



The Sutton Academy

Knowledge Rich Curriculum Plan

SCIENCE- Chemistry Year 10

Topic: Atomic Structure and the Periodic Table

Lesson/Learning Sequence	Intended Knowledge: <i>Students will know that...</i>	Prior Knowledge: <i>In order to know this, students need to already know that...</i>	Working Scientifically	Tiered Vocabulary and Reading Activity
Lesson1: Atoms, Elements and Compounds	- Students will know that elements are made up from the same type of atom - Students will know that compounds are made by chemical reactions - Students will know that compounds contain two or more different types of atoms bonded together - Students will know that compounds can be separated into elements through chemical reactions - Students will know that chemical formulae can be used to represent elements and compounds - Students will know how to represent chemical reactions using word equations - Students will know how to represent chemical reactions using balanced symbol equations	<i>Students need to already know that all substances are made up of atoms.</i> <i>Students need to already know that different types of atoms are represented by symbols from the periodic table</i> <i>Students need to already know that word equations are used to represent chemical reactions</i> <i>Students need to know what part of a chemical reaction are reactants and which part of a chemical reaction are products</i> <i>Students need to already know how to represent chemical reactions</i>		Tier 2 Tier 3 Elements: made of the same type of atom Compounds: contain two or more different types of atom bonded together Mixtures: contain two or more different substances not bonded together
Lesson 2: Mixtures and Separating mixtures (part 1 and 2)	- Students will know that in a mixture the chemical properties of the elements and compounds are unchanged - Students need to know that a solution is a mixture of a soluble solute in a solvent - Students need to know that a solute is the substance that is dissolved in a solvent - Students need to know that a solvent is the liquid a solute is dissolved in - Students need to know that the physical processes used to separate mixtures does not produce any new products - Students need to know that a mixture of fluids can be separated using fractional distillation	<i>Students need to already know that mixtures consist of two or more different elements and/or compounds not bonded together</i> <i>Students need to already know that mixtures can be separated using physical processes</i>	Using equipment to carry out separation techniques, such as filtration, evaporation and distillation.	Tier 2 Tier 3 Solution: A mixture of soluble solute in a solvent Solute: A substance that is dissolved in a solvent Solvent: The liquid a solute is dissolved in

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	- Students need to know that fractional distillation uses different boiling points to separate mixtures - Students need to know that examples of fractional distillation include the separation of crude oil and the purification of ethanol - Students need to know that filtration can be used to separate mixtures of undissolved solids and liquids - Students need to know that an example of a mixture that can be separated using filtration is sand and water - Students need to know that crystallisation is used to separate a solution - Students need to know that an example of a mixture that can be separated using crystallisation is salt and water - Students need to know that chromatography can be used to separate a mixture of inks/ dyes Students need to know an example of a mixture that can be separated using chromatography would be ink from a pen			
Lesson 3: History of the Atom	- Students will know that new experimental data will lead to scientific models being changed or developed - Students will know that the discovery of subatomic particles in order were: electrons --> protons --> neutrons - Students will know that before electrons were discovered, atoms were thought to be tiny spheres that couldn't be divided (John Dalton's model)	<i>Students need to already know that all substances are made up of atoms</i> <i>Students need to already know that scientific ideas develop over a period of time</i>		

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	- Students will know that the discovery of the electron led to the plum pudding model. (JJ Thompson) - Students will know that the plum pudding model is the idea that an atom is a ball of positive charge with negative particles (electrons) scattered in it - Students will know that in the alpha scattering experiment alpha particles were fired at gold foil. The observations made were that most of the positively charged alpha particles went straight through the gold foil, and some alpha particles were deflected, suggesting that there was a positive charge in the centre of the atom - Students will know that the results of the alpha scattering experiment led to the conclusion that the mass of an atom is concentrated in the nucleus, and that the nucleus is charged (Ernest Rutherford) - Students will know that the model that developed from the alpha scattering model was referred to as the "nuclear model" - Students will know that Niels Bohr adapted the nuclear model, by suggesting that the electrons are orbiting the nucleus at set distances - Students will know that further experiments led to the discovery that the nucleus contained smaller particles, leading to the discovery of protons Students will know that experiments performed by James Chadwick led to the discovery of neutrons			

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Lesson 4: Atomic Structure	- Students will know that protons are found in the nucleus, that they have a relative charge of +1 and a relative mass of 1 - Students will know that neutrons are found in the nucleus, they have a relative charge of 0 and a relative mass of 1 - Students will know that electrons orbit the nucleus in shells/ energy levels, that they have a relative charge of -1 and a negligible relative mass - Students will know that 1nm is equal to 1×10^{-9} m - Students will know that the radius of an atom is very small, about 0.1 nm - Students will know that the radius of a nucleus is smaller than 1/10000th of the whole atom Students will know that atoms have a neutral charge overall	<i>Students need to already know that all substances are made up of atoms</i> <i>Students need to already know that atoms consist of three subatomic particles; protons, neutrons and electrons</i>	Estimations involving relative sizes	Tier 2 Tier 3 Proton: positive subatomic particle Neutron: neutral subatomic particle Electron: negative electron particle Subatomic: smaller than an atom
Lesson 5: Relative Atomic Mass	- Students will know that the atomic number of an atom is equivalent to the number of protons found in the nucleus - Students will know that as an atom has no overall charge, the number of positively charged protons is equal to the number of negatively charged electrons - Students will know that the relative mass number of an atom is equal to the number of protons and neutrons found in the nucleus - Students will know that to work out the number of neutrons in an atom you would subtract the number of protons from the atomic mass	<i>Students will already need to know that atoms are represented using symbols, and that these symbols are found in the periodic table</i>		Tier 2 Relative: In relation or in proportion with something else Tier 3 Isotopes: Atoms which contain the same number of protons, but different number of neutrons Relative Atomic Mass: The mass of an atom, relative

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	- Students will know that isotopes are atoms that have the same number of protons but different number of neutrons to each other - Students will know that isotopes are the reason why some elements in the periodic table do not have whole numbers for their atomic mass (e.g. chlorine) - Students will know that relative atomic mass is the average relative mass of all the atoms of that element, considering the relative abundance of each atom - Students will know that to calculate relative atomic mass they would use the equation: $RAM = [(\% \text{ abundance of isotope 1} \times \text{mass of isotope 1}) + (\% \text{ abundance of isotope 2} \times \text{mass of isotope 2}) \dots] \div 100$ - Students will know how to use a periodic table to determine the atomic number and atomic mass of an atom - Students will know how to calculate the number of subatomic particles found in an atom Students will know how to calculate the relative atomic mass of an element based on the mass and abundance of different isotopes			to $1/12^{\text{th}}$ a Carbon-12 atom
Lesson 6: Electron Configuration	- Students need to know that electrons occupy the lowest energy level (shell) possible - Students need to know that the first electron shell can hold up to 2 electrons - Students need to know that the next 2 shells can hold up to 8 electrons	<i>Students need to already know that the number of protons in an atom is the same as the atomic number</i> <i>Students need to already know that the number of electrons is the same as the number of protons</i> <i>Students need to already know that electrons are found in electron shells orbiting the nucleus</i>		Tier 2 Configuration: An arrangement of parts in a particular form, figure or combination

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	- Students need to know that the location of electrons can be referred to as either energy levels or electron shells - Students need to know that electron configurations can be represented as diagrams (circles for the energy levels, crosses or dots for the electrons) or in numeric format (e.g. for sodium it would be 2.8.1) - Students will know how to draw electronic configurations for the first 20 elements Students will know how to write electronic configurations for the first 20 elements			
Lesson 7: The Periodic Table	- Students will know that atoms are arranged in the periodic table by increasing atomic number - Students will know that the columns in a periodic table are referred to as "groups" - Students will know that elements in the same group have similar chemical properties - Students will know that the rows in a periodic table are referred to as "periods" - Students will know that elements in the same group have the same number of electrons in their outermost shell - Students will know that elements in the same period have the same number of electron shells - Students will know that chemical properties are linked to the number of electrons in the outer shell - Students will know how to predict the chemical properties of	<i>Students need to already know that the periodic table contains all of the different types of atom that exist</i>		Tier 2 <i>Property: An attribute, quality or characteristic of something</i>

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	elements by their location in the periodic table Students will know how to explain the location of an element in the periodic table based on its electrons			
Lesson 8: Development of the periodic table	- Students will know that before subatomic particles were discovered, scientists arranged elements based on their masses. - Students need to know that some elements were placed in inappropriate sections of the periodic table as some elements hadn't been discovered - Students need to know that Mendeleev left blanks in his table for elements that had yet to be discovered. - Students need to know that Mendeleev began to group elements together based on their chemical properties, which led to him swapping some elements around Students need to know that Mendeleev was able to predict the properties of elements that had yet to be discovered based on where he left the blanks in his periodic table	<i>Students need to already know that atoms are arranged by increasing atomic number in the modern periodic table</i>		Tier 2 Devise: To invent from existing principles and ideas Tier 3 Unreactive: Does not undergo chemical reactions easily
Lesson 9: Metals and non-metals	- Students will know that an ion is an atom that has a charge - Students will know that ions are formed by losing or gaining electrons - Students will know that positive ions are formed when an atom loses an electron - Students will know that metals are atoms that form positive ions - Students will know that the majority of elements in the periodic table are metals, and that these are	<i>Students need to already know that metals have properties in common (electrical and heat conductors, majority are solid at room temperature, ductile, sonorous, malleable)</i> <i>Students need to already know that substances can be grouped into two groups, "metals" and "non-metals"</i>		Tier 2 Majority : the greater number/ most of. Tier 3 Ion : An atom that has lost or gained electrons. Ductile – can be shaped as a wire

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	found on the left-hand side of the periodic table - Students will know that negative ions are formed when an atom gains an electron - Students will know that non-metals are atoms that form negative ions Students will know that non-metals can be found on the right hand side of the periodic table			<i>Malleable – can bend to a wanted shape.</i>
Lesson 10: Group 0	- Students will know that elements found in group 0 are known as the "noble gases" - Students will know that the noble gases are unreactive (chemically inert) - Students will know that the noble gases are chemically inert as they have a full outer shell of electrons - Students will know that all noble gases have 8 electrons in their outer shell, except for helium which has 2 electrons in its outer shell Students will know that the boiling point of noble gases increases as you go down the group (with increasing relative atomic mass)	<i>Students need to already know that chemical properties are related to the number of electrons in the outer shell</i>		<i>Tier 2</i> <i>Scrupulous: Careful, thorough and extremely attentive to detail</i> <i>Property: a distinctive attribute of a material or substance</i> <i>Tier 3</i> <i>Chemically Inert: Unreactive</i> <i>Octet: Eight electrons in outer shell</i> <i>Monatomic: Substance made from one atom</i>
Lesson 11: Group 1	- Students will know that elements found in group 1 of the periodic table are known as the "alkali metals" - Students will know that alkali metals are relatively soft when compared to other metals (can be	<i>Students need to already know that chemical properties are related to the number of electrons in the outer shell</i>	<i>Making accurate observations</i>	<i>Tier 2</i> <i>Density: A measure of mass per unit volume</i> <i>Relative: In relation or</i>

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	cut by a knife), and the melting points of the alkali metals are relatively low - Students will know that the alkali metals are very reactive, and this is due to the fact they have one electron in the outer shell - Students will know that the reactivity of group 1 metals increases as you go down the group - Students will know that when the alkali metals react with water they produce hydrogen gas and a metal hydroxide - Students will know that when lithium reacts with water fizzing is observed - Students will know that when sodium reacts with water it reacts violently, forming a ball and moving around the surface of the water - Students will know that when potassium reacts with water a lilac flame is observed - Students will know that at room temperature alkali metals will react with oxygen to form metal oxides - Students will know that alkali metals burn vigorously with water. - Students will know that alkali metals react vigorously with chlorine gas, and the products are chlorides - Students will know that when a group 1 metal reacts it loses its outer electron - Students will know that reactivity is linked to how easy it is for the atom to lose the outer shell electron. - Students will know that the further down the group you go, the easier			<i>proportion to something else</i> <i>Tier 3</i> <i>Alkali: A base dissolved in water. pH is above 7</i> <i>Electrostatic attraction: Attraction between a positive and negative charge</i>

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	it is to remove the electron from the outer shell. - Students will know that when we go down a group: 1) The atoms get bigger 2) The bigger the atoms the further away the electrons are from the nucleus 3) The further the electrons are from the nucleus the smaller the attraction to the nucleus 4) The smaller the attraction the easier it is for the electron to be removed Students will know how to represent the reactions of alkali metals with word and balanced symbol equations			
Lesson 12: Group 7	- Students will know that elements found in group 7 are referred to as the "halogens" - Students will know that the halogens have similar chemical properties as they all have 7 electrons in their outer shell - Students will know that halogens are non-metals, and exist as diatomic molecules (molecules made up of 2 atoms) - Students will know that the boiling points of halogens increases as you go down the group - Students will know that when halogens react they gain an electron for their outer shell - Students will know that when halogens react with metals they form compounds known as salts - Students will know that the reactivity of the halogens decreases as you go down the group - Students will know that a displacement reaction is a reaction where a more	<i>Students need to already know that chemical properties are related to the number of electrons in the outer</i>		Tier 2 Tier 3 Salt: A product formed when a metal reacts with a halogen Diatomic: Molecule made of 2 atoms Displacement: When a more reactive element takes the place of a less reactive element in a compound

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	reactive element will take the place of a less reactive element in a compound - Students will know that more reactive halogens can displace less reactive halogens in compounds. - Students will know that when halogens react with hydrogens they form hydrogen halides - Students will know that when the hydrogen halides are dissolved in water they form an acidic solution. - Students will know that as you go down the group it is harder to gain an electron, this is because: 1) The atoms get bigger 2) the outer shell gets further away from the nucleus 3) There is less attraction between the outer shell and the nucleus, so harder to attract other electrons Students will know how to represent the reactions of the halogens with word and balanced symbol equations			
Lesson: Transition Metals (TRIPLE ONLY)	- Students will know that transition metals all have similar properties - Students will know that the middle block of atoms in the periodic table are the transition metals - Students will know that compared to the group 1 metals, transition metals have higher melting points and larger densities - Students will know that transition metals can form ions with different charges Students will know that transition metals form coloured compounds, and can be used in catalysts	<i>Students need to already know that chemical properties are related to the number of electrons in the outer shell</i> <i>Students need to already know that the majority of elements in the periodic table are metals</i>		