

Curriculum Plan

Department/subject: Chemistry Year 10

Our Vision: **We take opportunities and aspire to excellence**

Our Intent:

- All students will experience a curriculum richness, breadth and depth
- The curriculum equips every student with the knowledge and skills for the future in our local area and beyond
- The curriculum builds on prior knowledge and creates a 'web of knowledge'
- Gaps in knowledge and skills are identified and addressed quickly

Year	Autumn 1	Autumn 2
Knowledge to be taught	<p><u>Unit 1 – Foundations in Chemistry</u></p> <ul style="list-style-type: none"> • State that everything is made of atoms and recall what they are • Describe what elements and compounds are • State that elements and compounds are represented by symbols; and use chemical symbols and formulae to represent elements and compounds • Write word equations and balanced symbol equations for chemical reactions, including using appropriate state symbols • HT ONLY: Write balanced half equations and ionic equations • Describe what a mixture is • Name and describe the physical processes used to separate mixtures and suggest suitable separation techniques • Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick) • Describe the difference between the plum pudding model of the atom and the nuclear model of the atom • State the relative charge of protons, neutrons and electrons and describe the overall charge of an atom • State the relative masses of protons, neutrons and electrons and describe the distribution of mass in an atom 	<p><u>Unit 2 – Bonding Structure and Properties (cont.)</u></p> <ul style="list-style-type: none"> • Explain changes of state using particle theory and describe factors that affect the melting and boiling point of a substance • HT ONLY: Discuss the limitations of particle theory • Recall what (s), (l), (g) and (aq) mean when used in chemical equations and be able to use them appropriately • Explain how the structure of ionic compounds affects their properties, including melting and boiling points and conduction of electricity (sodium chloride structure only) • Explain how the structure of small molecules affects their properties • Explain how the structure of polymers affects their properties • Explain how the structure of giant covalent structures affects their properties • Explain how the structure of metals and alloys affects their properties, including explaining why they are good conductors • Explain why alloys are harder than pure metals in terms of the layers of atoms • Explain the properties of graphite, diamond and graphene in terms of their structure and bonding • Describe the structure of fullerenes, and their uses, including Buckminsterfullerene and carbon nanotubes

- Calculate the number of protons, neutrons and electrons in an atom when given its atomic number and mass number
- Describe isotopes as atoms of the same element with different numbers of neutrons
- Define the term relative atomic mass and why it takes into account the abundance of isotopes of the element
- Calculate the relative atomic mass of an element given the percentage abundance of its isotopes
- Describe how electrons fill energy levels in atoms, and represent the electron structure of elements using diagrams and numbers
- Recall how the elements in the periodic table are arranged
- Describe how elements with similar properties are placed in the periodic table
- Explain why elements in the same group have similar properties and how to use the periodic table to predict the reactivity of elements
- Describe the early attempts to classify elements
- Explain the creation and attributes of Mendeleev's periodic table
- Identify metals and non-metals on the periodic table, compare and contrast their properties
- Explain how the atomic structure of metals and non-metals relates to their position in the periodic table
- Describe noble gases (group 0) and explain their lack of reactivity
- Describe the properties of noble gases, including boiling points, predict trends down the group and describe how their properties depend on the outer shell of electrons
- Describe the reactivity and properties of group 1 alkali metals with reference to their electron arrangement and predict their reactions

- Chem ONLY: Compare the dimensions of nanoparticles to other particles and explain the effect of their surface area to volume ratio on their properties
- Chem ONLY: Discuss the applications of nanoparticles and their advantages and disadvantages, including uses in medicine, cosmetics, fabrics and the development of catalysts

Unit 3 – Quantitative Chemistry

- State that mass is conserved and explain why, including describing balanced equations in terms of conservation of mass
- Explain the use of the multipliers in equations in normal script before a formula and in subscript within a formula
- Describe what the relative formula mass (M_r) of a compound is and calculate the relative formula mass of a compound, given its formula
- Calculate the relative formula masses of reactants and products to prove that mass is conserved in a balanced chemical equation
- Explain observed changes of mass during chemical reactions in non-enclosed systems using the particle model when given the balanced symbol equation
- Explain why whenever a measurement is made there is always some uncertainty about the result obtained
- HT ONLY: State that chemical amounts are measured in moles (mol) and explain what a mol is with reference to relative formula mass and Avogadro's constant
- HT ONLY: Use the relative formula mass of a substance to calculate the number of moles in a given mass of the substance
- HT ONLY: Calculate the masses of reactants and products when given a balanced symbol equation
- HT ONLY: Use moles to write a balanced equation when given the masses of reactants and products (inc changing the subject of the equation)

- Describe the properties of group 7 halogens and how their properties relate to their electron arrangement, including trends in molecular mass, melting and boiling points and reactivity
- Describe the reactions of group 7 halogens with metals and non-metals
- Chem ONLY: Describe the properties of transition metals and compare them with group 1 elements, including melting points and densities, strength and hardness, and reactivity (for CR, Mn Fe, Co, Ni & Cu)

Unit 2 – Bonding

- Describe the three main types of bonds: ionic bonds, covalent bonds and metallic bonds in terms of electrostatic forces and the transfer or sharing of electrons
- Describe how the ions produced by elements in some groups have the electronic structure of a noble gas and explain how the charge of an ion relates to its group number
- Describe the structure of ionic compounds, including the electrostatic forces of attraction, and represent ionic compounds using dot and cross diagrams
- Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure
- Work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure
- Describe covalent bonds and identify different types of covalently bonded substances, such as small molecules, large molecules and substances with giant covalent structures
- Represent covalent bonds between small molecules, repeating units of polymers and parts of giant covalent structures using diagrams

- HT ONLY: Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams
- Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution
- HT ONLY: Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution
- Chem ONLY: Explain why it is not always possible to obtain the calculated or expected amount of a product
- Chem ONLY: Calculate the theoretical amount of a product and percentage yield of a product using the formula $\% \text{ yield} = \frac{\text{mass of product made}}{\text{max theoretical mass of product}} \times 100$
- Chem & HT ONLY: Calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction
- Chem ONLY: Describe atom economy as a measure of the amount of reactants that end up as useful products
- Chem ONLY: Calculate the percentage atom economy of a reaction to form a desired product using the equation $\% \text{ atom economy} = \frac{\text{RfM of desired product}}{\text{sum of RfM of all reactants}} \times 100$
- Chem & HT ONLY: Explain why a particular reaction pathway is chosen to produce a specified product, given appropriate data
- Chem & HT ONLY: Calculate the amount of solute (in moles or grams) in a solution from its concentration in mol/dm³
- Chem & HT ONLY: Calculate the concentration of a solution when it reacts completely with another solution of a known concentration
- Chem & HT ONLY: Describe how to carry out titrations of strong acids and strong alkalis and calculate quantities in titrations involving concentrations in mol/dm³ and g/dm³
- Chem & HT ONLY: Explain how the concentration of a solution in mol/dm³ is related to the mass of the solute and the volume of the solution
- Chem & HT ONLY: Explain what the volume of one mole of any gas at room temperature is

	<ul style="list-style-type: none"> ● Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane ● Deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule ● Describe the arrangement of atoms and electrons in metallic bonds and draw diagrams the bonding in metals ● Name the three States of matter, identify them from a simple model and state which changes of state happen at melting and boiling points 	<ul style="list-style-type: none"> ● Chem & HT ONLY: Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass
Keywords	<ul style="list-style-type: none"> ● Atom ● Element ● Mixture ● Compound ● Proton ● Neutron ● Electron ● Sub-atomic ● Charge 	<ul style="list-style-type: none"> ● Conservation ● Mass ● Particle ● Molecule ● Reaction ● Reactive Reactant - A substance that takes part in and undergoes change during a reaction. ● Product ● Relative ● Range ● Mean
Links to prior knowledge	KS2 Materials Topic KS3 Particle Model, Separating Materials, Elements, Periodic Table, Types of Reactions, Chemical Reactions.	KS2 Materials Topic KS3 Particle Model, Separating Materials, Elements, Periodic Table, Types of Reactions, Chemical Reactions.
How knowledge is assessed	<ul style="list-style-type: none"> ● An end of unit test will cover the main ideas in the topic. This will be marked by the teacher and a feedback lesson will go over the assessment in detail. 	<ul style="list-style-type: none"> ● An end of unit test will cover the main ideas in the topic. This will be marked by the teacher and a feedback lesson will go over the assessment in detail.

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How gaps will be addressed	<ul style="list-style-type: none"> Gaps in knowledge will be identified by any of the strategies above. Formally marked work will require a response from the student and subsequent work in lessons will link back to the areas of need. End of unit test feedback to require one lesson dedicated to addressing gaps in knowledge and exam skills 	<ul style="list-style-type: none"> Gaps in knowledge will be identified by any of the strategies above. Formally marked work will require a response from the student and subsequent work in lessons will link back to the areas of need. End of unit test feedback to require one lesson dedicated to addressing gaps in knowledge and exam skills
Cultural capital lessons	<p>Cultural: How ideas in Science are accepted by society.</p> <p>Physical: Practical techniques, health and safety, development of fine motor and dexterity skills.</p>	<p>Cultural: How ideas in Science are accepted by society.</p> <p>Physical: Practical techniques, health and safety, development of fine motor and dexterity skills.</p>