Year: Y12 BTEC Level 3
Subject: Applied Science

Term	Week	Focus	Summary	Learning Outcomes	Learning skills
Term 1.1	1	The Periodic Table and Atomic Structure	History of the Atom (GCSE Revision) The Atom (GCSE Revision) Mass Number and Atomic Number (GCSE Revision) Mass Spectrometry Mass Spectrometry Calculations Interpreting Mass Spectra	Identify elements and their symbols accurately Explain the meaning and significance of atomic number, mass number, and relative atomic mass Discuss the organisation of the Periodic Table into groups and periods Locate s, p, and d blocks on the Periodic Table Compare and contrast metals and non-metals Explain the properties and locations of subatomic particles - protons, electrons, and neutrons Use your knowledge to recall the charges and relative masses of subatomic particles Identify factors that influence atomic radius and ionic radius, including nuclear charge, number of shells, shielding, and ion charge Use your knowledge to define isotopes Calculate relative atomic mass and isotope composition Interpret mass spectra to determine relative atomic mass and isotope composition	Learners develop the ability to break down a research task and decide on a suitable approach (ACP Analysing) when researching the history of the atom. Learners develop the ability to be flexible and open-minded when exploring new content in relation to their previous knowledge of the atomic structure (VAA Agile). Learners will practise the ability to demonstrate confidence and experiment with novel ideas such as mass spectrometry (VAA Agile).
	2	The Periodic Table and Atomic Structure	Electronic Structure	Describe energy levels/shells and their significance in electronic structure Draw electronic orbitals and their shapes Apply the Aufbau principle and discuss its importance in determining electronic structure Apply Hund's Rule of Maximum Multiplicity and discuss how it relates to electron spin Use your knowledge to give examples of exceptions to these rules Represent electronic structure using s, p, d and electrons in boxes notation	Learners will have the opportunity to develop the ability to think fluently while generating ideas and applying it to a similar concept (ACP Creating) when exploring electronic configurations and the Aufbau principle. Learners develop the ability to use connections from past experiences to seek possible generalisations (ACP Linking) when reviewing the

				Use your knowledge to define first and successive ionisation energies Explain how ionisation energies are evidence for electronic structure of an atom Discuss the factors affecting ionisation energy trends down a group and across a period	electronic orbitals present in energy levels. Learners will develop their ability to train and prepare through working on past exam questions in order to become more proficient (VAA Hardworking).
	3	The Periodic Table and Atomic Structure	Assessment for Learning Aim A	Describe how the Periodic Table and its features relate to atomic structure Determine relative atomic mass and isotope composition of elements Explain the rules used to determine the electronic structure of atoms and ions Explain trends in atomic and ionic radius down a group and across a period Analyse how ionisation energy changes down a group, across a period and successively for each electron in the atom of an element	Learners will be able to generate ideas from their knowledge of sub-atomic particle charges and bonding to create shapes of molecules in 3 dimensional space (ACP Creating). Learners will practise the ability to work with big ideas related to electrostatic forces of attraction and atomic structure from previous lessons (ACP Linking). Learners will develop their ability to train and prepare through working on past exam questions in order to become more proficient (VAA Hardworking).
	4	Structure and Bonding	Metallic Bonding Ionic Bonding Covalent and Dative Covalent Bonding	Demonstrate an understanding of giant metallic structures such as iron, steel, and aluminium Draw a diagram including lattice of cations, delocalised electrons, and electrostatic attraction in metallic bonding Demonstrate an understanding of electron transfer, formation of cations and anions, and electrostatic attraction in ionic bonding Describe covalent bonding as an electrostatic attraction between two nuclei	Learners will develop the ability to work effectively within the rules of the atomic structure (ACP Analysing) when drawing crystal structures. Learners will practise to use connections from their knowledge of ionic, covalent and metallic bonding to seek generalisations

				Differentiate between single, double and triple bonds, dative covalent (coordinate) bonds, giant covalent structures and simple molecular structures Discuss the physical properties of different types of bonds and structures Create dot and cross diagrams for ionic and covalent bonding Represent the electronic configurations of ions Create 3-dimensional representations of molecules Describe the lattice arrangements of atoms, ions, and molecules	about giant covalent structures and their properties (ACP Linking). Learners will have the opportunity to develop their use of scientific language with such ease that it no longer requires active thinking (ACP Realising).
	5	Structure and Bonding	VSEPR Theory Electronegativity Polar Molecules Intermolecular Forces	Explain the principles and rules of electron pair repulsion theory Determine molecular shapes using electron pair repulsion theory Use your knowledge to define electronegativity Determine the extent of bonding characteristics by using electronegativity Discuss how the shape of molecules affects their polarity Differentiate between polar and nonpolar molecules Describe the different types of intermolecular forces Explain the effect of intermolecular forces on physical properties such as melting and boiling points Discuss the effects of hydrogen bonding on the density of ice compared to water	Learners will be able to generate ideas from their knowledge of sub-atomic particle charges and bonding to create shapes of molecules in 3 dimensional space (ACP Creating). Learners will practise the ability to work with big ideas related to electrostatic forces of attraction and atomic structure from previous lessons (ACP Linking). Learners will develop their ability to train and prepare through working on past exam questions in order to become more proficient (VAA Hardworking).
	6	Structure and Bonding	Assessment for Learning Aim B	Describe different types of bonding, intermolecular force and structure Explain how bonding and structure influence physical properties	Learners will develop their ability to train and prepare through working on past exam questions in order to become more proficient (VAA Hardworking).

				Assess the use of electronegativity in determining bonding characteristics of a compound Predict the shape and polarity of molecules using electron pair repulsion theory and electronegativity Analyse how melting/ boiling point changes for elements and their compounds across a period and down a group	
	7	Chemical Reactions	The s Block Elements Trends and Reactivity of s Block Elements	Describe the appearance and physical properties of s block elements Describe the reactivity of s block elements with water and predict the products formed Predict the reaction of s block elements with oxygen, restricted to simple oxides and name the products formed Write equations for displacement reactions involving s block elements and their ions Perform flame tests of ions and identify s block ions Predict solubility of s block hydroxides and sulfates Explain the trends in physical and chemical properties down the s block group Compare physical and chemical properties of s block elements with transition metals such as iron and copper Write balanced chemical equations for all reactions involving s block elements	Learners will develop the ability to use the Periodic Table with such ease that identifying key information no longer required active thinking (ACP Realising). Learners practise the ability to analyse what is happening in one element to extrapolate and generate general descriptions (ACP Linking).

Term 1.2	1	Chemical Reactions	The Halogens Trends and Reactivity of Halogens	Describe the appearance and physical properties of halogens Explain the reactivity of halogens with metals and their ability to undergo displacement reactions Explain the reaction of metal halides with concentrated sulfuric acid and how this can be used to identify the halide ion Describe the test for halide ions using acidified silver nitrate and ammonia solution Identify trends in physical and chemical properties of halogens down the group Write balanced chemical equations for all reactions involving halogens	Learners develop the ability to be flexible and open-minded when exploring the reactivity of halogens in relation to their knowledge of the atomic structure (VAA Agile).
	2	Chemical Reactions	Transition Metals Physical and Chemical Properties Noble Gases	Identify physical properties of transition metals Describe the reactivity of transition metals with oxygen, water, and dilute acids Write balanced chemical equations for all reactions involving transition metals Explain how the physical properties of the element influence its reactivity Analyse the trends in physical and chemical properties of the element within its group and period in the periodic table Describe the physical properties of noble gases, including density, melting and boiling points, and solubility Explain the chemical behaviour of noble gases, including their inertness Identify examples of reactions that noble gases undergo, such as reactions with oxygen and fluorine, including the conditions required for these reactions Write balanced chemical equations to represent reactions of noble gases with oxygen and fluorine	Learners practise the ability to analyse what is happening in one element to extrapolate and generate general descriptions of chemical and physical changes (ACP Linking).

	3	Chemical Reactions	Reduction and Oxidation Oxidation States Writing Half-Equations Extraction of Elements	Explain the reduction and oxidation process in terms of loss/ gain of oxidation Explain the reduction and oxidation process in terms of loss/ gain of electrons Apply the rules for assigning oxidation states Write balanced ionic half-equations for redox reactions Combine ionic half-equations to write full equations showing oxidation and reduction Discuss the reactivity of reducing and oxidizing agents Describe the reduction and oxidation methods for the extraction of metals magnesium from their oxides or sulfides Explain the electrolysis methods for the extraction of metals Discuss the operating conditions, energy requirements, continuous and batch processes, atom economy, by-products, safety, and environmental considerations involved in the production methods of metals Compare the different methods of metal extraction in relation to the properties of substances Deduce uses of the extracted elements according to their properties	Learners will have the opportunity to work effectively within the rules of assigning oxidation states (ACP Analysing). Learners will be able to transfer knowledge from one known reaction to an unknown reaction when assigning oxidation states (ACP Metathinking). Learners will be able to assign oxidation states with speed and accuracy (ACP Realising).
	4	Chemical Reactions	Assessment for Learning Aim C	Investigate the physical and chemical properties of s block elements and of the halogens Explain the chemistry of s block elements and halogens in terms of oxidation number and electron transfer Compare the properties of s block elements with transition metals and halogens with noble gases Explain the use of reduction and oxidation to extract elements from compounds	Learners will have the opportunity to work effectively within the rules of assigning oxidation states (ACP Analysing). Learners will be able to transfer knowledge from one known reaction to an unknown reaction when assigning oxidation states (ACP Metathinking).

				Assess the different industrial methods of extraction of elements from their compounds and their uses	Learners will be able to assign oxidation states with speed and accuracy (ACP Realising).
	5	Quantitative Chemistry	Reacting Quantities The Mole and the Avogadro Constant Empirical and Molecular Formula Balancing Equations Calculations from Balanced Equations	Use your knowledge to define the mole and Avogadro's constant Construct an equation for the relationship between mole, mass and molar mass Discuss the relationship between mole, gas molar volume and the volume of a gas Construct an equation for the relationship between mole, concentration and volume of a solution Explain the conservation of mass during a reaction Calculate moles, mass and concentration from given data Determine the maximum amounts of a reactant needed or a product formed using chemical equations and stoichiometry	Learners will be able to break down a task, decide on a suitable approach and then use their problem solving skills to achieve a numerical answer (ACP Analysing). Learners will have the opportunity to monitor, evaluate and self-correct their work (ACP Metathinking). Learners will be able to work at speed and with accuracy to achieve maximum marks in calculation questions (ACP Realising).
	6	Quantitative Chemistry	Gravimetric and Volumetric Techniques Titrations Error Calculations	Calibrate and use weighing scales with accuracy Discuss experimental techniques to accurately transfer solids, mixing solutions, filtering, washing and drying solids Conduct an experiment to form group 2 sulfates, hydroxides and silver chloride Conduct an experiment for the oxidation of a metal, reduction of a metal oxide, and decomposition of a hydrogencarbonate or hydrated compound with precision Prepare a standard solution with precision Demonstrate the transfer of solution using a pipette and burette Conduct an acid-base neutralisation titration Justify the use of indicators based on the reaction	Learners will learn to be able to work in teams and take a variety of roles by evaluating their own ideas and contributions when working in groups for the practical (VAA Empathetic). Learners will develop their ability to train and prepare through working on past exam questions in order to become more proficient (VAA Hardworking).

				Recognise absolute, random and systematic errors Evaluate uncertainty in measurements Identify and minimise percentage error Discuss repeatability, reproducibility, precision and accuracy of measurements	
	7	Quantitative Chemistry	Assessment for Learning Aim D	Calculate moles from mass, concentration and volumes, and vice-versa Correctly prepare and dilute a standard solution for quantitative analysis Carry out a gravimetric technique to determine the mass of an analyte Carry out volumetric techniques to determine the concentration of a solution Evaluate the accuracy of the procedures used in gravimetric and volumetric analysis and suggest improvements	Learners will develop their ability to train and prepare through working on past exam questions in order to become more proficient (VAA Hardworking).