**11 CHEMISTRY- TERM 1**

| **TOPIC / TIMING (Weeks)** | **QCAA OBJECTIVES** | **LEARNING GOALS and SUCCESS CRITERIA** | **Notebook Page** |
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| **Atomic Structure and Isotopes**  **Week 1 (3 lessons)** | **Unit 1 Topic 1**  **Objectives 1,2** | **SC1:** I can describe the basic structure of the atom including the nucleus, protons, neutrons and electrons, electrostatic attraction and nuclear binding force.  **SC2:** I can recall the relative size and charge of the proton, neutron and electron.  **SC3:** I can describe how ions are formed and recall the terms cation and anion.  **SC4:** I can use and apply the nuclear symbol notation to determine the number of protons, neutrons and electrons in atoms, ions and isotopes  **SC5:** I can recall the relative energy levels of the s, p and d orbitals to construct electron configurations for atoms and ions up to *Z* = 36 and recognise that the periodic table is arranged into four blocks associated with the four sub-levels s, p, d and f  **SC6:** I can apply the Aufbau principle, Hund’s rule and the Pauli exclusion principle to write electron configurations for atoms and ions up to *Z* = 36 and use orbital diagrams to represent the character and relative energy of orbitals  **SC7:** I can recognise the electron configuration of Cr and Cu as exceptions  **LG 1**: **Students understand that atoms can be modelled as a nucleus surrounded by electrons in distinct energy levels held together by electrostatic forces of attraction between the nucleus and electrons; the location of electrons within atoms can be represented using electron configurations; and the structure of the periodic table is based on the electronic configuration of atoms**  **SC8:** I can recall isotopes are atoms of the same element that have different numbers of neutrons and can be represented in the form AX (IUPAC) or X-A  **SC9:** I can recognise that isotopes of an element have the same electron configuration and possess similar chemical properties but have different physical properties  **SC10:**understand that the relative atomic mass of an element is the ratio of the weighted average mass per atom of the naturally occurring form of the element to 1/12 the mass of an atom of carbon-12  **LG2: Students can demonstrate an understanding that isotopes represent differences between atoms that impact on physical properties** |  |
| **Periodic Table / Trends**  **Week 2** (**3 lessons**) | **Unit 1 Topic 1**  **Objectives** 1, 2, 3, 4, 5, 6, 7 | **SC11:** I can recall that elements are represented by symbols and recognise that the structure of the periodic table is based on the atomic number and the properties of the elements  **SC12:** I can describe trends across periods and down groups, including atomic radii, valences, ionic radii, 1st ionisation energy and electronegativity as exemplified by groups 1, 2, 13–18 and period 3  **SC13:** I can analyse, interpret and evaluate data to explain in atomic radii, valences, ionic radii, 1st ionisation energy and electronegativity across periods of the periodic table.  **SC14:** I canexplain how successive ionisation energy data is related to the electron configuration of an atom  **SC15:** I can compare and explain the metallic and non-metallic behaviour of elements, including group trends and the reactivity for the alkali metals (Li–Cs) and the halogens (F–I)  **SC16:** I canrecognise that oxides change from basic through amphoteric to acidic across a period  **LG3: Students can analyse, evaluate and interpret data to explain and justify conclusions for periodic trends, patterns and relationships** |  |
| **Chemical reactions**  **Week** **3 (2 lessons)** | **(Unit 1 Topic 3)**  **Objectives 1,4** | **SC17:** I can deduce that chemical reactions and phase changes involve energy changes commonly observable as changes in the temperature of the surroundings and/or the emission of light  **SC18:** I can deduce and construct balanced chemical equations when reactants and products are specified and apply state symbols (s), (l), (g) and (aq)  **LG4: Students understand that chemical change can be represented by balanced chemical reactions with state symbols.** |  |
| **Mole concept and law of conservation of mass**  Weeks 3,4,5 **(7 lessons)** | **Unit 1 Topic 3**  **Objectives** **1, 2, 3, 4** | **SC19:** I can understand that the empirical formula expresses the simplest whole number ratio of elements in a compound  **SC20:** I can solve (and make predictions for) problems including   * + determining the percentage composition from relative atomic masses;   + empirical formula of a compound from the percentage composition by mass; and   + molecular formula of a compound from its empirical formula and molar mass   **Mandatory Practical** : **Derive the empirical formula of a compound from reactions involving mass changes**  **SC21:** I can recognise that a mole is a precisely defined quantity of matter equal to Avogadro’s number of particles  **SC22:** I can appreciate the law of conservation of mass and understand that the mole concept relates mass, moles and molar mass  **SC23:** I can solve (and make predictions for) problems including   * amount of substance in moles; number of representative particles; and molar mass of atoms, ions, molecules and formula units * using the mole concept to calculate the mass of reactants and products;   **SC24:** I can use the appropriate stoichiometric ratio to determine that reactants can be limiting  **SC25:** I can solve (and make predictions for) problems which involve determining limiting reagent, related quantities of other reactants and products  **SC26:** I can appreciate that experimental yield can be different from theoretical yield  **SC27:** I can calculate percentage yield from experimental or given data  **LG 5:** **Students can use the concept and formulas involved in calculations of mole and masses to solve and explain problems involving mass relationships in balanced equations.** |  |
| **Measurement uncertainty and error**  **Weeks 6 and 7 (6** **lessons**) | **(Unit 1 Topic 3)**  **Objectives 2, 3, 4** | **SC28:** I can distinguish between precision and accuracy  **SC29:** I can explain how measurements have limits to their precision and accuracy that must be considered when evaluating experimental results  **LG6: Students will be able to predict the relative accuracy and precision of experimental data**  **SC30:** I can distinguish between qualitative and quantitative data;  **SC31:** I can explain that quantitative data obtained from measurements is always associated with random error/measurement uncertainties  **SC32:** I can calculate the measurement uncertainties in processed data, including the use of absolute uncertainties and percentage uncertainties  **SC33:** I can communicate measurement uncertainties as a range (±) to an appropriate precision  **SC34**: I can calculate the percentage error when the experimental result can be compared with a theoretical result  **SC35**: I can distinguish between random and systematic errors (expt design/procedure lead to systematic errors and repeated trials and measurements reduce random errors)  **SC36** I understand that propagation of random error in data processing shows the impact of measurement uncertainties on the final result  **SC37:** I understand that the number of significant figures in a result is based on the figures given in the data and can determine results of calculations to the appropriate number of significant figures  **LG7: Students can calculate and explain the propagation of random errors (uncertainty) through an experiment** |  |
| **Compounds / mixtures**  **Week 8 (3 lessons)** | **Unit 1 Topic 2** | **SC 38:** I can recall that pure substances may be elements or compounds  **SC 39:** I can recognise that materials are either pure substances with distinct measurable properties (e.g. melting and boiling point, reactivity, strength, density) or mixtures with properties dependent on the identity and relative amounts of the substances that make up the mixture  **SC 40:** I can distinguish between heterogeneous and homogeneous mixtures  **SC 41:** I can recognise that nanomaterials are substances that contain particles in the size range 1–100 nm and have specific properties relating to the size of these particles  **LG 8: I can analyse and interpret given data to evaluate the physical properties of pure substances and mixtures** |  |
|  |  | **DATA TEST**  **Week 8 (1 lesson)** |  |
| **Exothermic and Endothermic Reactions**  **Week 9 (3 lessons)** | **Unit 1 Topic 3**  **Objectives 1,2,3,4,5,6** | **SC42:** I can explain how endothermic and exothermic reactions relate to the law of conservation of energy and the breaking and reforming of bonds; understand that heat energy is released or absorbed by the system to or from the surrounds  **SC43:** I can understand that heat is a form of energy and that temperature is a measure of the average kinetic energy of the particles  **SC44:** I can apply the relationship between temperature and enthalpy changes to identify thermochemical reactions as exothermic or endothermic; deduce from enthalpy evel diagrams and thermochemical equations the relative stabilities of reactants and products, and the sign of the enthalpy change (ΔH) for a reaction  **SC45:** I can explain, in terms of average bond enthalpies, why reactions are exothermic or endothermic  **SC46:** I can construct and use appropriate representations (including chemical symbols and formulas, and chemical and thermochemical equations) to communicate conceptual understanding, solve problems and make predictions  **SC47:** I can calculate the heat change for a substance given the mass, specific heat capacity and temperature change  **SC48:** I can use data to calculate the enthalpy change (ΔH) for a reaction  **Mandatory Practical**: **Conduct a calorimetry experiment to measure the enthalpy of a reaction.**  **LG 9**: **Students understand that thermochemical equations are identified as exothermic or endothermic and are able to explain and/or calculate enthalpy changes from a variety of methods used. (using average bond enthalpies ,using specific heat capacities and using data from thermochemical equations)** |  |
| **Introduction to bonding**  **Week 10 (2 lessons)** | **(Unit 1 Topic 1)**  Objectives 1, 2, 3, 4, 5, 7 | **SC 49:** I can recognise that the properties of atoms, including their ability to form chemical bonds, are explained by the arrangement of electrons in the atom and by the stability of the valence electron shell  **SC 50:** I can understand that the number of electrons lost, gained or shared is determined by the electron configuration of the atom and recall that transitional elements can form more than one ion  **SC 51:** I can recognise that ions are atoms or groups of atoms that are electrically charged due to an imbalance in the number of electrons and protons and recognise that ions are represented by formulas which include the number of constituent atoms and the charge of the ion  **SC 52:** I can understand that chemical bonds are caused by electrostatic attractions that arise because of the sharing or transfer of electrons between participating atoms and the valency is a measure of the number of bonds that an atom can form  **SC 53:** I can determine the formula of an ionic compound from the charges on the relative ions and name the compound  **LG 10:Students can write and describe the exchange of electrons in compounds formed from ions (ionic compounds)**  **SC 54:** I can deduce Lewis (electron dot) structure of molecules and ions showing all valence electrons for up to four electron pairs for each atom  **SC 55:** I can identify the numbers of bonding and lone pairs of electrons around each atom in a molecule  **LG 11: Students can draw Lewis diagrams of simple ionic and covalent formula**  **LG 12 : Students can explain that basic differences in the physical properties of Ionic and Covalent substances using basic description of lattice and molecular structure** |  |
| **Bonding and properties**  **Week 10 (1 lessons)** | **Unit 1 Topic 2**  **Objectives 1, 2, 3, 4, 5, 7** | **SC 56:**I can recognise that the properties of ionic compounds, including high melting point, brittleness, and ability to conduct electricity when liquid or an aqueous solution, can be explained by modelling ionic bonding as ions arranged in a crystalline lattice structure with strong electrostatic forces of attraction between oppositely charged ions  **SC 57:**I can understand that the type of bonding within ionic, metallic and covalent substances explains their physical properties, including melting and boiling point, thermal and electrical conductivity, strength and hardness  **SC 58:**I can understand that hydrocarbons, including alkanes (saturated), alkenes (unsaturated) and benzene, have different chemical properties that are determined by the nature of the bonding within the molecules  **SC59:**I can I can analyse and interpret given data to evaluate the properties, structure and bonding of ionic, covalent and metallic compounds  **LG 13: Students can describe and identify the type of bonding present in simple ionic, metallic, and covalent substances.** |  |