NAME

****SUBJECT KNOWLEDGE AUDIT SECONDARY XXXXXXX

Throughout the training year you are required to take personal responsibility for renewing and updating your subject knowledge, identifying areas for development, setting personal targets and addressing any areas of weakness. This process commences now, before the course starts, and will continue throughout.

RAG Rate your confidence in each area with a grade. **RED (High) Green (Low)** Highlight the statements which you believe require development

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Teachers should understand:** | Pre-Interview | Pre- programme | Assessment Point 1 | Assessment Point 2 | Assessment Point 3 | Assessment Point 4 |
|  | C1.1 THE PARTICLE MODEL |  |  |  |  |  |  |
| 1.1a | Describe the main features of the particle model in terms of states of matter and change of state. |  |  |  |  |  |  |
| 1.1b | Explain in terms of the particle model the distinction between physical changes and chemical changes. |  |  |  |  |  |  |
| **1.1c** | **Explain the limitations of the particle model in relation to changes of state when particles are represented by inelastic spheres (e.g. like bowling balls).** |  |  |  |  |  |  |
|  | C1.2 ATOMIC STRUCTURE |  |  |  |  |  |  |
| 1.2a | Describe how and why the atomic model has changed over time. |  |  |  |  |  |  |
| 1.2b | Describe the atom as a positively charged nucleus surrounded by negatively charged electrons, with the nuclear radius much smaller than that of the atom and with most of the mass in the nucleus. |  |  |  |  |  |  |
| 1.2c | Recall the typical size (order of magnitude) of atoms and small molecules. |  |  |  |  |  |  |
| 1.2d | Recall relative charges and approximate relative masses of protons, neutrons and electrons. |  |  |  |  |  |  |
| 1.2e | Calculate numbers of protons, neutrons and electrons in atoms and ions, given atomic number and mass number of isotopes. |  |  |  |  |  |  |
|  | Explain the mechanism of enzyme action. |  |  |  |  |  |  |
|  | C2.1 PURITY & SEPARATING MIXTURES |  |  |  |  |  |  |
| 2.1a | Explain what is meant by the purity of a substance, distinguishing between the scientific and everyday use of the term ‘pure’. |  |  |  |  |  |  |
| 2.1b | Use melting point data to distinguish pure from impure substances. |  |  |  |  |  |  |
| 2.1c | Calculate relative formula masses of species separately and in a balanced chemical equation. |  |  |  |  |  |  |
| 2.1d | Deduce the empirical formula of a compound from the relative numbers of atoms present or from a model or diagram and vice versa. |  |  |  |  |  |  |
| 2.1e | Explain that many useful materials are formulations of mixtures. |  |  |  |  |  |  |
| 2.1f | Describe, explain and exemplify the processes of filtration, crystallisation, simple distillation, and fractional distillation. |  |  |  |  |  |  |
| 2.1g | Describe the techniques of paper and thin layer chromatography. |  |  |  |  |  |  |
| 2.1h | Recall that chromatography involves a stationary and a mobile phase and that separation depends on the distribution between the phases. |  |  |  |  |  |  |
| 2.1i | Interpret chromatograms, including measuring R**f** values. |  |  |  |  |  |  |
| 2.1j | Suggest suitable purification techniques given information about the substances involved. |  |  |  |  |  |  |
| 2.1k | Suggest chromatographic methods for distinguishing pure from impure substances. |  |  |  |  |  |  |
|  | C2.2 BONDING |  |  |  |  |  |  |
| 2.2a | Describe metals and non-metals and explain the differences between them on the basis of their characteristic physical and chemical properties. |  |  |  |  |  |  |
| 2.2b | Explain how the atomic structure of metals and non-metals relates to their position in the Periodic Table. |  |  |  |  |  |  |
| 2.2c | Explain how the position of an element in the Periodic Table is related to the arrangement of electrons in its atoms and hence to its atomic number. |  |  |  |  |  |  |
| 2.2d | Describe and compare the nature and arrangement of chemical bonds in:  i. ionic compounds ii. simple molecules iii. giant covalent structures iv. polymers v. metals. |  |  |  |  |  |  |
| 2.2e | Explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons. |  |  |  |  |  |  |
| 2.2f | Construct dot and cross diagrams for simple covalent and binary ionic substances. |  |  |  |  |  |  |
| 2.2g | Describe the limitations of particular representations and models. |  |  |  |  |  |  |
| 2.2h | Explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number. |  |  |  |  |  |  |
| 2.2i | Explain in terms of atomic number how Mendeleev’s arrangement was refined into the modern Periodic Table. |  |  |  |  |  |  |
|  | C2.3 PROPERTIS OF MATERIALS |  |  |  |  |  |  |
| 2.3a | Recall that carbon can form four covalent bonds. |  |  |  |  |  |  |
| 2.3b | Explain that the vast array of natural and synthetic organic compounds occur due to the ability of carbon to form families of similar compounds, chains and rings. |  |  |  |  |  |  |
| 2.3c | Explain the properties of diamond, graphite, fullerenes and graphene in terms of their structures and bonding. |  |  |  |  |  |  |
| 2.3d | Use ideas about energy transfers and the relative strength of chemical bonds and intermolecular forces to explain the different temperatures at which changes of state occur. |  |  |  |  |  |  |
| 2.3e | Use data to predict states of substances under given conditions. |  |  |  |  |  |  |
| 2.3f | Explain how the bulk properties of materials (ionic compounds; simple molecules; giant covalent structures; polymers and metals) are related to the different types of bonds they contain, their bond strengths in relation to intermolecular forces and the ways in which their bonds are arranged. |  |  |  |  |  |  |
| C3 | Explain how the structure of the xylem and phloem are adapted to their functions in the plant. |  |  |  |  |  |  |
|  | C3.1 INTRODUCING CHEMICAL REACTIONS |  |  |  |  |  |  |
| 3.1a | Use chemical symbols to write the formulae of elements and simple covalent and ionic compounds. |  |  |  |  |  |  |
| 3.1b | Use the names and symbols of common elements and compounds and the principle of conservation of mass to write formulae and balanced chemical equations **and half equations**. |  |  |  |  |  |  |
| 3.1c | Use the names and symbols of common elements from a supplied Periodic Table to write formulae and balanced chemical equations where appropriate. |  |  |  |  |  |  |
| 3.1d | Use the formula of common ions to deduce the formula of a compound. |  |  |  |  |  |  |
| **3.1e** | **Construct balanced ionic equations.** |  |  |  |  |  |  |
| 3.1f | Describe the physical states of products and reactants using state symbols (s, l, g and aq). |  |  |  |  |  |  |
| 3.1g | Describe tests to identify selected gases. |  |  |  |  |  |  |
| **3.1h** | **Recall and use the definitions of the Avogadro constant (in standard form) and of the mole.** |  |  |  |  |  |  |
| **3.1i** | **Explain how the mass of a given substance is related to the amount of that substance in moles and vice versa.** |  |  |  |  |  |  |
| **3.1j** | **Explain how the mass of a solute and the volume of the solution is related to the concentration of the solution.** |  |  |  |  |  |  |
| 3.1k | Recall and use the law of conservation of mass. |  |  |  |  |  |  |
| 3.1l | Explain any observed changes in mass in nonenclosed systems during a chemical reaction and explain them using the particle model. |  |  |  |  |  |  |
| **3.1m** | **Deduce the stoichiometry of an equation from the masses of reactants and products and explain the effect of a limiting quantity of a reactant.** |  |  |  |  |  |  |
| **3.1n** | **Use a balanced equation to calculate masses of reactants or products.** |  |  |  |  |  |  |
|  | C3.2 ENERGETICS |  |  |  |  |  |  |
| 3.2a | Distinguish between endothermic and exothermic reactions on the basis of the temperature change of the surroundings. |  |  |  |  |  |  |
| 3.2b | Draw and label a reaction profile for an exothermic and an endothermic reaction. |  |  |  |  |  |  |
| 3.2c | Explain activation energy as the energy needed for a reaction to occur. |  |  |  |  |  |  |
| **3.2d** | **Calculate energy changes in a chemical reaction by considering bond making and bond breaking energies.** |  |  |  |  |  |  |
|  | C3.3 TYPES OF CHEMICAL REACTIONS |  |  |  |  |  |  |
| 3.3a | Explain reduction and oxidation in terms of loss or gain of oxygen, identifying which species are oxidised and which are reduced. |  |  |  |  |  |  |
| **3.3b** | **Explain reduction and oxidation in terms of gain or loss of electrons, identifying which species are oxidised and which are reduced.** |  |  |  |  |  |  |
| 3.3c | Recall that acids form hydrogen ions when they dissolve in water and solutions of alkalis contain hydroxide ions. |  |  |  |  |  |  |
| 3.3d | Describe neutralisation as acid reacting with alkali or a base to form a salt plus water. |  |  |  |  |  |  |
| 3.3e | Recognise that aqueous neutralisation reactions can be generalised to hydrogen ions reacting with hydroxide ions to form water. |  |  |  |  |  |  |
| 3.3f | Recall that carbonates and some metals react with acids and write balanced equations predicting products from given reactants. |  |  |  |  |  |  |
| **3.3g** | **Use and explain the terms dilute and concentrated (amount of substance) and weak and strong (degree of ionisation) in relation to acids.** |  |  |  |  |  |  |
| 3.3h | Recall that relative acidity and alkalinity are measured by pH. |  |  |  |  |  |  |
| **3.3i** | **Describe neutrality and relative acidity and alkalinity in terms of the effect of the concentration of hydrogen ions on the numerical value of pH (whole numbers only).** |  |  |  |  |  |  |
| **3.3j** | **Recall that as hydrogen ion concentration increases by a factor of ten the pH value of a solution decreases by a factor of one.** |  |  |  |  |  |  |
| 3.3k | Describe techniques and apparatus used to measure pH. |  |  |  |  |  |  |
|  | C3.4 ELECTROLYSIS |  |  |  |  |  |  |
| 3.4a | Recall that metals (or hydrogen) are formed at the cathode and non-metals are formed at the anode in electrolysis using inert electrodes. |  |  |  |  |  |  |
| 3.4b | Predict the products of electrolysis of binary ionic compounds in the molten state. |  |  |  |  |  |  |
| 3.4c | Describe competing reactions in the electrolysis of aqueous solutions of ionic compounds in terms of the different species present. |  |  |  |  |  |  |
| 3.4d | Describe electrolysis in terms of the ions present and reactions at the electrodes. |  |  |  |  |  |  |
| 3.4e | Describe the technique of electrolysis using inert and non-inert electrodes. |  |  |  |  |  |  |
| C4 | Explain how abiotic and biotic factors can affect communities. |  |  |  |  |  |  |
|  | C4.1 PREDICTING CHEMICAL REACTIONS |  |  |  |  |  |  |
| 4.1a | Recall the simple properties of Groups 1, 7 and 0. |  |  |  |  |  |  |
| 4.1b | Explain how observed simple properties of Groups 1, 7 and 0 depend on the outer shell of electrons of the atoms and predict properties from given trends down the groups. |  |  |  |  |  |  |
| 4.1c | Predict possible reactions and probable reactivity of elements from their positions in the Periodic Table. |  |  |  |  |  |  |
| 4.1d | Explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion. |  |  |  |  |  |  |
| 4.1e | Deduce an order of reactivity of metals based on experimental results. |  |  |  |  |  |  |
| C5 | Describe the genome as the entire genetic material of an organism. |  |  |  |  |  |  |
|  | C5.1 CONTROLLING REACTIONS |  |  |  |  |  |  |
| 5.1a | Suggest practical methods for determining the rate of a given reaction. |  |  |  |  |  |  |
| 5.1b | Interpret rate of reaction graphs. |  |  |  |  |  |  |
| 5.1c | Describe the effect of changes in temperature, concentration, pressure, and surface area on rate of reaction. |  |  |  |  |  |  |
| 5.1d | Explain the effects on rates of reaction of changes in temperature, concentration and pressure in terms of frequency and energy of collision between particles. |  |  |  |  |  |  |
| 5.1e | Explain the effects on rates of reaction of changes in the size of the pieces of a reacting solid in terms of surface area to volume ratio. |  |  |  |  |  |  |
| 5.1f | Describe the characteristics of catalysts and their effect on rates of reaction. |  |  |  |  |  |  |
| 5.1g | Identify catalysts in reactions. |  |  |  |  |  |  |
| 5.1h | Explain catalytic action in terms of activation energy. |  |  |  |  |  |  |
| 5.1i | Recall that enzymes act as catalysts in biological systems. |  |  |  |  |  |  |
|  | 5.2 EQUILIBRIA |  |  |  |  |  |  |
| 5.2a | Recall that some reactions may be reversed by altering the reaction conditions. |  |  |  |  |  |  |
| 5.2b | Recall that dynamic equilibrium occurs in a closed system when the rates of forward and reverse reactions are equal. |  |  |  |  |  |  |
| **5.2c** | **Predict the effect of changing reaction conditions on equilibrium position and suggest appropriate conditions to produce as much of a particular product as possible.** |  |  |  |  |  |  |
| C6 | Explain how evolution occurs through the natural selection of variants that have given rise to phenotypes best suited to their environment. |  |  |  |  |  |  |
|  | 6.1 IMPROVING PROCESSES & PRODUCTS |  |  |  |  |  |  |
| 6.1a | Explain, using the position of carbon in the reactivity series, the principles of industrial processes used to extract metals, including extraction of a non-ferrous metal. |  |  |  |  |  |  |
| 6.1b | Explain why and how electrolysis is used to extract some metals from their ores. |  |  |  |  |  |  |
| **6.1c** | **Evaluate alternative biological methods of metal extraction.** |  |  |  |  |  |  |
| 6.1d | Describe the basic principles in carrying out a life-cycle assessment of a material or product. |  |  |  |  |  |  |
| 6.1e | Interpret data from a life-cycle assessment of a material or product. |  |  |  |  |  |  |
| 6.1f | Describe a process where a material or product is recycled for a different use, and explain why this is viable. |  |  |  |  |  |  |
| 6.1g | Evaluate factors that affect decisions on recycling. |  |  |  |  |  |  |
| 6.1h | Describe the separation of crude oil by fractional distillation. |  |  |  |  |  |  |
| 6.1i | Explain the separation of crude oil by fractional distillation. |  |  |  |  |  |  |
| 6.1j | Describe the fractions as largely a mixture of compounds of formula C**n**H**2n+2** which are members of the alkane homologous series. |  |  |  |  |  |  |
| 6.1k | Recall that crude oil is a main source of hydrocarbons and is a feedstock for the petrochemical industry. |  |  |  |  |  |  |
| 6.1l | Explain how modern life is crucially dependent upon hydrocarbons and recognise that crude oil is a finite resource. |  |  |  |  |  |  |
| 6.1m | Describe the production of materials that are more useful by cracking. |  |  |  |  |  |  |
|  | C6.2 INTERPRETING & INTERACTING WITH EARTH SYSTEMS |  |  |  |  |  |  |
| 6.2a | Interpret evidence for how it is thought the atmosphere was originally formed. |  |  |  |  |  |  |
| 6.2b | Describe how it is thought an oxygen-rich atmosphere developed over time. |  |  |  |  |  |  |
| 6.2c | Describe the greenhouse effect in terms of the interaction of radiation with matter within the atmosphere. |  |  |  |  |  |  |
| 6.2d | Evaluate the evidence for additional anthropogenic (human activity) causes of climate change and describe the uncertainties in the evidence base. |  |  |  |  |  |  |
| 6.2e | Describe the potential effects of increased levels of carbon dioxide and methane on the Earth’s climate and how these effects may be mitigated. |  |  |  |  |  |  |
| 6.2f | Describe the major sources of carbon monoxide, sulfur dioxide, oxides of nitrogen and particulates in the atmosphere and explain the problems caused by increased amounts of these substances. |  |  |  |  |  |  |
| 6.2g | Describe the principal methods for increasing the availability of potable water in terms of the separation techniques used. |  |  |  |  |  |  |
| 6.3f | Describe a minimum of one common human infection, one plant disease and sexually transmitted infections in humans including HIV/AIDS. |  |  |  |  |  |  |
| 6.3g | Describe physical plant defence responses to disease. |  |  |  |  |  |  |
| 6.3h | Describe chemical plant defence responses. |  |  |  |  |  |  |
| **6.3i** | **Describe different ways plant diseases can be detected and identified, in the lab and in the field.** |  |  |  |  |  |  |
| 6.3j | Explain how white blood cells and platelets are adapted to their defence functions in the blood. |  |  |  |  |  |  |
| 6.3k | Describe the non-specific defence systems of the human body against pathogens. |  |  |  |  |  |  |
| 6.3l | Explain the role of the immune system of the human body in defence against disease. |  |  |  |  |  |  |
| **6.3m** | **Describe how monoclonal antibodies are produced.** |  |  |  |  |  |  |
| **6.3n** | **Describe some of the ways in which monoclonal antibodies can be used.** |  |  |  |  |  |  |
| 6.3o | Explain the use of vaccines and medicines in the prevention and treatment of disease. |  |  |  |  |  |  |
| 6.3p | Explain the aseptic techniques used in culturing organisms. |  |  |  |  |  |  |
| 6.3q | Describe the processes of discovery and development of potential new medicines. |  |  |  |  |  |  |
| 6.3r | Recall that many non-communicable human diseases are caused by the interaction of a number of factors. |  |  |  |  |  |  |
| 6.3s | Evaluate some different treatments for cardiovascular disease. |  |  |  |  |  |  |
| 6.3t | Analyse the effect of lifestyle factors on the incidence of non-communicable diseases at local, national and global levels. |  |  |  |  |  |  |
| 6.3u | Describe cancer as the result of changes in cells that lead to uncontrolled growth and division. |  |  |  |  |  |  |
| 6.3v | Discuss potential benefits and risks associated with the use of stem cells in medicine. |  |  |  |  |  |  |
| 6.3w | Explain some of the possible benefits and risks of using gene technology in medicine. |  |  |  |  |  |  |
| 6.3x | Discuss the potential importance for medicine of our increasing understanding of the human genome. |  |  |  |  |  |  |