

# Combined Science - Chemistry Paper 1 Foundation Tier Personal Learning Checklist (PLC)

## C1 Atomic Structure and the Periodic Table

| <b>Learning Objectives:</b>  | <b>Confidence</b> |          |          |
|--|-------------------|----------|----------|
|  | <b>R</b>          | <b>A</b> | <b>G</b> |
| 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   |                   |          |          |
| 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  |                   |          |          |
| 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   |                   |          |          |
| 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 |                   |          |          |

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| Describe the reactions of group 7 halogens with metals and non-metals |  |  |  |
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## C2 Bonding

| Learning Objectives:   | Confidence |   |   |
|--|------------|---|---|
|  | R          | A | G |
| 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  |            |   |   |
| 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                                     |            |   |   |
| Explain changes of state using particle theory and describe factors that affect the melting and boiling point of a substance   |            |   |   |
| 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  |            |   |   |

## C3 Quantitative Chemistry

| Learning Objectives:   | Confidence |   |   |
|--|------------|---|---|
|  | R          | A | G |
| 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    |            |   |   |

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| Describe what the relative formula mass (Mr) 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   |  |  |  |
| Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution                     |  |  |  |

## C4 Chemical Changes

| <b>Learning Objectives:</b>  | <b>Confidence</b> |          |          |
|--|-------------------|----------|----------|
|  | <b>R</b>          | <b>A</b> | <b>G</b> |
| Describe how metals react with oxygen and state the compound they form, define oxidation and reduction   |                   |          |          |
| Describe the arrangement of metals in the reactivity series, including carbon and hydrogen, and use the reactivity series to predict the outcome of displacement reactions   |                   |          |          |
| Recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids   |                   |          |          |
| Relate the reactivity of metals to its tendency to form positive ions and be able to deduce an order of reactivity of metals based on experimental results   |                   |          |          |
| Recall what native metals are and explain how metals can be extracted from the compounds in which they are found in nature by reduction with carbon  |                   |          |          |
| Evaluate specific metal extraction processes when given appropriate information and identify which species are oxidised or reduced   |                   |          |          |
| Explain that acids can be neutralised by alkalis, bases and metal carbonates and list the products of each of these reactions  |                   |          |          |
| Predict the salt produced in a neutralisation reaction based on the acid used and the positive ions in the base, alkali or carbonate and use the formulae of common ions to deduce the formulae of the salt                          |                   |          |          |
| Describe how soluble salts can be made from acids and how pure, dry samples of salts can be obtained   |                   |          |          |
| <i><b>Required practical 1:</b> preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution</i> |                   |          |          |
| Recall what the pH scale measures and describe the scale used to identify acidic, neutral or alkaline solutions  |                   |          |          |
| Define the terms acid and alkali in terms of production of hydrogen ions or hydroxide ions (in solution), define the term base   |                   |          |          |
| Describe the use of universal indicator to measure the approximate pH of a solution and use the pH scale to identify acidic or alkaline solutions  |                   |          |          |
| Describe how ionic compounds can conduct electricity when dissolved in water and describe these solutions as electrolytes  |                   |          |          |
| Describe the process of electrolysis   |                   |          |          |
| Describe the electrolysis of molten ionic compounds and predict the products at each electrode of the electrolysis of binary ionic compounds   |                   |          |          |
| Explain how metals are extracted from molten compounds using electrolysis and use the reactivity series to explain why some metals are extracted with electrolysis instead of carbon   |                   |          |          |
| Describe the electrolysis of aqueous solutions and predict the products of the electrolysis of aqueous solutions containing single ionic compounds   |                   |          |          |
| <i><b>Required practical 3:</b> investigate what happens when aqueous solutions are electrolysed using inert electrodes</i>  |                   |          |          |

# C5 Energy Changes

| Learning Objectives:   | Confidence |   |   |
|--|------------|---|---|
|  | R          | A | G |
| Describe how energy is transferred to or from the surroundings during a chemical reaction  |            |   |   |
| Explain exothermic and endothermic reactions on the basis of the temperature change of the surroundings and give examples of everyday uses   |            |   |   |
| <b>Required practical 4:</b> <i>investigate the variables that affect temperature changes in reacting solutions</i>  |            |   |   |
| Describe what the collision theory is and define the term activation energy  |            |   |   |
| Interpret and draw reaction profiles of exothermic and endothermic reactions, inc identifying the relative energies of reactants and products, activation energy and overall energy change |            |   |   |