:   * chlorine content of swimming pools * Fe redox titration with KMnO4 * reactivity experiments * Electrolysis * Electrochemical cells * Design lab - electrochemical cells   Tests/Worksheets/Quizzes on covered concept(s) | Unit Test  MCQ+ Database question+ Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.:  Resources are uploaded to Managebac® for students to use when the topic is being covered. | Are oxidation numbers “real”?  Chemistry has developed a systematic language that has resulted in older names becoming obsolete. What has been gained and lost in this process? |
| **Structure 3.2— Reactivity 3.2**  **(Organic Chemistry 1) . Functional group chemistry:**  **SL 4 weeks**  **AHL 2 weeks** | How does the classification of organic molecules help us to predict their properties?  Why are some reactions of alkenes  classified as reduction reactions while others are  classified as electrophilic addition reactions?  What happens when reactants share their electron pairs with others? | S. 3.2.1—Organic compounds can be represented by different types of formulas.  S 3.2.2—Functional groups give characteristic physical and chemical properties to a compound.  S 3.2.3,4—Homologous series  S 3.2.5—“IUPAC nomenclature”  S 3.2.6—Structural isomerism.  R 3.2.9,10—Functional groups in organic compounds may undergo REDOX.  R 3.2.11—Reduction of unsaturated compounds  R 3.3.1—A radical is a molecular entity that has an unpaired electron.  R 3.3.2—Radicals are produced by homolytic fission  R 3.3.3—Radicals take part in substitution reactions  R 3.4.3—Heterolytic fission  R 3.4.4— electrophiles  R 3.4.5—Alkenes are susceptible to electrophilic attack  **Additional higher level:**  S 3.2.7—Stereoisomers  R 3.4.1—Nucleophiles  R 3.4.2—Nucleophilic substitution reactions  R 3.4.9—Nucleophilic substitution reactions include the reactions between halogenoalkanes and nucleophiles  R 3.4.10—The rate of the substitution reactions is influenced by the identity of the leaving group  R 3.4.11—Alkenes readily undergo electrophilic addition reactions.  R 3.4.12—The relative stability of carbocations  R 3.4.13—Electrophilic substitution reactions include the reactions of benzene with electrophiles.  **Skills**  Identification of different classes: alkanes, alkenes, alkynes, halogenoalkanes, alcohols, ethers, aldehydes, ketones, esters, carboxylic acids, amines, amides,nitriles and arenes.  Identification of typical functional groups in molecules eg phenyl, hydroxyl,  carbonyl, carboxyl, carboxamide, aldehyde, ester, ether, amine, nitrile, alkyl, alkenyl and alkynyl.  Construction of 3-D models (real or virtual) of organic molecules.  **Concept**  Orientation of Atoms and Molecules, Energy, Enthalpy  **ATL**  **Thinking**-students will have to apply theoretical knowledge to lab work  **Social-** Students work in groups during lab work  **Communication-** Students will write a lab report  **Self-management-** students will have a set time to complete the lab work | Labs:   * boiling point trends in organic compounds (database) * reactions of organic compounds * hydrolysis of halogenoalkanes * Identification of functional groups   Tests/Worksheets/Quizzes on covered concept(s) | Unit Test  MCQ+ Database question+ Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.  Resources are uploaded to Managebac® for students to use when the topic is being covered. | The use of the different formulas illustrates the value of different models with different depths of detail.  IUPAC could be discussed as an example of the use of the language of chemistry as a tool to classify and distinguish between different structures. |
| **MOCK EXAMS - (2 weeks)**  **March 2025** | | | | | | |
| **Organic Chemistry 2.**  **Structure 2.**  **Polymers**  **SL 1 week**  **AHL only**  **2 weeks**  **Structure 3.2 (spectroscopic Identification of organic compounds)** | What are the structural features of  some plastics that make them biodegradable?  Why is the atom economy 100% for an addition polymerization reaction?  What are the techniques used in structural determination of organic and inorganic compounds?  Can we have a technique to determine a complete structure of a molecule? | **2**.4.4—Polymers  2.4.5—Addition polymers  **Additional higher level:**  2.4.6—Condensation polymers  3.2.8—Mass spectrometry (MS) of organic compounds  3.2.9—Infrared (IR) spectroscopy  3.2.10—Proton nuclear magnetic resonance spectroscopy (1H NMR)  3.2.11—High resolution 1HNMR.  3.2.12—combined techniques.  **Skills**  Deduction of information about the structural features of a compound from percentage composition data, MS, 1H NMR or IR.  **Concept**  Fragmentation patterns  ATL  **Thinking -**Students will learn to calculate the IHD of organic compounds and ﻿interpret spectrograms,  **Learner Profile**  Inquirer Principled Thinker | Data processing and Error analysis in IAs  Tests/Worksheets/Quizzes on covered concept(s) | Unit Test  MCQ+ Database questions + Short answer questions  The score will be converted to 100% and graded (1-7) using IB grade boundaries. | Resources include handouts, question sheets, labs, tests, exams, videos, PPT’s and more.  Resources are uploaded to Managebac® for students to use when the topic is being covered. | Electromagnetic waves can transmit information beyond that of our sense  perceptions. What are the limitations of sense perception as a way of knowing? |
| **IBDP EXAMS (3 weeks)**  **May 2025** | | | | | | |

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