**CHEMISTRY – Unit 3 LG/SC**

| **TOPIC NAME**  **and TIMING** | **QCAA Ref**  **&**  **Obj** | **LEARNING GOALS and SUCCESS CRITERIA** |
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| **Redox Reactions**  **Yr 11 Week 34,35 (6 lessons)** | **Unit 3 Topic 2**  **Objectives 1,2,3,4,5** | **SC1:** I can recognise that a range of reactions, including displacement reactions of metals, combustion, corrosion and electrochemical processes, can be modelled as redox reactions involving oxidation of one substance and reduction of another substance  **SC2:** I can understand that the ability of an atom to gain or lose electrons can be predicted from the atom’s position in the periodic table, and explained with reference to valence electrons, consideration of energy and the overall stability of the atom  **SC3:** I can identify the species oxidised and reduced, and the oxidising agent and reducing agent, in redox reactions.  **SC4:** I can understand that oxidation can be modelled as the loss of electrons from a chemical species, and reduction can be modelled as the gain of electrons by a chemical species; these processes can be represented using balanced half-equations and redox equations (acidic conditions only)  **SC5:** I can deduce the oxidation state of an atom in an ion or compound and name transitional metal compounds from a given formula by applying oxidation numbers represented as roman numerals  **SC6:** I can use appropriate representations, including half-equations and oxidation numbers, to communicate conceptual understanding, solve problems and make predictions  **Mandatory Practical**: Perform single displacement reactions in aqueous solutions. |
| **LG 1**: **Students can understand the processes involved in the oxidation and reduction of substances** |
| **Electrochemical Cells:**  **Yr 11 Wk 36** (**1lsn**) | **Unit 3 Topic 2**  **Objectives** 1,2 | **SC7**: I can understand that electrochemical cells, including galvanic and electrolytic cells, consist of oxidation and reduction half-reactions connected via an external circuit that allows electrons to move from the anode (oxidation reaction) to the cathode (reduction reaction).  **LG 2: Students can understand that electrochemical cells consist of oxidation and reduction half reactions.** |
| **Galvanic cells:**  **Yr 11 Week 36,37** (**5 lessons**) | **Unit 3:Topic 2**  **Objectives** 1,2,3,4,5 | **SC8**: I can understand that galvanic cells, including fuel cells, generate an electrical potential difference from a spontaneous redox reaction which can be represented as cell diagrams including anode and cathode half-equations  **SC9**: I can recognise that oxidation occurs at the negative electrode (anode) and reduction occurs at the positive electrode (cathode) and explain how two half-cells can be connected by a salt bridge to create a voltaic cell (examples of half-cells are Mg, Zn, Fe and Cu and their solutions of ions)  **SC10**: I can describe, using a diagram, the essential components of a galvanic cell; including the oxidation and reduction half-cells, the positive and negative electrodes and their solutions of their ions, the flow of electrons and the movement of ions, and the salt bridge  **Mandatory Practical :** Construct a galvanic cell using two metal/metal-ion half cells. |
| **LG3: Students can understand and explain the processes that occur within galvanic cells** |
| **Standard Electrode Potential/Electrolytic Cells:**  **Yr 11 Week 38 (3 lessons)** | **Unit 3: Topic 2**  **Objectives: 1,2,3,4,5** | **SC11:** I can determine the relative strength of oxidising and reducing agents by comparing standard electrode potentials.  **SC12:** I can recognise that cell potentials at standard conditions can be calculated from standard electrode potentials; these values can be used to compare cells constructed from different materials.  **SC13:** I can recognise the limitation associated with standard reduction potentials.  **SC14:** I can use appropriate mathematical representation to solve problems and make predictions about spontaneous reactions, including calculating cell potentials under standard condition.  **Sc15:** I can understand that electrolytic cells use an external electrical potential difference to provide the energy to allow a non-spontaneous redox reaction to occur, and appreciate that these can be used in small-scale and industrial situations, including metal plating and the purification of copper  **Sc16:** I can predict and explain the products of the electrolysis of a molten salt and aqueous solutions of sodium chloride and copper sulfate. Explanations should refer to Eø values, the nature of the electrolyte and the concentration of the electrolyte  **SC17:** I can describe, using a diagram, the essential components of an electrolytic cell; including source of electric current and conductors, positive and negative electrodes, and the electrolyte  **LG 4: Students can understand and use a table of Standard Electrode Potentials and understand the processes involved in Electrolytic cells.** |
| **Chemical Equilibrium**  **Yr 12 Week 1 (3 lessons)** | **Unit 3: Topic 1**  **Objectives 1,2,3,4,5** | **SC18**: I can recognise that chemical systems may be open (allowing matter and energy to be exchanged with the surroundings) or closed (allow energy, but not matter, to be exchanged with the surroundings)  **SC19**: I can understand that physical changes are usually reversible, whereas only some chemical reactions are reversible  **SC20**: I can appreciate that observable changes in chemical reactions and physical changes can be described and explained at an atomic and molecular level  **SC21**: I can symbolise equilibrium equations by using ⇌ in balanced chemical equations  **SC22:** I can understand that, over time, physical changes and reversible chemical reactions reach a state of dynamic equilibrium in a closed system, with the relative concentrations of products and reactants defining the position of equilibrium  **SC23**: I can explain the reversibility of chemical reactions by considering the activation energies of the forward and reverse reactions  **SC24:** I can analyse experimental data, including constructing and using appropriate graphical representations of relative changes in the concentration of reactants and product against time, to identify the position of equilibrium |
| **LG5: Students can understand and explain chemical Equilibrium** |
| **Factors that effect equilibrium**  **Yr 12 Week 2 (3 lessons)** | **Unit 3:Topic 1**  **Objectives 1,2,3,4,5** | **SC25**: I can explain and predict the effect of temperature change on chemical systems at equilibrium by considering the enthalpy change for the forward and reverse reactions  **SC26**: I can explain the effect of changes of concentration and pressure on chemical systems at equilibrium by applying collision theory to the forward and reverse reactions  **SC27**: I can apply Le Châtelier’s principle to predict the effect changes of temperature, concentration of chemicals, pressure and the addition of a catalyst have on the position of equilibrium and on the value of the equilibrium constant |
| **LG 6: Students can understand how various factors affect the position of equilibrium** |
| **Equilibrium constants**  **Yr 12 Week 3 (3 lessons)** | **Unit 3: Topic 1**  **Objectives 1,2,3,4,5** | **SC28**: I can understand that equilibrium law expressions can be written for homogeneous and heterogeneous systems and that the equilibrium constant (Kc), at any given temperature, indicates the relationship between product and reactant concentrations at equilibrium  **SC29**: I can deduce the equilibrium law expression from the equation for a homogeneous reaction and use equilibrium constants (Kc), to predict qualitatively, the relative amounts of reactants and products (equilibrium position)  **SC30**: I can deduce the extent of a reaction from the magnitude of the equilibrium constant  **SC31**: I can use appropriate mathematical representation to solve problems, including calculating equilibrium constants and the concentration of reactants and products |
| **LG7: Students can understand the use of equilibrium constants** |
| **Properties of acids and bases/ Bronsted-Lowry model**  **Yr 12 Week 4 (3 lessons)** | **Unit 3: Topic 1**  **Objectives 1,2,3,4,5** | **SC32**: I can understand that acids are substances that can act as proton (hydrogen ion) donors and can be classified as monoprotic or polyprotic depending on the number of protons donated by each molecule of the acid  **SC33**: I can distinguish between strong and weak acids and bases in terms of the extent of dissociation, reaction with water and electrical conductivity and distinguish between the terms strong and concentrated for acids and bases  **SC34**: I can recognise that the relationship between acids and bases in equilibrium systems can be explained using the Brønsted-Lowry model and represented using chemical equations that illustrate the transfer of hydrogen ions (protons) between conjugate acid-base pairs  **SC34**: I can recognise that amphiprotic species can act as Brønsted-Lowry acids and bases  **SC35**: I can identify and deduce the formula of the conjugate acid (or base) of any Brønsted-Lowry base (or acid)  **SC36**: I can appreciate that buffers are solutions that are conjugate in nature and resist a change in pH when a small amount of an acid or base is added; Le Châtelier’s principle can be applied to predict how buffer solutions respond to the addition of hydrogen ions and hydroxide ions |
| **LG8: Students can understand properties of acids and bases as well as Bronsted-Lowry acids and bases** |
| **Volumetric Analysis**  **Yr 12 Week 5,6 (6 lessons)** | **Unit 3: Topic 1**  **Objectives 1,2,3,4,5** | **SC37**: I can distinguish between the terms end point and equivalence point  **SC38**: I can recognise that acid-base titrations rely on the identification of an equivalence point by measuring the associated change in pH, using chemical indicators or pH meters, to reveal an observable end point  **SC39**: I can sketch the general shapes of graphs of pH against volume (titration curves) involving strong and weak acids and bases. Identify and explain their important features, including the intercept with pH axis, equivalence point, buffer region and points where pKa = pH or pKb = pOH  **SC40:** I can use appropriate mathematical representations and analyse experimental data and titration curves to solve problems and make predictions, including using the mole concept to calculate moles, mass, volume and concentration from volumetric analysis data  **Mandatory practical : Acid-base titration to calculate the concentration of a solution with reference to a standard solution.** |
| **LG9: Students can understand the process of titrations including analysing titration curves and calculations from volumetric analysis data.** |
| **pH scale**  **Yr 12 Week 7 (3 lessons)** | **Unit 3: Topic 1**  **Objectives** | **SC41**: I can understand that water is a weak electrolyte and the self-ionisation of water is represented by Kw = [H+][OH–]; Kw can be used to calculate the concentration of hydrogen ions from the concentration of hydroxide ions in a solution  **SC42**: I can understand that the pH scale is a logarithmic scale and the pH of a solution can be calculated from the concentration of hydrogen ions using the relationship pH = –log10 [H+]  **SC43**: I can use appropriate mathematical representation to solve problems for hydrogen ion concentration [H+(aq)], pH, hydroxide ion concentration [OH–(aq)] & pOH |
| **LG10: Students can understand and perform calculations involving pH** |
| **Dissociation constants**  **Yr 12 Week 8 (3 lessons)** | **Unit 3: Topic 1**  **Objectives 1,2,3,4,5** | **SC44**: I can explain the degree of ionisation at equilibrium in aqueous solution, which can be represented with chemical equations and equilibrium constants (Ka)  **SC45**: I can determine the expression for the dissociation constant for weak acids (Ka) and weak bases (Kb) from balanced chemical equations  **SC46**: I can analyse experimental data to determine and evaluate the relative strengths of acids and bases  **SC47:** I can use appropriate mathematical representation to solve problems, including calculating dissociation constants (Ka and Kb) and the concentration of reactants and products |
| **LG11: Students can understand the role of dissociation constants** |
| **Acid-base Indicators**  **Yr 12 Week 9 (3 lessons)** | **Unit 3: Topic 1**  **Objectives 1,2,3,4,5** | **SC48**: I can understand that an acid-base indicator is a weak acid or a weak base where the components of the conjugate acid-base pair have different colours; the acidic form is of a different colour to the basic form  **SC49**: I can explain the relationship between the pH range of an acid-base indicator and its pKa value  **SC50**: I can recognise that indicators change colour when the pH = pKa and identify an appropriate indicator for a titration, given equivalence point of the titration and pH range of the indicator |
| **LG12: Students can understand the use of acid-base indicators** |

**\*\* DATA TEST WILL OCCUR IN WEEK 5**

**\*\* STUDENT EXPERIMENT WILL COMMENCE IN WEEK 10**

**(following the Data test)**