Scheme of work – AS Chemistry Topic 1 & Topic 5

Week	Prior Learning	Content of Lessons	Teaching Suggestions	Spec Ref
1 Structure of atoms and the Periodic Table	GCSE Atomic Structure and Periodic Table	Know the structure of an atom in terms of electrons, protons and neutrons Know the relative mass and relative charge of protons, neutrons and electrons know what is meant by the terms 'atomic (proton) number' and 'mass number' Be able to determine the number of each type of sub-atomic particle in an atom, molecule or ion from the atomic (proton) number and mass number Understand the term 'isotopes' Be able to define the terms 'relative isotopic mass' and 'relative atomic mass', based on the ^{12}C scale Understand the terms 'relative molecular mass' and 'relative formula mass', including calculating these values from relative atomic masses	Carry out research to produce a timeline of events in the development of our current understanding of the structure of the atom. Build a model to represent Geiger and Muller's experiment to confirm most of an atom is empty space. Annotate a Periodic Table with key information, showing how to determine numbers of sub-atomic particles 'Build an atom' simulation (http://tinyurl.com/buildanatomsim) Students play a 'spot the difference' game with cards showing all the key definitions Design a spreadsheet to calculate relative molecular mass / relative formula mass from relative atomic masses	Topic 1: 1-7

2 Mass Spectro-metry and the formation of ions Electron orbitals	GCSE Atomic Structure and Periodic Table	Be able to analyse and interpret data from mass spectrometry to calculate relative atomic mass from relative abundance of isotopes and vice versa Be able to predict the mass spectra for diatomic molecules, including chlorine Understand how mass spectrometry can be used to determine the relative molecular mass of a molecule Be able to define the terms 'first ionisation energy' and 'successive ionisation energies' Understand reasons for the general increase in first ionisation energy across a period Understand reasons for the decrease in first ionisation energy down a group Understand how ideas about electronic configuration developed from: i. the fact that atomic emission spectra provide evidence for the existence of quantum shells ii. the fact that successive ionisation energies provide evidence for the existence of quantum shells and the group to which the element belongs iii. the fact that the first ionisation energy of successive elements provides evidence for electron subshells	Plot a graph of IE across a period and / or down a group and use these to help explain the quantum model for electron configurations Plot graphs of the successive ionisation energies of a selection of atoms and use these to predict the group to which the element belongs	Topic 1: 8-19

		Know the number of electrons that can fill the first four quantum shells Know that an orbital is a region within an atom that can hold up to two electrons with opposite spins Know the shape of an *s*-orbital and a *p*-orbital Know the number of electrons that occupy s-, *p*- and *d*-subshells	Make models of s and p orbitals	
3 Electronic configu-ration and Periodicity	GCSE Periodic Table Week 2 – electronic configu-ration	Know that electrons fill subshells singly, before pairing up, and that two electrons in the same orbital must have different spins Be able to predict the electronic configurations, using 1s notation and electrons-in-boxes notation, of: i. atoms, given the atomic number, Z, up to Z=36 ii. ions, given the atomic number, Z, and the ionic charge, for *s* and *p* block ions only, up to Z=36 Know that elements can be classified as *s*, *p* and *d*-block elements Understand that electronic configuration determines the chemical properties of an element Understand periodicity in terms of a repeating pattern across different periods	Carry out a 'Whiteboard' or 'Pupil Response Unit' quiz on electronic configurations, using both '$1s^2$ etc.' and 'electrons in boxes' models (http://tinyurl.com/electronquiz) Students can self-assess using online quiz Carry out Periodic Table Card Game based on formulae of oxides of elements (www.tes.co.uk/teaching-resource/Periodic-table-card-game-differentiated-6301845/)	Topic 1: 20-25

		Understand reasons for the trends in the following properties of the elements from Periods 2 and 3 of the Periodic Table: i. the melting and boiling temperatures of the elements, based on given data, in terms of structure and bonding ii. ionisation energy based on given data or recall of the plots of ionisation energy versus atomic number Be able to illustrate periodicity using data, including electronic configurations, atomic radii, melting and boiling temperatures and first ionisation energies.	Plot melting and boiling temperatures of the elements in Periods 2 and 3. Annotate the graphs to explain trends in terms of structure. Provide students with images showing trends in Period 2 for atomic radii and ask them to predict the trend in Period 3	
4 Inorganic reactions, equations and yields	GCSE Chemical Formulae and Equations GCSE Reacting Masses	Be able to write balanced full and ionic equations, including state symbols, for chemical reactions Be able to relate ionic and full equations, with state symbols, to observations from simple test tube reactions, to include: i. displacement reactions ii. reactions of acids iii. precipitation reactions Be able to calculate percentage yields and percentage atom economies using chemical equations and experimental results *Understand risks and hazards in practical procedures and suggest appropriate precautions where necessary.	Look at a selection of solubility data for a range of salts and work as a group to propose a set of solubility rules. Use the accepted solubility rules to peer assess. Carry out a selection of displacement, precipitation and acid reactions, using mini whiteboards to write equations. Prepare a sample of a salt and compare predicted to actual yield, considering any potential loss of product e.g. copper(II) sulphate or ammonium iron(II) sulphate. (Nuffield Advanced Chemistry, 4^{th} edition, ISBN 0-582-32835-7)	Topic 5 : 6 & 14 – 16

5 Amount of substance		Know that the mole (mol) is the unit for amount of a substance Be able to use the Avogadro constant, *L*, in calculations Know that the molar mass of a substance is the mass per mole of the substance in g mol^{-1} Know what is meant by the terms 'empirical formula' and 'molecular formula' Be able to use experimental data to calculate i. empirical ii. molecular formulae including the use of $pV = nRT$ for gases and volatile liquids	Carry out experiments to determine the molar ratio in a reaction e.g. iron and sulfuric acid. (Nuffield Advanced Chemistry, 4th edition, ISBN 0-582-32835-7) View video on Mole and Avogadro as part of 'Flip Learning' preparation, then use scaffolded worksheets to check understanding (www.youtube.com/watch?v=AsqEkF7hcII) Carry out experiments to confirm the empirical formula of a compound (e.g. magnesium oxide) (http://tinyurl.com/formulaofanoxide) Carry out experiments to determine the number of water molecules in a hydrated salt (e.g. hydrated copper(II) sulphate)	Topic 5 : 1-5
6 Calculating amounts in reactions using moles	GCSE Reacting Masses and Volumes	Be able to calculate amounts of substances (in mol) in reactions involving mass and volume of gas Be able to calculate reacting masses from chemical equations, and vice versa, using the concepts of amount of substance and molar mass Be able to calculate reacting volumes of gases from chemical equations, and vice versa, using the concepts of amount of substance	Carry out experiments to investigate thermal decomposition of carbonates (e.g. 'Carbonate rocks!' – RSC) (http://tinyurl.com/carbonaterocks) Assess progress of learners using AfL sheet from RSC (www.rsc.org/education/teachers/resources/aflchem/resources/36/index.htm)	Topic 5 : 7-10

		Be able to calculate reacting volumes of gases from chemical equations, and vice versa, using the concepts of molar volume of gases ***CORE PRACTICAL 1:*** **Measure the molar volume of a gas**		
7 Calculating concen-tration and carrying out titrations	Week 6 – Calcula-ting Amounts of Substance	Be able to calculate solution concentrations, in mol dm^{-3} and g dm^{-3}, for simple acid-base titrations using a range of acids, alkalis and indicators. Be able to: i. calculate measurement uncertainties and measurement errors in experimental results ii. comment on sources of error in experimental procedures Understand how to minimise the percentage error and percentage uncertainty in experiments involving measurements ***CORE PRACTICAL 2:*** **Prepare a standard solution from a solid acid** ***CORE PRACTICAL 3:*** **Find the concentration of a solution of hydrochloric acid**	Carry of preparation of a standard solution e.g. potassium hydrogenphthalate (Advanced Practical Chemistry, ISBN 978 0 7195 7507 5) Determine the solubility of a weak base by titration with standard acid. Compare experimental value to accepted value (Nuffield Advanced Chemistry: 4th edition ISBN: 0-582-32835-7)	Topic 5 : 11-13