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| partment | SCIENCE (chemistry) |
| Key Stage | KEY STAGE 4 |
| Course Level | GCSE |
| Exam Board | AQA |

| Unit | Title | Weighting | Examination Method |
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| 1-4 | Paper 1 | 50% | External written exam |
| 5-7 | Paper 2 | 50% | External written exam |

| **Unit Title** | **End Points** | **Substantive Knowledge**<br><br>**What will they learn about in this topic?** | **Disciplinary Knowledge**<br><br>**What subject concepts will be developed through this topic?** | **Assessment Method** |
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| Atomic structure and the periodic table | Students will have developed a strong understanding of how the model of the atom has changed over years and what the model looks like today. They will also have a developed understanding of the elements in different groups different from each other in terms of properties and reactivity. | **Atoms, elements, compounds and mixtures:**<br>To be able to name compounds of these elements from given formulae or symbol equations<br>To be able to write word equations for the reactions in this specification<br>To be able to write formulae and balanced chemical equations for reactions.<br>To be able to describe, explain and give examples of the specified processes of separation and suggest suitable separation and purification techniques for mixtures when given appropriate information.<br><br>**History of the atom and the current model:**<br>To be able to describe why the new evidence from the scattering experiment led to a change in the atomic model.<br>To be able to describe the difference between the plum pudding model of the atom and the nuclear model of the atom.<br>To be able to use the nuclear model to describe atoms.<br>To be able to calculate the numbers of protons, neutrons and electrons in an atom or ion, given its atomic number and mass number. | Students will learn to use a range of equipment to separate chemical mixtures.<br>Students will show an understanding of why and describe how scientific methods and theories develop over time.<br>Develop their use of SI units and the prefix nano.<br>Students should be able to represent the electronic structures of the first twenty elements of the periodic table in both forms.<br>Calculating means and presenting data in a graph.<br>Drawing 2-D diagrams from 3D objects.<br>Graph skills to plot graphs on boiling point data and identify trends from graphs | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | | To be able to relate size and scale of atoms to objects in the physical world.<br><br>**<u>Relative atomic mass:</u>**<br>To be able to calculate the relative atomic mass of an element given the percentage abundance of its isotopes.<br><br>**<u>History of The Periodic Table and The Modern Periodic Table:</u>**<br>To be able to describe the steps that led to the development of the periodic table.<br>To be able to 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<br>To be able to predict possible reactions and probable reactivity of elements from their positions in the periodic table.<br>To be able to explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties.<br>To be able to explain how the atomic structure of metals and non-metals relates to their position in the periodic table<br>To be able to explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number.<br><br>**<u>Group 0, Group 1 and Group 7:</u>**<br>To be able to explain how properties of the elements in Group 0 depend on the outer shell of electrons of the atoms.<br>To be able predict properties from given trends down the group.<br>To be able to explain how properties of the elements in Group 1 depend on the outer shell of electrons of the atoms.<br>To be able to describe the reactions of the first three alkali metals with oxygen, chlorine and water. | | |

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| | | To be able to predict properties from given trends down the group.<br>To be able to explain how properties of the elements in Group 7 depend on the outer shell of electrons of the atoms.<br>To be able to describe the nature of the compounds formed when chlorine, bromine and iodine react with metals and non-metals.<br>To be able to predict properties from given trends down the group.<br><br>**<u>Properties of transition metals (chemistry only):</u>**<br>To be able to describe the difference compared with Group 1 in melting points, densities, strength, hardness and reactivity with oxygen, water and halogens. | | |
| Bonding, structure, and the properties of matter | Students will have developed a strong understanding of the different types of bonding and how this effects the properties of substances. | **<u>Chemical bonds and Ionic bonding:</u>**<br>To be able to explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons.<br>To be able to draw dot and cross diagrams for ionic compounds<br>To be able to work out the charge on the ions of metals and non-metals from the group number of the element.<br>To be able to deduce that a compound is ionic from a diagram of its structure<br>To describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure<br>To work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure.<br>To be able to explain the properties of ionic compounds.<br><br>**<u>Covalent Bonding:</u>**<br>To be able to draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane.<br>To be able to represent the covalent bonds in | Students will be able to visualise and represent 2D and 3D forms including two dimensional representations of 3D objects<br>Recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding.<br>Recognise substances as metallic giant structures from diagrams showing their bonding.<br>To be able to recognise polymers from diagrams showing their bonding and structure.<br>To be able to recognise giant covalent structures from diagrams showing their bonding and structure.<br>Calculate areas of triangles and rectangles, surface areas and volumes of cubes.<br>Make order of magnitude calculations.<br>Use ratios, fractions and percentages. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | | small molecules, in the repeating units of polymers and in part of giant covalent structures, using a line to represent a single bond.<br>To be able to describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent molecules or giant structures<br>To be able to deduce the molecular formula of a substance from a given model or diagram<br>To be able to use the idea that intermolecular forces are weak compared with covalent bonds to explain the bulk properties of molecular substances.<br><br>**Metallic bonding**<br>To be able to describe the structure and bonding in a metal.<br>To be able to explain why alloys are harder than pure metals in terms of distortion of the layers of atoms in the structure of a pure metal.<br><br>**The three states of matter**<br>To be able to predict the states of substances at different temperatures given appropriate data<br>To be able to explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding<br>To be able to recognise that atoms themselves do not have the bulk properties of materials<br>To be able to explain the limitations of the particle theory in relation to changes of state when particles are represented by solid inelastic spheres which have no forces between them. (HT only)<br><br>**Structure and bonding of carbon**<br>To be able to explain the properties of diamond in terms of its structure and bonding.<br>To be able to explain the properties of graphite in terms of its structure and bonding.<br>To be able to explain the properties of graphene in terms of its structure and bonding.<br>To be able to recognise graphene and fullerenes | | |

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| | | from diagrams and descriptions of their bonding and structure and give examples of the uses of fullerenes, including carbon nanotubes.<br><br>**<u>Nanoparticles:</u>**<br>To be able to compare 'nano' dimensions to typical dimensions of atoms and molecules.<br>To be able to consider advantages and disadvantages of the applications of these nanoparticulate materials.<br>To be able to evaluate the use of nanoparticles for a specified purpose and explain that there are possible risks associated with the use of nanoparticles. | | |
| Quantitative Chemistry | Pupils will be able to use their understanding of mass conservation to calculate missing masses, or to identify why mass does not appear to have been conserved.<br>Students will be able to confidently carry out a range of calculations including relative formula mass, percentage by mass, number of moles and reacting masses, concentration and percentage yield. | **<u>Conservation of mass and balanced chemical equations</u>**<br>To understand that mass is conserved in a chemical reaction.<br>To be able to explain that any observed change in mass is caused by a gas escaping to the surroundings.<br><br>**<u>Relative formula mass</u>**<br>To be able to calculate relative formula mass.<br>To be able to calculate the percentage by mass in a compound given the relative formula mass and the relative atomic masses.<br><br>**<u>Moles (HT)</u>**<br>To be able to use the relative formula mass of a substance to calculate the number of moles in each mass of that substance and vice versa.<br>To be able to calculate the masses of substances shown in a balanced symbol equation<br>To be able to calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product.<br><br>**<u>Limiting Reactants (HT)</u>**<br>To be able to explain the effect of a limiting quantity of a reactant on the amount of products it | Will learn how to change the subject of an equation.<br>To be able to substitute numerical values into algebraic equations using appropriate units for physical quantities.<br><br>Using scientific equipment to product results that are accurate and reliable. Calculating means and presenting data in a graph. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | | is possible to obtain in terms of amounts in moles or masses in grams.<br>To be able to identify which substance is the limiting reactant in a reaction.<br><br>**Concentration of solutions**<br>To be able to calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution.<br>To be able to explain how the mass of a solute and the volume of a solution is related to the concentration of the solution.<br>To be able to explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution.<br>To be able to calculate unknown concentration from known.<br><br>**Percentage Yield**<br>To be able to calculate the percentage yield of a product from the actual yield of a reaction.<br>To be able to calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction.<br>**Atom economy**<br>To be able to calculate the atom economy of a reaction to form a desired product from the balanced equation.<br>To be able to 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.<br><br>**Use of amount of substance in relation to volumes of gases**<br>To be able to calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass.<br>To be able to calculate volumes of gaseous reactants and products from a balanced equation and a given volume of a gaseous reactant or | | |

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| | | product. | | |
| Chemical Changes | Pupils will be able to make observations during the reactions of alkali metals and water, metals and acids, metal hydroxides and acids and metal carbonate and acids.<br>Pupils will be able to analyse their results and observations in order to make conclusions about metal reactivity.<br><br>Pupils will be able to use their understanding of the reactivity series to determine how a metal should be extracted from its ore and describe the process of electrolysis with reference to oxidation and reduction. | **<u>Reactivity of metals</u>**<br>To be able to explain reduction and oxidation in terms of loss or gain of oxygen.<br>To be able to recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids and where appropriate, to place these metals in order of reactivity<br>To explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion.<br><br>**<u>Extraction of metals and reduction</u>**<br>To be able to identify the substances which are oxidised or reduced in terms of gain or loss of oxygen.<br>To be able to write ionic equations for displacement reactions.<br>To be able to identify in a given reaction, symbol equation or half equation which species are oxidised and which are reduced.<br><br>**<u>Reactions of acids</u>**<br>To be able to explain in terms of gain or loss of electrons, that these are redox reactions<br>To be able to predict products from given reactants and use the formulae of common ions to deduce the formulae of salts.<br>To be able to describe how to make pure, dry samples of named soluble salts from information provided.<br><br>**<u>The pH scale and neutralisation strong and week acids</u>**<br>To be able to describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution and use the pH scale to identify acidic or alkaline solutions.<br>To be able to use and explain the terms dilute and | Students can by mixing of reagents to explore chemical changes and/or products deduce an order of reactivity of metals based on experimental results.<br><br>Interpret or evaluate specific metal extraction processes when given appropriate information.<br><br>Make order of magnitude calculations<br><br>Using experimental technique in the 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.<br><br>Use experimental methods in determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration. Use experimental methods in determination of the concentration of one of the solutions in mol/dm3 and g/dm3 from the reacting volumes and the known concentration of the other solution.<br><br>investigate what happens when aqueous solutions are electrolysed using inert electrodes. This should be an investigation involving developing a hypothesis. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | | concentrated (in terms of amount of substance), and weak and strong (in terms of the degree of ionisation) in relation to acids.<br>To be able to describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH.<br>To be describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH<br><br>**<u>Electrolysis</u>**<br>To be able to predict the products of the electrolysis of binary ionic compounds in the molten state.<br>To be able to explain why a mixture is used as the electrolyte during the electrolysis of Aluminium Oxide<br>To be able to explain why the positive electrode must be continually replaced during the electrolysis of Aluminium oxide.<br>To be able to write half equations for the reactions occurring at the electrodes during electrolysis (HT)<br>To be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound. | | |
| Energy Changes | Pupils will be able to carry out an investigation into endothermic and exothermic reactions, identifying variables to control and why this is important, and interpreting their results to conclude if the reaction in endothermic or exothermic. Pupils will be able to use information given to calculate the energy transferred or the bond energies. | **<u>Energy Changes:</u>**<br>To be able to distinguish between exothermic and endothermic reactions based on the temperature change of the surroundings.<br>To be able to evaluate uses and applications of exothermic and endothermic reactions.<br>To be able to draw simple reaction profiles (energy level diagrams) for exothermic and endothermic reactions showing the relative energies of reactants and products, the activation energy and the overall energy change, with a curved line to show the energy as the reaction proceeds.<br>To use reaction profiles to identify reactions as exothermic or endothermic.<br>To explain that the activation energy is the energy needed for a reaction to occur.<br>To be able to calculate the energy transferred in | Investigate the variables that affect temperature changes in reacting solutions such as, eg acid plus metals, acid plus carbonates, neutralisations, displacement of metals. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | | chemical reactions using bond energies supplied.<br>**<u>Chemical cells and fuel cells</u>**<br>To be able to interpret data for relative reactivity of different metals and evaluate the use of cells.<br>To be able to evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries<br>To be able to (HT only) write the half equations for the electrode reactions in the hydrogen fuel cell. | | |
| The rate and extent of chemical change | Students will be able to describe a range of factors that affect rate of reaction and explain, with reference to particles and kinetic energy, why these factors affect rate of reaction.<br>Pupils will be able to predict changes to rate of reaction when these factors are changed and calculate rate of reaction using the gradient of a graph | **<u>Rate of reaction</u>**<br>To be able to calculate the mean rate of a reaction from the quantity of a reactant used or the quantity of a product formed and the time taken.<br>To be able to recall how changing these factors affects the rate of chemical reactions.<br><br>To be able to predict and explain using collision theory the effects of changing conditions of concentration, pressure and temperature on the rate of a reaction.<br><br>To be able to predict and explain the effects of changes in the size of pieces of a reacting solid in terms of surface area to volume ratio.<br><br>To be able to explain how catalysts affect the rate of reaction in terms of activation energy.<br>**<u>Reversible reactions and dynamic equilibrium</u>**<br>To be able to explain what is meant by reversible reaction.<br>To be able to explain how a change in concentration of reactant or product will affect the position of equilibrium and yield of product formed.<br>To be able to explain how a change in temperature of the reaction will affect the position of equilibrium and yield of product formed.<br>To be able to explain how a change in pressure will affect the position of equilibrium and yield of product formed. | To draw, and interpret, graphs showing the quantity of product formed or quantity of reactant used up against time<br><br>To draw tangents to the curves on these graphs and use the slope of the tangent as a measure of the rate of reaction<br><br>To (HT only) calculate the gradient of a tangent to the curve on these graphs as a measure of rate of reaction at a specific time.<br><br>Plot two variables from experimental or other data.<br><br>Translate information between graphical and numeric form.<br><br>Make estimates of the results of simple calculations.<br><br>Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| Organic Chemistry | Students will be able to describe uses in the wider world of fractions of crude oil. Students will be able to describe how the fractions of crude oil are separated, with reference to evaporation and condensation.<br>Pupils will be able to identify simple alkanes, alkenes, alcohols, carboxylic acid from their structure | **Carbon compounds as fuels and feedstock**<br>To be able to describe how crude oil is formed and explain how it is separated by fractional distillation.<br>To be able to recognise alkanes and know names and structures of the first four alkanes.<br>To be able to recall how properties of alkanes change with increasing molecular size.<br>To be able to write balanced symbol equations for the complete combustion of alkanes.<br>To be able to describe in general terms the conditions used for catalytic cracking and steam cracking.<br>To describe the test used to distinguish between alkanes and alkenes.<br>To be able to balance cracking equations.<br><br>**Reactions of alkenes and alcohols**<br>To be able to describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes<br>To be able to draw 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.<br>To recall the main uses of these alcohols.<br>To be able to describe how alcohols are made by fermentation.<br>To be able to recognise alcohols and know names and structures of the first four alcohols.<br>To be able to 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.<br>To be able to write balanced symbol equations for the complete combustion of alcohols.<br><br>**Carboxylic acids**<br>To be able to recognise carboxylic acids from their names and formulae.<br>To be able to describe when the first 4 carboxylic acids react with carbonates, dissolve in water and | Make models of alkane molecules using the molecular modelling kits.<br><br>Recognise substances that are alkenes from their names or from given formulae in these forms.<br><br>To draw diagrams to represent the formation of a polymer from a given alkene monomer<br>To relate the repeating unit to the monomer.<br><br>To draw 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.<br><br>Use models to represent addition polymerisation.<br><br>Visualise and represent 2D and 3D forms including two-dimensional representations of 3D objects. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | | react with alcohols.<br>To be able to explain why carboxylic acids are weak acids.<br><br>**<u>Addition Polymerisation</u>**<br>To recognise addition polymers and monomers from diagrams in the forms shown and from the presence of the functional group C=C in the monomers.<br>To be able to draw polymers from monomers.<br><br>**<u>Condensation polymerisation</u>**<br>To be able to explain the basic principles of condensation polymerisation.<br>To be able to name the types of monomers from naturally occurring polymers. | | |
| Chemical Analysis | Student will learn about a range of qualitative tests to detect specific chemicals. They will learn to appreciate that Instrumental methods are more sensitive and provide faster more accurate analysis of chemicals. | **<u>Purity, formulations and chromatography</u>**<br>To be able to use melting point and boiling point data to distinguish pure from impure substances.<br>To be able to identify formulations given appropriate information.<br>To be able to explain how paper chromatography separates mixtures.<br>To be able to interpret chromatograms and determine Rf values from chromatograms.<br><br>**<u>Identification of ions by chemical and spectroscopic means</u>**<br>To be able to identify species from the results of the tests<br>To be able to identify metal ions when solutions are tested with sodium hydroxide solution.<br>To be able to write balanced equations for the reactions to produce the insoluble hydroxides.<br>To be able to state advantages of instrumental methods compared with the chemical tests | Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Students should calculate Rf values.<br><br>To be able to test for hydrogen, oxygen, chlorine and carbon dioxide.<br><br>Investigate flame colours of different substances to identify metal ions that are present.<br><br>To use of chemical tests to identify the ions in unknown single ionic compounds covering the ions in Flame tests, sodium hydroxide test, carbonate tests, halides and sulfates tests.<br><br>Be able to 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 emission spectroscopy. | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |
| Chemistry of the atmosphere | Students will learn how the Earth and its atmosphere has changed over the | **<u>The Earth's early atmosphere</u>**<br>To be able to describe what Earth's early atmosphere was like and how it changed.<br>To be able to describe what led to these changes. | | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year |

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| | billions of years. They will look at the impact that human activities have had on climate change. | To be able to describe and explain the formation of deposits of limestone, coal, crude oil and natural gas.<br><br>**<u>Carbon dioxide and methane as greenhouse gases</u>**<br>To be able to describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.<br>To be able to recall two human activities that increase the amounts of each of the greenhouse gases carbon dioxide and methane.<br>To be able to evaluate the quality of evidence in a report about global climate change given appropriate information and describe uncertainties in the evidence base<br>To be able to recognise the importance of peer review of results and of communicating results to a wide range of audiences.<br>To be able to describe briefly four potential effects of global climate change.<br>To be able to discuss the scale, risk and environmental implications of global climate change.<br>To be able to describe actions to reduce emissions of carbon dioxide and methane and why actions might be limited.<br><br>**<u>Common atmospheric pollutants and their sources</u>**<br>To be able to describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels<br>be able to describe and explain the problems caused by increased amounts of these pollutants in the air. | | exam |
| Using resources | Students will learn to appreciate that Earth's resources are limited and will eventually run out. They will learn that in order to operate sustainably, chemists | **<u>Using the Earth's resources and obtaining potable water</u>**<br>To be able to state examples of natural products that are supplemented or replaced by agricultural and synthetic products<br>To be able to distinguish between finite and renewable resources given appropriate | To extract and interpret information about resources from charts, graphs and tables<br><br>Use orders of magnitude to evaluate the significance of data.<br><br>To analyse and purify of water samples from | End of topic test<br><br>Also assessed in the end of term synoptic assessments and End of Year exam |

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| | seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. They will investigate how scientists develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. They will appreciate the significant effect Pollution, disposal of waste products and changing land use has on the environment, and how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised. | information.<br>To be able to distinguish between potable water and pure water<br>To be able to describe the differences in treatment of ground water and salty water<br>To be able to give reasons for the steps used to produce potable water.<br>To be able to comment on the relative ease of obtaining potable water from waste, ground and salt water.<br>To be able to describe the process of phytomining and bioleaching.<br><br>**<u>Life cycle assessment and recycling</u>**<br>To be able to carry out simple comparative LCAs for shopping bags made from plastic and paper.<br><br>**<u>Using materials (chemistry only)</u>**<br>To be able to describe experiments and interpret results to show that both air and water are necessary for rusting<br>To be able to explain sacrificial protection in terms of relative reactivity.<br>To be able to recall a use of each of the alloys.<br>To be able to explain how low density and high density poly(ethene) are both produced from ethene<br>To be able to explain the difference between thermosoftening and thermosetting polymers in terms of their structures.<br>To be able to<br>given appropriate information compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals.<br><br>**<u>The Haber process and the use of NPK fertilisers (chemistry only)</u>**<br>To be able to recall a source for the nitrogen and a source for the hydrogen used in the Haber process.<br>To be able to apply the principles of dynamic equilibrium in Reversible reactions and dynamic | different sources, including pH, dissolved solids and distillation.<br><br>To able to evaluate alternative biological methods of metal extraction, given appropriate information.<br><br>Interpret LCAs of materials or products given appropriate information.<br><br>Recognise and use expressions in decimal form.<br>Use ratios, fractions and percentages.<br>Make estimates of the results of simple calculations.<br>Use an appropriate number of significant figures.<br>Translate information between graphical and numeric form.<br>To be able to evaluate ways of reducing the use of limited resources, given appropriate information.<br><br>Investigate the conditions for rusting.<br><br>To interpret and evaluate the composition and uses of alloys other than those specified given appropriate information.<br><br>Compare the properties of thermosetting and thermosoftening polymers.<br><br>Students should be able to, given appropriate information compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals<br><br>To be able to interpret graphs of reaction conditions versus rate<br><br>Using titration to prepare an ammonium salt. | |

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| | | equilibrium to the Haber process<br>To be able to explain the trade-off between rate of production and position of equilibrium<br>To be able 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.<br>To be able to recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid<br>To compare the industrial production of fertilisers with laboratory preparations of the same compounds, given appropriate information | | |