CHEMISTRY 'HEAD' - THE KNOWLEDGE YOU WILL COVER FROM YEAR 7-11

5	Chemistry	Matter 	**The Particle Model** · Identify solids, liquids and gases from the particle model ·Explain some properties of solids, liquids and gases using the particle model. · Define and describe the process of diffusion · Explain changes of state using the particle model.	**Separating mixtures** · Describe the process of filtration. ·Explain dissolving in terms of particles. · Describe and explain the distillation. · Describe and explain chromatography.	**Periodic Table** · Describe how the periodic table is organised and explain why it is useful. · Describe physical and Chemical properties of group 1. ·Describe Physical and Chemical Properties of group 7. ·Explain patterns in reactions using the periodic table.	**Elements** ·Identify the three sub atomic particles and their charges and relative mass · Explain the differences between atoms, elements and compounds in terms of particles. · Compare the properties of elements and comounds. · Explain how properties of polymers relate to their function. · Explain how properties of ceramics relate to their function.	**The atom, symbols, relative atomic mass, electronic charge and isotopes** · Apply the use of chemical formula to balance equations. · Select and compare separation techniques chromatography, distillation. · Apply knowledge of physical processes to explain crystallisation. · Describe the main features of the plum pudding,nuclear and atomic models and describe the alpha scattering experiment. · Explain how to use the periodic table to calculate proonss, neutrons and electrons in an atom and apply this to isotopes.	**The periodic table** · Explain how the periodic table is organised in terms of electronic structure. · Apply knowledge of the periodic table to predict some reactions of elements. ·Explain how the chemical properties of an elements relates to its electronic structure and therefore position in the periodic table. ·Describe and evaluate developments in the formation of the periodic table. ·Explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms. · Describe and explain reactions of group 1 and group 7 elements and the	**Structure and bonding of carbon** ·Explain the properties of diamond in terms of its structure and bonding. ·Explain the properties of graphite in terms of its structure and bonding. · Know that graphite is similar to metals in that it has delocalised electrons.	**Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations** · Explain the meaning of the law of conservation and use word and simple symbol equations to represent this. · Describe the equations given in terms of number of moles, reactants and products. · Define atomic number, relative atomic mass and relative formula mass and be able to use the periodic table to calculate these. · Explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and	**Use of amount of substance in relation to masses of pure substances (HT)** · Define one mole in terms of a number · Calculate the number of moles in a substance using the relative formula mass. · Calculate the masses of substances shown in a balanced symbol equation. · Calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product · Use the masses of substances present in a reaction to write a balanced equation. ·explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of	**Yield and atom economy of chemical reactions (chemistry only)** · Calculate the percentage yield of a product from the actual yield of a reaction. ·Calculate the percentage yield of a product from the actual yield of a reaction. · Calculate the atom economy of a reaction to form a desired product from the balanced equation. · Explain why a particular reaction pathway is chosen to produce a specified product given appropriate data such as atom economy (if not calculated), yield, rate, equilibrium position and usefulness of by-products.	**Using concentrations of solutions in mol/dm3 (chemistry only)** · Explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution. ·Use titrations using the idea that volumes of two solutions that react completely are known and the concentration of one solution is known, the concentration of the other solution can be calculated.	**Use of amount of substance in relation to volumes of gases** ·Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass ·Calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or product.	**Purity, formulations and chromatography** Define the term pure substance and formulation ·Use melting point and boiling point data to distinguish pure from impure substances. ·Identify formulations given appropriate information. know the names of components in paisne rapriatory products. ·Explain how paper chromatography separates mixtures ·Suggest how chromatographic methods can be used for distinguishing pure substances from impure substances ·Interpret chromatograms and determine Rf values from chromatograms			
6	Chemistry	Reactions 	**Metals and Non Metals** · Describe the physical properties of metals and non metals. ·Describe the reaction between metals and acids using particle diagrams and word equations. ·Explain displacement reactions using the idea of reactivity and word equations. ·Recall examples of oxidation reactions and describe them using particle diagrams and word equations.	**Acids and alkalis** · Descrive what acids and alkalis are. ·Recall examples of acids and alkalis. ·Describe how to use indicators and the pH scale to identify different acids and alkalis. ·Describe what the pH scale measures. ·Recall and apply the neutralisation equation. ·Use the pH scale to explain neutralisation.	**Chemical energy** · Explain energy changes taking place during exothermic reactions. · Describe examples of exothermic and endothermic reactions. · State what a catalyst is and explain how it works in terms of energy.	**Exothermic and endothermic reactions** · Distinguish between exothermic and endothermic reactions on the basis of the temperature change of the surroundings · Evaluate uses and applications of exothermic and endothermic reactions given appropriate information. · Apply reaction profiles to identify reactions as exothermic or endothermic · Explain that the activation energy is the energy needed for a reaction to	**Chemical cells and fuel cells (chemistry only)** ·Explain the how an electrochemical cell is constructed and the use of rechargeable and non rechargeable cells. · Interpret data in terms of the relative reactivity of different metals and to evaluate the use of cells. · Evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries. · Write the half equations for the	**Rate of reaction** ·Calculate the mean rate of a reaction from given information about the quantity of a reactant used or the quantity of a product formed and the time taken. ·Explain using collision theory the effects of changing conditions of concentration, pressure, temperature and surface area on the rate of a reaction. ·Identify catalysts in reactions from their effect on the rate of reaction and because they are not included in	**Reversible reactions and dynamic equilibrium** · Explain what is meant by a reversible reaction. · Describe the effects of temperature on hydrated copper sulfate reversible reaction. · Describe Le Chatelier's principle. · Explain the effects on equilibrium of changing conditions using suitable examples. Interpret appropriate given data to predict the effect of a change in temperature, pressure or	**Chemical bonds, ionic, covalent and metallic** · Explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons in ionic, covalent and metallic bonding. · Use dot and cross diagrams and other molecular notation to represent bonding in ionic and covalent substances. ·Describe the bonding in metals and represent this in diagram form. ·Evaluate the usefulness of some models of ionic, covalent and metallic	**How bonding and structure are related to the properties of substances** · Predict the states of substances at different temperatures given appropriate data. · Explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding. · Include appropriate state symbols in chemical equations for the reactions in this specification. · Describe the structure of giant ionic lattices and general properties of these materials	**Bulk and surface properties of matter including nanoparticles (chemistry only)** · Compare nano' dimensions to typical dimensions of atoms and molecules · Given appropriate information, evaluate the use of nanoparticles for a specified purpose · Explain that there are possible risks associated with the use of nanoparticles.	**Reactivity of metals** · Explain reduction and oxidation in terms of loss or gain of oxygen. · Recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper withwater or dilute acids and where appropriate, to place these metals in order of reactivity explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion · Evaluate specific metal extraction processes when given appropriate	**Reactions of acids** ·Explain in terms of gain or loss of electrons, that these are redox reactions · Identify which species are oxidised and which are reduced in given chemical equations. ·Use the formulae of common ions to deduce the formulae of salts. ·Describe how to make pure, dry samples of named soluble salts from	**Electrolysis** ·Describe the process of electrolysis in molten and aqueous compounds ·Write half equations for the reactions occurring at the electrodes during electrolysis, and may be required to complete and balance supplied half equations. predict the products of the electrolysis of binary ionic compounds in the molten state and aqueous state. · Explain why a mixture is used as the electrolyte.	**Properties of transition metals** ·Compare the physical and chemical properties of group 1 with transition metals with reference to Cr, Mn, Fe, Cu, Ni, Co. ·Explain the links between properties of transition metals with their common uses. ·Describe how to carry out flame tests and recognise some common metals from these tests	**Identification of common gases** ·Describe how to carry out the test for hydrogen, oxygen, carbon dioxide and chlorine and what a postive result would show	**Identification of ions by chemical and spectroscopic means** ·Describe how to carry out a flame test and the positive results for Lithium, Sodium, Potassium, Calcium and Copper. Describe how to carry out chemical tests for anions and cations and what positive results would show. ·Write balanced equations for the reactions to produce the insoluble hydroxides. ·State advantages of instrumental methods compared with the chemical tests in this specification. ·Interpret an instrumental result given appropriate data in chart or tabular form, when accompanied by a reference set in the same form, limited to flame
7	Chemistry	Earth 	**Earth Structure** · Describe the composition and structure of the Earth. ·Describe the properties of metamorphic, igneous and sedimentary rocks and explain how they are formed. · Explain the stages of the rock cycle. ·Explain how fossils are formed and how they can give evidence about the past.	**The Universe** · Describe the characteristics of stars and our own sun as one of them and explain the concept of galaxies and our own galaxy as one of them. ·Describe night, day and the seasons and the phases of the moon and explain these in terms of the motion of the Earth and other celestial bodies. ·Recall the definition of a light year and explain why it is used in astronomy. ·Describe the use of models of our solar system and other and evaluate their effectiveness.	**Climate** ·Describe the composition of the modern atmosphere the ancient atmosphere and explain why it has changed over time. · Describe the carbon cycle and explain the effects that humans have had on the carbon cycle. · Describe the carbon cycle and explain the effects that humans have had on the carbon cycle. · Explain the consequences of global warming for living things.	**The composition and evolution of the Earth's atmosphere** ·Describe the composition of the Earths atmosphere ·Interpret evidence and evaluate different theories about the Earths early atmosphere. ·Explain why the composition of the atmosphere has changed over billions of years.Compare the Earths atmosphere to that of Mars and Venus ·Explain how algae and plants have caused the concentrations of oxygen in the atmosphere to increase. ·Explain how algae and plants have caused the concentrations of carbon dioxide in the atmosphere to decrease.	**Carbon dioxide and methane as greenhouse gases** ·Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. ·Evaluate the quality of evidence in a report about global climate change given appropriate information. ·Describe briefly four potential effects of global climate change and discuss the scale, risk and environmental implications of global climate change. ·Describe actions to reduce emissions of carbon dioxide and methane and explain why actions may be limited.	**Common atmospheric pollutants and their sources** ·Describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels ·Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used. ·Describe and explain the problems caused by increased amounts of different pollutants in the air.	**Using the Earth's resources and obtaining potable water** · State examples of natural products that are supplemented or replaced by agricultural and synthetic products. Distinguish between finite and renewable resources given appropriate information. Distinguish between potable water and pure water. ·Describe the differences in treatment of ground water and salty water. ·Give reasons for the steps used to produce potable water. Evaluate alternative biological methods of metal extraction, given appropriate information.	**Earth's resources** ·Describe some of the resources that the Earth provides and explain how human activity can limit these resources. ·Describe the process of recycling and explain some advantages and disadvantages of these processes. ·Describe what an ore is and how more reactive metals and less reactive metals can be extracted from their ores.	**Life cycle assessment and recycling** ·Carry out simple comparative LCAs for shopping bags made from plastic and paper ·Evaluate ways of reducing the use of limited resources, given appropriate information.	**Using materials (chemistry only)** ·Describe experiments and interpret results to show that both air and water are necessary for rusting. ·Explain sacrificial protection in terms of relative reactivity. ·Recall uses for different alloys ·Explain how low density and high density poly(ethene) are both produced from ethene. ·Explain the difference between thermosoftening and thermosetting polymers in terms of their structures. ·Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals. ·Explain how the properties of materials are related to their uses and select appropriate materials.	**Carbon compounds as fuels and feedstock** ·Describe the formation of crude oil and define hydrocarbons ·Recognise substances as alkanes given their formulae in these forms. ·Explain how fractional distillation works in terms of evaporation and condensation. Recall how boiling point, viscosity and flammability change with increasing molecular size. ·Write balanced equations for the complete combustion of hydrocarbons with a given formula. ·Describe in general terms the conditions used for catalytic cracking and steam cracking.	**Types of reactions** · Use a formula to explain combustions. · Explain chemical changes using the particle model. · Explain uses of combustion in the wider world. · Explain thermal decomposition reactions using particles and formula and describe some uses of this reaction. · Explain oxidation using symbol equations and the particle model.	**Reactions of alkenes and alcohols (chemistry only)** ·Recognise substances as alkenes given their formulae in these forms. ·Represent fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine. ·Describe what happens when any of the first four alcohols react with sodium, burn in air, are added to water, react with an oxidising agent ·Know the conditions used for fermentation of sugar using yeast. ·Recognise alcohols from their names or from given formulae. ·Describe what happens when any of the first four carboxylic acids react with carbonates, dissolve in water, react with alcohols.	**Synthetic and naturally occurring polymers (chemistry only)** ·Recognise addition polymers and monomers from diagrams in the forms shown and from the presence of the functional group -C=C- in the monomers. ·Draw diagrams to represent the formation of a polymer from a given alkene monomer. ·Explain the basic principles of condensation polymerisation by reference to the	**The Haber process and the use of NPK fertilisers (chemistry only)** ·Interpret graphs of reaction conditions versus rate · Apply the principles of dynamic equilibrium in Reversible reactions and dynamic equilibrium to the Haber process · Explain the trade-off between rate of production and position of equilibrium · Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies, control of equilibrium position and rate. · Recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid · Compare the industrial production of fertilisers with laboratory preparations of the same compounds, given	