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**Knowledge Rich Curriculum Plan**

Science – Chemistry

Year 12



| **Science** **Year 12 Chemistry**  | **Unit: Periodicity** |  |  |
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| **Lesson/Learning Sequence**  | **Intended Knowledge:***Students will know that…* | **Tiered Vocabulary**  | **Prior Knowledge:***In order to know this students, need to already know that…* |
| **Lesson:** **The Periodic Table** | * Students will know that atoms found in groups 1 and 2 are classified as being in the “s block”, as their outer electrons are found in an s orbital.
* Students will know that atoms found in groups 3 to 8 are classified as being in the “p block”, as their outer electrons are found in a p orbital.
* Students will know that the transition metals are classified as being in the “d block”, as their outer electrons are found in a d orbital.
* Students will know that the f block atoms are found in the bottom 2 rows of the periodic table.
 |  | * ***Students need to already know that a periodic table is arranged in periods (the rows) and groups (the columns)***
* ***Students need to already know that an atom’s electronic configuration is linked to its place in a periodic table.***
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| **Lesson:** **Physical Properties of Group 3** | * Students will know that as you go across Period 3, the first ionisation energy generally increases
* Students will know that there is a fall in first ionisation energies as you go from magnesium to aluminium, and this is caused due to the electron being removed from a p-orbital which has a slightly higher energy level than the s orbitals.
* Students will know that there is a fall in first ionisation energy between phosphorus and sulfur, and that this is caused due to electron repulsion as the electrons begin to pair up in the p orbital.
* Students will know that as you go across Period 3 (excluding argon) decreases. This is due to the fact that the nuclear charge increases as you go across the period.
* Students will know that as you go across Period 3 the electronegativity increases. This is due to the nuclear charge increasing.
* Students will know that sodium, magnesium and aluminium have metallic structures, and due to this they have the expected properties of a metallic structure (high melting/ boiling points, electrical conductivity, malleability)
* Students will know that silicon has a giant covalent structure, and because of this has the expected properties of a giant covalent structure (high melting, boiling points)
* Students will know that phosphorus (P4), sulfur (S8), chlorine (Cl2) and Argon have simple molecular structures.
 | Ionisation energy: the energy needed to remove one mole of electrons from one mole of atoms in their gaseous stateElectronegativity: the ability of an atom to pull electrons from a covalent bond towards it. | * ***Students need to already know that ionisation energy is the energy required to remove 1 mole of electrons from one mole of atoms in their gaseous state***
* ***Students need to already know that atomic radius is the radius of an atom, and depends on the nuclear charge and shielding.***
* ***Students need to already know that electronegativity is a measure of an atoms ability to attract a bonding pair of electrons.***
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| **Lesson:** **Group 2 – The Alkaline Earth Metals** | * Students will know that as you go down group 2 the atomic radius increases. This is due to the amount of shielding increasing, reducing the electrostatic attraction between the outer electrons and the nucleus.
* Students will know that as you go down group 2 the first ionisation energy decreases. This is due to the amount of shielding increasing (and distance between the outer electrons and the nucleus), decreasing the electrostatic attraction between the electrons and the nucleus.
* Students will know that group 2 elements have relatively high melting and boiling points due to having a metallic structure.
* Students will know that generally boiling and melting point decrease as you go down the group.
* Students will know that magnesium burns in steam to produce white magnesium oxide and hydrogen gas, as shown in the equation: Mg (s) + H2O (g) --> MgO (s) + H2 (g)
* Students will know that calcium, strontium and barium react with cold water with increasing vigour. Students will know that the products of this reaction are the metal hydroxide and hydrogen, as shown in the reaction: X (s) + 2H2O (l) --> X(OH)2 + H2
* Students will know that hydroxides become more soluble as you go down group 2. Students will know that magnesium hydroxide is sparingly soluble, whilst calcium hydroxide and barium hydroxide are soluble in water.
* Students will know that group 2 sulfates become less soluble as you go down the group. Barium sulfate is insoluble, whilst magnesium and calcium sulfate are soluble.
* Students will know that barium chloride is used as a test for sulfate ions as barium sulfate is a product, which will form as a white precipitate.
* Students will know that magnesium is used in the extraction of titanium as it can reduce titanium chloride.
* Students will know that magnesium hydroxide is used in medicine as an indigestion tablet, as it will neutralise excess stomach acid.
* Students will know that calcium hydroxide is used in agriculture to correct soil acidity.
* Students will know that calcium oxide and calcium carbonate is used in gas flues to remove sulfur dioxide.
* Students will know that barium sulfate is used as a barium meal, which allows for X-rays to be taken of intestines. Students will know that it can be used for this purpose as it is insoluble.
 |  | * ***Students need to already know that group 2 is the second column in the periodic table.***
* ***Students need to already know that atomic radius depends on nuclear charge and shielding***
* ***Students need to already know that first ionisation energy is the energy required to remove one mole of electrons from one mole of gaseous atoms.***
* ***Students need to already know that melting and boiling points is dictated by the substances structure***
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| **Lesson:** **Group 7: the Halogens - trends** | * Students will know that the atomic radius increases as you go down group 7. This is due to the fact that the shielding increases as you go down the group, decreasing the electrostatic attraction between the nucleus and the outermost electrons.
* Students will know that the electronegativity decreases as you go down the group. This is because the bonding pair gets further away from the nucleus, decreasing the electrostatic attraction between the nucleus and the bonding pair.
* Students will know that as you go down the group the melting and boiling points increase. This is due to an increase in Van der Waals forces as the molecules contain more electrons.
* Students will know that the halogens can act as oxidising agents.
* Students will know that a halogen higher in the group can oxidise the ions of one lower down.
* Students will know how to represent oxidising reactions using symbol equations.
* Students will know that halide ions can act as reducing agents.
* Students will know that the reducing ability of halide ions increases as you go down the group
* Students will know that bromide ions reduce sulfuric acid to produce sulfur dioxide (bromine is also produced)
* Students will know that iodide ions reduce sulfuric acid to produce a mixture of products, including hydrogen sulfide.
* Students will know how to represent the reactions of halide ions with sulfuric acid using equations.
* Students will know that acidified silver nitrate is used to test for halide ions
* Students will know that when acidified silver nitrate is used as the nitric acid will remove other ions that might also give a precipitate with the silver nitrate.
* Students will know that when acidified silver nitrate is added to a solution of halide ions, the following results are seen: F- : no precipitate, Cl- : white precipitate, Br- : cream precipitate, I- : yellow precipitate.
* Students will know how to represent these tests using ionic equations
* Students will know that the precipitate formed can be confirmed using ammonia solution. The silver chloride precipitate will dissolve to give a colourless solution, The silvery bromide precipitate will be unchanged when dilute ammonia solution is added, but dissolves in concentrated ammonia solution, whilst the silver iodide precipitate is insoluble in ammonia.
 |  | * ***Students need to already know that group 7 is the 7th column in the periodic table***
* ***Students need to already know that group 7 elements are referred to as the halogens***
* ***Students need to already know that the halogens are diatomic***
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| **Lesson:** **Chlorine and chlorate** | * Students will know that chlorine reacts with water to form chloride ions and chlorate ions.
* Students will know that chlorate ions are ClO3 -
* Students will know that chlorine can also produce chloride ions and oxygen when it reacts with water
* Students will know how to evaluate the use of chlorine to treat water.
* Students will know that chlorine reacts with cold dilute aqueous sodium hydroxide to form sodium chloride, sodium chlorate and water.
* Students will know that sodium chlorate is used as bleach.
 |  | * ***Students need to already know that chlorine is used to treat water***
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| **Lesson:** **Required Practical 4** | * Students will know that ammonium ions are tested by adding sodium hydroxide and warming gently. The gas that is produced is tested with damp red litmus paper, which turns blue due to the production of ammonia.
* Students will know that carbonate ions are tested for through using dilute acid. Effervescence is observed due to the production of carbon dioxide, which can be further tested for by using limewater (which turns cloudy)
* Students will know that sulfate ions are tested for by adding barium chloride to a solution of the sample. If sulfate ions are present a white precipitate is observed.
* Students will know that hydroxide ions are tested for by adding magnesium chloride solution to a solution of the sample. If hydroxide ions are present a white precipitate is observed.
* Students will know how to carry out the above tests.
* Students will know how to represent the tests using ionic equations.
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