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| **Topic 3 – Bonding & Properties Personal Learning Plan** |
| **Required Prior knowledge** |
| **No** | **Outcome** | **Success Criteria** | ☹ | 😐 | ☺ |
| **1** | I can explain what an element is and can identify it from its symbol. | An element is made up of only 1 **type** of atom and every element has a symbol which is either a single capital letter or a capital letter followed by a lower case letter. |  |  |  |
| **2** | I can explain what a period and a group are in the periodic table | A group is a column in the periodic table where all the elements have similar chemical properties that gradually change as you move through the group. A period is a row in the periodic table, there are various trends as you go across a period like the size of the atom. |  |  |  |
| **3** | I can name groups 1, 7, 8 of the periodic table and the name of the middle block. | Group 1 = Alkali metals, group 7 = halogens, group 8 = noble gases, middle block = transition metals |  |  |  |
| **4** | I can give some of the properties and uses of groups 1, 7, 8 and the middle block elements | **Group 1** - all stored under oil. Very reactive metals getting more reactive as you go down the group. All react with water to produce hydrogen gas and an alkali. **Group 7** - very reactive non-metals getting more reactive as you go up the group. Similar smell, gradual change in colour, increasing m.p. going down the group. **Group 8** - very unreactive gases. **Transition metals** - typical properties of everyday metals (shiny, strong, high melting and boiling points, malleable, ductile etc). |  |  |  |
| **5** | I can recall the names of the three sub-atomic particles in an atom. | Protons, neutrons and electrons |  |  |  |
| **6** | I can give the mass, charge and location of the three sub-atomic particles | **Proton:** mass 1 amu, positive charge, found in the central nucleus. **Electron**: mass ~0 amu, negative charge, found orbiting the nucleus. **Neutron:** mass 1 amu, no charge, found in the central nucleus. |  |  |  |
| **7** | I can identify the mass number and atomic number from an element symbol | Mass number is usually written in the top left hand corner of the element symbol. Atomic number in the bottom left hand corner of the element symbol. |  |  |  |
| **8** | I can calculate the number of each type of sub-atomic particles in an atom from the mass number and atomic number | The atomic number = the number of protons. The mass number is the number of protons + neutrons as they are the only subatomic particles with mass. Therefore, by doing the mass number take away the atomic number, the number of neutrons can be worked out. As an atom is overall neutral, the number of electrons must equal the number of protons. |  |  |  |
| **9** | I can state and draw the electron arrangement for a given element. | Electrons are arranged in 'shells' which are like concentric rings around the nucleus. A maximum of 2 electrons can go into the first shell, then a maximum of 8 electrons in subsequent shells. A shell must be full before electrons can be added to new shells. The electron arrangement shows the number of shells and the number of electrons in each shell. It is written in square brackets with commas separating each shell. E.g. [2,8,1] is the electron arrangement for sodium. |  |  |  |
| **10** | I know what the group number and period number mean in terms of electron arrangement. | The group number tells you the number of electrons in the outermost shell. The period number tells you the number of shells. |  |  |  |
| **11** | I can explain how ions are formed | An atom is neutral because the number of positive protons and negative electrons are equal and so balance out. If the number of electrons surrounding the nucleus changes, the balance is upset. If an atom gains or loses electrons it becomes charged and is called an ion. There are two possible outcomes:Gain electrons = negative ionLose electrons = positive ion |  |  |  |
| **12** | I can work out the number of each sub-atomic particle present in an ion from its symbol, atomic number and mass number  | Ions are represented in the same way as atoms with a symbol, mass number and atomic number. To show that they are charged, either a positive or negative sign is shown at the top right of the symbol e.g. Na+.If an atom gains/loses more than one electron a bigger charge is produced. The size of the charge is represented by a number e.g. Ca2+. The number shows the difference between the electrons and protons. |  |  |  |

**Practice Questions**

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| **Learning Intention**We are learning about chemical bonds |
| No. | **Outcome** | **What you know and understand** | ☹ | 😐 | ☺ |
| 1 | I can state the names of the 3 different bonding types that chemicals could have and which types of elements they typically contain. |  |  |  |  |
| 2 | I can explain why atoms would bond to each other |  |  |  |  |
| 3 | I can draw Lewis structures for elements | e.g. sodium e.g. phosphoruse.g. oxygen e.g. aluminium  |  |  |  |

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| **Learning Intention**We are learning about ionic bonds and the structures of ionic compounds |
| No. | **Outcome** | **What you know and understand** | ☹ | 😐 | ☺ |
| 4 | I can explain, using Lewis structures, how elements form an ionic compound. |  |  |  |  |
| 5 | I can explain how an ionic bond holds substances together. |  |  |  |  |
| 6 | I can predict the charge of an element’s ion from its group number |  |  |  |  |
| 7 | I can relate the charge of an ion to its valency |  |  |  |  |
| 8 | I can describe the structure of an ionic compound and recognise a diagram of that structure |  |  |  |  |
| 9 | I can describe the general properties of ionic compounds. |  |  |  |  |
| 10 | I can explain the general properties of ionic compounds. |  |  |  |  |
| 11 | I can write the ionic formula for an ionic compound | e.g. sodium nitridee.g. magnesium sulphidee.g. aluminium oxide |  |  |  |
| 12 | I can write the formula for compounds involving transition metals. |  |  |  |  |
| 13 | I know the name and formula for polyatomic ions | NH4+ phosphateOH-, nitrateSO42-  carbonate |  |  |  |
| 14 | I can write the formula for compounds involving polyatomic ions | e.g. ammonium carbonatee.g. iron (III) hydroxidee.g. calcium sulfate |  |  |  |

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| **Learning Intention**We are learning about metals and understanding their properties |
| No. | **Outcome** | **What you know and understand** | ☹ | 😐 | ☺ |
| 15 | I can explain how metal elements are held together. |  |  |  |  |
| 16 | I can explain the high melting points of metals and why they conduct electricity as solids and liquids.  |  |  |  |  |
| 17 | I can explain what an alloy is and why they are useful |  |  |  |  |

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| **Learning Intention**We are learning about covalent bonds and the structures of covalent elements and compounds |
| No. | **Outcome** | **What you know and understand** | ☹ | 😐 | ☺ |
| 18 | I can explain what a covalent bond is and how it holds two atoms together |  |  |  |  |
| 19 | I can state what a molecule is |  |  |  |  |
| 20 | I can draw Lewis structures for covalent substances | e.g. oxygen e.g. C2H6e.g. nitrogen Image result for propanone  e.g. e.g watere.g. carbon + hydrogen |  |  |  |
| 21 | I can state and explain the relationship between covalent bond length and its strength |  |  |  |  |
| 22 | I can state and explain the relationship between single, double and triple bonds and their strength |  |  |  |  |
| 23 | I can work out the chemical formula or the name for a compound when its name contains the prefixes mono-, di-, tri-, tetra-, penta-, hexa-, hepta-, octa-, nona- and deca-, | e.g. dinitrogen tetroxidee.g. phosphorus pentoxidee.g. SF6 |  |  |  |
| 24 | I can explain what a chemical formula shows about a molecule |  |  |  |  |
| 25 | I can explain what VSEPR theory is  |  |  |  |  |
| 26 | I can describe and draw the 3D shapes of molecules containing different numbers of atoms and state the bond angles | e.g. H2 e.g. CO2e.g. H2O e.g NH3e.g. CH4 e.g. SF6e.g. NH4+  e.g. BH3 |  |  |  |
| 27 | I can draw resonance structures for relevant structures  | e.g. CO32- e.g. C6H6e.g. O3 e.g. SO42- |  |  |  |
| 28 | I can state what a covalent network is and give some examples of them |  |  |  |  |
| 29 | I can explain what the chemical formula of a covalent network shows |  |  |  |  |
| 30 | I can explain the properties of covalent networks including the one that is the exception |  |  |  |  |

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| **Learning Intention**We are learning to understand the properties of covalent molecules |
| No. | **Outcome** | **What you know and understand** | ☹ | 😐 | ☺ |
| 31 | I can explain the electrical conductivity of covalent substances |  |  |  |  |
| 32 | I can explain how a polar covalent bond forms |  |  |  |  |
| 33 | I can explain what a polar molecule is and how it arises. |  |  |  |  |
| 34 | I can describe a simple test for a polar molecule |  |  |  |  |
|   35 | I can explain how hydrogen bonding occurs |  |  |  |  |
| 36 | I can explain how non-polar substances bond |  |  |  |  |
| 37 | I can explain melting/boiling points and viscosity of chemicals through their bonding |  |  |  |  |
| 38 | I can explain the how molecular size and shape affects boiling point/viscosity | e.g. compare F2 to I2e.g. compare CH4 with C8H18Image result for methylpropaneImage result for butanee.g. compared to |  |  |  |

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| **Learning Intention**We are learning about the effect of bonding on solubility of substances |
| Level | **Outcome** | **What you know and understand** | ☹ | 😐 | ☺ |
| 39 | I know the meaning of the words: *soluble, insoluble, solute, solvent and solution* |  |  |  |  |
| 40 | I can describe the solubility of covalent substances in water |  |  |  |  |
| 41 | I can explain what happens when an ionic substance dissolves |  |  |  |  |
| 42 | I can describe the solubility of ionic substances in water |  |  |  |  |
| 43 | I can explain the general rule of solubility for “like dissolves like” |  |  |  |  |
| 44 | I can describe the solubility of metallic substances in water |  |  |  |  |
| 45 | I can name acids and know what ion they form when dissolved in water | e.g. HCle.g. H2SO4e.g. H2SO3 |  |  |  |

**Key Words from Topic 3 Bonding & Properties**

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| **Key Word or Phrase** | **Meaning** |
| cation |  |
| anion |  |
| Molecule |  |
| Covalent bond |  |
| Covalent network |  |
| Valency |  |
| Molecular formula |  |
| Polyatomic ion |  |
| Ionic bond |  |
| Formula unit/ionic formula |  |
| Metallic bonding |  |
| Oxidation number/state |  |
| Delocalised electrons  |  |
| Octet rule |  |
| Diatomic molecule |  |
| Covalent naming prefixes |  |
| Lewis structure |  |
| allotrope |  |
| VSEPR theory |  |
| Electron domain |  |
| Resonance structures |  |
| Polar bond |  |
| viscosity |  |
| London Dispersion forces |  |
| Temporary dipole |  |
| Induced dipole |  |
| Dipole-dipole interactions |  |
| Hydrogen bonding |  |

**Practice Past IB Paper Questions**

**1**



**2**



**3**



**4**



**5**



**6**



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