Science Faculty

Chemistry 1: Atomic Structure & The Periodic Table Checklist

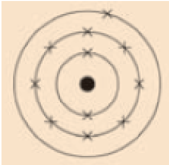
Assessment Guidance

At the end of studying each topic you will be assessed on some of the following criteria form your exam board. The assessment will last for 45 miutes and be worth 45 marks, it will include a range of questions, including some multiple choice questions, some short answer questions and some questions which require longer answers. To access the highest marks for your test, use as many key scientific words as possible.

Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
1.1.1 Atoms, elements and compounds			
Define the word 'element' in terms of atoms.			
Recall that there are about 100 different elements which are shown in the periodic table.			
Describe what a compound is and how they are represented.			
Describe how compounds are formed and separated, and what this involves.			
Use the names and symbols of the first 20 elements in the periodic table, the elements in Groups 1 and 7, and other elements in the Chemistry course.			
Name compounds of these elements from formulae or symbol equations.			
Write word equations for all the chemical reactions in the Chemistry course.			
Write formulae and balanced chemical equations for all the chemical reactions in the Chemistry course.			
1.1.2 Mixtures			
Describe what a mixture is and whether the properties of each substance in the mixture are changed or unchanged.			
State the 5 processes which can be used to separate mixtures, and remember that they do not involve chemical reactions.			
For each process, state the mixture(s) it can be used to separate.			
Describe, explain and give examples of the each of these processes.			
Suggest suitable separation and purification techniques for mixtures when given information.			
1.1.3 The development of the model of the atom			

Can you…?	☺	😐	☹
Explain what may lead to a scientific model being changed or replaced.			
Describe how the model of the atom changed as new evidence was discovered.			
Describe the roles of Niels Bohr and James Chadwick in the development of the model of the atom.			
Explain why the new evidence from the scattering experiment led to a change in the atomic model.			
Describe the difference between the plum pudding model of the atom and the nuclear model of the atom.			
1.1.4 Relative electrical charges of subatomic particles			
State the relative charges of protons, neutrons and electrons.			
Explain why atoms have no overall electrical charge.			
State what atomic number represents.			
State how atoms of different elements differ from each other.			
Use the nuclear model to describe the structure of atoms.			
1.1.5 Sizer and mass of atoms			
State the radius of an atom.			
State the radius of a nucleus			
State where most of the mass of an atom is.			
State the relative masses of protons, neutrons and electrons.			
State what mass number represents.			
Describe what an isotope is, how they differ from one another and how they are the same.			
Use the mass number and atomic number to calculate the number of protons, neutrons and electrons in an atom or ion.			
Relate the size of atoms to objects that can be seen.			
1.1.6 Relative atomic mass			
State what relative atomic mass is and how it is calculated.			
Calculate relative atomic mass from data given.			
1.1.7 Electronic Structure			
Describe how electrons fill up the energy levels (or 'shells') around the nucleus, starting from the lowest energy level (or innermost available shell).			

Can you…?	☺	😐	☹
Represent the electronic structure of the first 20 elements of the periodic table in the following forms:  sodium 2,8,1			
1.2.1 Periodic table			
Describe how elements in the periodic table are arranged and why it is called the periodic table.			
State the name of the columns in the periodic table and why elements are placed in the same column.			
Explain how the position of an element in the periodic table is related to the arrangement of electrons in its atoms and its atomic number.			
Predict possible reactions and reactivity of elements from their positions in the periodic table.			
1.2.2 Development of the periodic table			
State how scientists initially classified elements.			
Describe problems with the early periodic table.			
Explain how Mendeleev overcame these problems.			
Explain how Mendeleev was proved right, and why the initial order based on atomic weights was not always correct.			
Describe the steps in the development of the periodic table.			
1.2.3 Metals and non-metals			
Identify where metals and non-metals appear in the periodic table.			
State the type of ion metals form.			
State the type of ion non-metals form.			
Describe the physical and chemical properties of metals.			
Describe the physical and chemical properties of non-metals			
Explain how the atomic structure of metals and non-metals relates to their position in the periodic table.			
Explain how the reactions of elements are related to the arrangement of electrons in their atoms and therefore their atomic number.			
1.2.4 Group 0 (Noble Gases)			
Explain why the noble gases (group 0) are unreactive, in terms of their outer electrons.			
Describe the trend in boiling point going down group 0.			
Predict properties from trends down the group.			

Can you…?	☺	😐	☹
1.2.5 Group 1 (Alkali Metals)			
Describe the electronic structure of the alkali metals (group 1) and explain how their properties depend on this.			
Describe the reactions (observations and products) of the first 3 alkali metals with oxygen.			
Describe the reactions (observations and products) of the first 3 alkali metals with chlorine.			
Describe the reactions (observations and products) of the first 3 alkali metals with water.			
Explain the trend in reactivity going down the group.			
Predict properties from trends down the group.			
1.2.6 Group 7 (Halogens)			
Describe the electronic structure of the halogens (group 7) and explain how their properties depend on this.			
State the type of element the halogens are and describe what their molecules consist of.			
Describe the type of compounds formed when they react with metals			
Describe the type of compounds formed when they react with non-metals			
Explain the trend in reactivity going down the group.			
Explain displacement reactions involving halogens and solutions of their salts.			
Predict properties from trends down the group.			
1.3.1 Comparison of transition metals with group 1 elements (Chemistry only)			
State what the transition elements are.			
Describe the difference compared with group 1 in melting points, strength, hardness and reactivity with oxygen, water and halogens.			
Give examples of general properties with reference to Cr, Mn, Fe, Co, Ni, Cu.			
1.3.2 Typical properties of transition metals (Chemistry only)			
Describe the typical properties of transition elements.			
Give examples of general properties with reference to compounds of Cr, Mn, Fe, Co, Ni, Cu.			

Science Faculty

Chemistry 2: Bonding, Structure & Properties of Matter Checklist

Assessment Guidance

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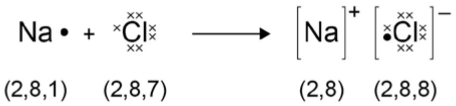
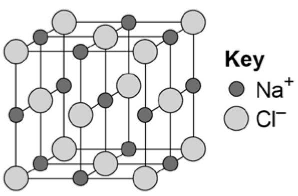
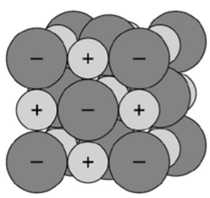
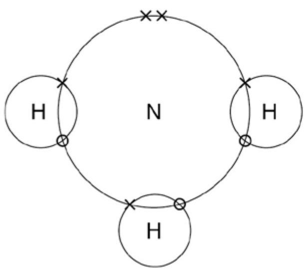
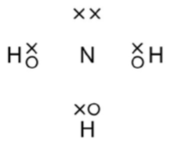
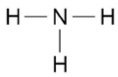
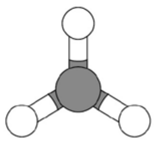
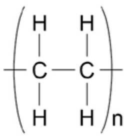
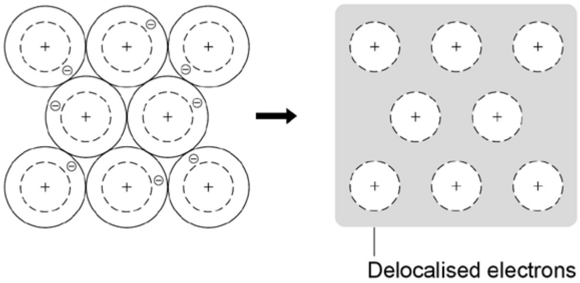
Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
2.1.1 Chemical bonds			
State the three types of strong chemical bonds.			
For each bond, state what it is, where it occurs and the particles involved.			
2.1.2 Ionic bonding			
Describe the formation of an ionic bond in terms of electron transfer.			
Represent the electron transfer during the formation of an ionic compound using dot and cross diagrams. For example. 			
Work out the charge on the ions of elements in group 1, 2, 6 and 7.			
Draw dot and cross diagrams for ionic compounds formed by elements in groups 1 and 2 with elements in group 6 and 7.			
2.1.3 Ionic compounds			
Describe the structure of a giant ionic lattice, with references to the forces holding it together.			
Recognise ionic structures represented in the following forms, for example sodium chloride.  			
Describe the limitations of using dot and cross diagrams to represent a giant ionic structure.			
Describe the limitations of using ball and stick diagrams to represent a giant ionic structure.			
Describe the limitations of using 2D diagrams to represent a giant ionic structure.			

Can you...?	☺	😐	☹
Describe the limitations of using 3D diagrams to represent a giant ionic structure.			
Work out the empirical formula of an ionic compound from given information.			
2.1.4 Covalent bonding			
Describe a covalent bond in terms of electron sharing.			
Recall that some covalent substances consist of small molecules, some have very large molecules, such as polymers, and some have giant covalent structures such as diamond and silicon dioxide.			
Recognise common substances that consist of small molecules from their chemical formula.			
Recognise the covalent bonds in molecules and giants structures in the following forms. **For ammonia (NH_3)**  and/or  and/or  and/or  Polymers can be represent in the form:  poly(ethene) where n is a large number.			
Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane.			
Represent the covalent bonds in small molecules, in the repeating units of polymers and in part of giant covalent structures, using a line to represent a single bond.			
Describe the limitations of using dot and cross diagrams to represent molecules or giant structures.			
Describe the limitations of using ball and stick diagrams to represent molecules or giant structures.			
Describe the limitations of using 2D diagrams to represent molecules or giant structures.			
Describe the limitations of using 3D diagrams to represent molecules or giant structures.			
Work out the molecular formula of a substance from a given model or diagram in these forms, showing the atoms and bonds in the molecule.			

Can you…?	☺	😐	☹
2.1.5 Metallic bonding			
Describe the structure of a metallic lattice, with reference to positive ions and electrons.			
Describe metallic bonding with reference to electrons.			
Recognise metallic substances in the following forms.  			
2.2.1 The three states of matter			
Describe the particle model.			
Describe the three states of matter using the particle model.			
Explain changes in state using the particle model.			
Explain what determines the melting and boiling point of different substances, with reference to forces, particles, bonding and structure.			
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 the types of bonding present.			
Recognise that atoms themselves do not have the bulk properties of materials.			
Explain the limitations of the particle theory in relation to changes of state .			
2.2.2 State symbols			
State the four state symbols and what they mean.			
Use state symbols in chemical equations.			
2.2.3 Properties of ionic compounds			
Describe the structure of a giant ionic lattice with reference to ions and electrostatic forces.			
Recall that ionic compounds have high melting and boiling points.			
Recall that ionic compounds don’t conduct electricity when solid, but do when melted or dissolved.			
Explain the properties of ionic compounds in terms of their structure and bonding.			
2.2.4 Properties of small molecules			
Recall that substances which consist of small molecules are usually gases or liquids and have relatively low melting points and boiling points.			

Can you…?	☺	😐	☹
Describe what happens when these substances melt or boil, with reference to the intermolecular forces present.			
Describe how these forces change as the size of the molecules increase, and the effect this has on the melting and boiling points of substances.			
Recall that these substances don't conduct electricity.			
Explain the properties of small molecules in terms of their structure and bonding.			
Use ideas about the strength of intermolecular forces and covalent bonds to explain the bulk properties of molecular substances.			
2.2.5 Polymers			
Recall that polymers have very large molecules, and that the atoms in the polymer molecules are linked to other atoms by strong covalent bonds			
State the relative strength of the intermolecular forces between polymer molecules, and the effect this has on their state at room temperature.			
Recognise polymers from diagrams showing their structure and bonding.			
2.2.6 Giant covalent structures			
Recall that substances that consist of giant covalent structures are solids with very high melting points.			
Recall that all of the atoms in these structures are linked to other atoms by strong covalent bonds.			
Explain the properties of giant covalent structures in terms of their structure and bonding.			
Describe what happens when these substances melt or boil, with reference to the covalent bonds present.			
Recall that diamond and graphite (which are forms of carbon) and silicon dioxide (silica) are examples of giant covalent structures.			
Recognise giant covalent structures from diagrams showing their bonding and structure.			
2.2.7 Properties of metals and alloys			
Recall that metals have giant structures of atoms with strong metallic bonds.			
Recall that these strong metallic bonds mean that most metals have high melting and boiling points.			
Describe the arrangements of atoms in pure metals.			
Explain the properties of metals in terms of their structure and bonding.			
State what an alloy is and describe how the atoms are arranged.			
Explain the properties of alloys (when compared to pure metals) in terms of their structure and bonding.			
2.2.8 Metals as conductors			

Can you...?	☺	😐	☹
Recall that metals are good conductors of electricity.			
Recall that metals are good conductors of thermal energy.			
Explain these properties of metals in terms of their structure and bonding.			
2.3.1 Diamond			
Describe the structure of diamond.			
Recall that diamond is very hard and has a very high melting point.			
Recall that diamond doesn't conduct electricity.			
Explain these properties in terms of its structure and bonding.			
2.3.2 Graphite			
Describe the structure of graphite.			
Recall that graphite is soft and slippery.			
Recall that graphite has a high melting point.			
Recall that graphite conducts electricity.			
Explain these properties in terms of its structure and bonding.			
2.3.3 Graphene and fullerenes			
Describe the structure of graphene.			
Recall that its properties make it useful in electronics and composites.			
Explain the properties of graphene in terms of its structure and bonding.			
Describe the structure of fullerenes.			
Recall that the first fullerene to be discovered was Buckminsterfullerene (C_{60}) which has a spherical shape.			
Recall that carbon nanotubes are cylindrical fullerenes with very high length to diameter ratios.			
Recall that their properties make them useful for nanotechnology, electronics and materials.			
Recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure			
Give examples of the uses of fullerenes, including carbon nanotubes.			
2.1 Sizes of particles and their properties (Chemistry only)			
Recall that nanoscience refers to structures that are 1–100 nm in size, of the order of a few hundred atoms. Nanoparticles, are smaller than fine particles ($PM_{2.5}$), which have diameters between 100 and 2500 nm (1×10^{-7} m and 2.5×10^{-6} m). Coarse particles (PM_{10}) have diameters between 1×10^{-5} m and 2.5×10^{-6} m. Coarse particles are often referred to as dust.			
Recall that as the side of cube decreases by a factor of 10 the surface area to volume ratio			

Can you…?	☺	😐	☹
increases by a factor of 10.			
Explain why nanoparticles may have properties different from those for the same materials in bulk			
Recall that these properties may also mean that smaller quantities are needed to be effective than for materials with normal particle sizes.			
Compare 'nano' dimensions to typical dimensions of atoms and molecules.			
2.2 Uses of nanoparticles (Chemistry only)			
Recall that nanoparticles have many applications in medicine, in electronics, in cosmetics and sun creams, as deodorants, and as catalysts. New applications for nanoparticulate materials are an important area of research.			
Consider advantages and disadvantages of the applications of these nanoparticulate materials			
Evaluate the use of nanoparticles for a specified purpose when given appropriate information			
Explain that there are possible risks associated with the use of nanoparticles.			

Chemistry 3: Quantitative Chemistry Checklist

Assessment Guidance

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Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
3.1.1 Conservation of mass and balanced chemical equations			
Recall that the law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants.			
Interpret symbol equations representing chemical reactions.			
3.1.2 Relative formula mass			
Calculate the relative formula mass of a compound.			
Recall that in a balanced chemical equation, the sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown.			
3.1.3 Mass changes when a reactant or product is a gas			
Give examples of reactions that appear to involve a change in mass.			
Explain why some reactions appear to involve a change in mass.			
3.1.4 Chemical measurements			
Explain what is meant by measurement uncertainty.			
Represent the distribution of results and estimate uncertainty.			
Use the range of a set of measures about the mean as a measure of uncertainty.			
3.2.1 Moles (HT only)			
Recall that chemical amounts are measured in moles. The symbol for the unit mole is mol.			
Recall that the number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02×10^{23} per mole.			
Recall that the mass of one mole of a substance in grams is equal to its relative formula mass.			
Use the relative formula mass of a substance to calculate the number of moles in a given mass of that substance and vice versa.			

Can you…?	☺	😐	☹
3.2.2 Amounts of substances in equations (HT only)			
Interpret chemical equations in terms of moles.			
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.			
3.2.3 Using moles to balance equations (HT only)			
Recall that the balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios.			
Balance an equation given the masses of reactants and products.			
3.2.4 Limiting reactants (HT only)			
State what it means if a reactant is the limiting reactant.			
State what it means if a reactant is in excess.			
Explain the effect of a limiting quantity of a reactant on the amount of products it is possible to obtain in terms of amounts in moles or masses in grams.			
3.2.5 Concentration of solutions			
Recall that the concentration of a solution can be measured in mass per given volume of solution, eg grams per dm^3 (g/dm^3).			
Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution.			
Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution. (HT only)			
3.3.1 Percentage yield (Chemistry only)			
Explain why it is not always possible to obtain the calculated amount of product from a reaction.			
Recall that the amount of product obtained is known as the yield.			
State what percentage yield is.			
Calculate the percentage yield of a product from the actual yield of a reaction.			
Calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction. (HT only)			
3.3.2 Atom economy (Chemistry only)			
Recall that the atom economy (atom utilisation) is a measure of the amount of starting materials that end up as useful products.			
Explain why atom economy is important.			

Can you…?	☺	😐	☹
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.			
3.4 Using concentrations of solutions in mol/dm3 (Chemistry only) (HT only)			
Recall that concentrate can be measured in mol/dm^3.			
Calculate the amount in moles of solute or the mass in grams of solute in a given volume of solution from its concentration in mol/dm^3.			
If two solutions react completely, calculate the concentration of a solution using the volumes of the two solutions and the concentration of one of the solutions.			
Explain how the concentration of a solution in mol/dm^3 is related to the mass of the solute and the volume of the solution.			
3.5 Use of amount of substance in relation to volumes of gases (Chemistry only) (HT only)			
Recall that equal amounts in moles of gases occupy the same volume under the same conditions of temperature and pressure.			
Recall that the volume of one mole of any gas at room temperature and pressure (20^oC and 1 atmosphere pressure) is 24 dm^3.			
Recall that the volumes of gaseous reactants and products can be calculated from the balanced equation for the reaction.			
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.			
Change the subject of a mathematical equation.			

Chemistry 4: Chemical Change Checklist

Assessment Guidance

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Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
4.1.1 Metal oxides			
Recall that metals react with oxygen to produce metal oxides.			
Describe reduction and oxidation in terms of loss or gain of oxygen.			
4.1.2 The reactivity series			
Explain what determines the reactivity of a metal.			
Explain why displacement reactions occur.			
State and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water.			
State and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with dilute acids			
Place these metals in order of reactivity.			
Deduce an order of reactivity of metals based on experimental results.			
4.1.3 Extraction of metals and reduction			
Explain why some metals such as gold are found in the Earth as the metal itself but most metals are found as compounds that require chemical reactions to extract the metal.			
State what determines whether a metal can be extracted from its oxide by reduction carbon.			
Interpret or evaluate specific metal extraction processes when given appropriate information			
Identify the substances which are oxidised or reduced in terms of gain or loss of oxygen.			
4.1.4 Oxidation and reduction in terms of electrons (HT only)			
Describe reduction and oxidation in terms of loss or gain of electrons.			
Write ionic equations for displacement reactions.			
Identify in a given reaction, symbol equation or half equation which species are oxidised and which			

Can you…?	☺	😐	☹
are reduced.			
4.2.1 Reactions of acids with metals			
Recall that acids react with some metal to produce salts and hydrogen.			
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.			
4.2.2 Neutralisation of acids and salt production			
Recall that acids are neutralised by alkalis (eg soluble metal hydroxides) and bases (eg insoluble metal hydroxides and metal oxides) to produce salts and water. Recall that Acids are neutralised by metal carbonates to produce salts, water and carbon dioxide.			
Name salts produced by these reactions.			
Predict products from given reactants.			
Use the formulae of common ions to deduce the formulae of salts.			
4.2.3 Soluble salts			
State the reactions that can be used to make soluble salts.			
Describe how to make pure, dry samples of named soluble salts from information provided.			
4.2.4 The pH scale and neutralisation			
Recall that acids produce hydrogen ions (H^+) in aqueous solutions.			
Recall that aqueous solutions of alkalis contain hydroxide ions (OH^-).			
Describe what the pH scale is and how it is used.			
Recall that in neutralisation reactions between an acid and an alkali, hydrogen ions react with hydroxide ions to produce water.			
State the ionic equation for a neutralisation reaction.			
Describe the use of universal indicator or a wide range indicator to measure the approximate pH of a solution.			
Use the pH scale to identify acidic or alkaline solutions.			
4.2.5 Titrations (Chemistry only)			
Recall that the volumes of acid and alkali solutions that react with each other can be measured by titration using a suitable indicator.			
Describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids only) to find the reacting volumes accurately			
Calculate the chemical quantities in titrations involving concentrations in mol/dm^3 and in g/dm^3. (HT Only)			

Can you…?	☺	😐	☹
4.2.6 Strong and weak acids (HT only)			
State what a strong acid is and give examples.			
State what a weak acid is and give examples.			
Recall that for a given concentration of aqueous solutions, the stronger an acid, the lower the pH.			
Recall that as the pH decreases by one unit, the hydrogen ion concentration of the solution increases by a factor of 10.			
Use and explain the terms dilute and concentrated, and weak and strong in relation to acids			
Describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (whole numbers only).			
4.3.1 The process of electrolysis			
State what happens to the ions in an ionic compound when it is melted or dissolved in water.			
State what an electrolyte is.			
Describe and explain what happens to ions during electrolysis.			
4.3.2 Electrolysis of molten ionic compounds			
Describe and explain what happens during the electrolysis of molten compounds..			
Predict the products of the electrolysis of ionic compounds in the molten state.			
4.3.3 Using electrolysis to extract metals			
Explain why electrolysis is used to extract some metals.			
Recall that large amounts of energy are used in the extraction process to melt the compounds and to produce the electrical current.			
Describe how aluminium is extracted using electrolysis.			
Explain why a mixture is used as the electrolyte during the extraction of aluminium.			
Explain why the positive electrode must be continually replaced during the extraction of aluminium.			
4.3.4 Electrolysis of aqueous solutions			
Recall that the ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved.			
Explain what will be produced at the negative electrode (cathode) and how this is linked to the break down of water molecules.			
Explain what will be produced at the positive electrode (anode) and how this is linked to the break down of water molecules.			
Predict the products of the electrolysis of aqueous solutions containing a single ionic compound.			

Can you…?	☺	😐	☹
4.3.5 Representation of reactions at electrodes as half equations (HT only)			
Describe and explain what happens are the cathode (negative electrode) and anode (positive electrode) in terms of electrons, oxidation and reduction.			
Write half equations for the reactions occurring at the electrodes.			

Chemistry 5: Energy Changes Checklist

Assessment Guidance

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Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
5.1.1 Energy transfer during exothermic and endothermic reactions			
Recall that Energy is conserved in chemical reactions. The amount of energy in the universe at the end of a chemical reaction is the same as before the reaction takes place. If a reaction transfers energy to the surroundings the product molecules must have less energy than the reactants, by the amount transferred.			
Describe what an exothermic reaction is and give examples.			
Describe what an endothermic reaction is and give examples.			
State every day uses of exothermic reactions.			
State every day uses of 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.			
5.1.2 Reaction profiles			
State what must occur for particles to react.			
Explain what the activation energy is.			
Recall that reaction profiles can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction.			
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.			
Use reaction profiles to identify reactions as exothermic or endothermic.			
5.1.3 The energy change of reactions (HT only)			
Recall that during a chemical reaction energy must be supplied to break bonds in the reactants and energy is released when bonds in the products are formed.			

Can you…?	☺	😐	☹
Recall that the energy needed to break bonds and the energy released when bonds are formed can be calculated from bond energies.			
State how the energy needed to break bonds and the energy released when bonds are formed differ in endothermic and exothermic reactions.			
Calculate the energy transferred in chemical reactions using bond energies supplied.			
5.2.1 Cells and batteries (Chemistry only)			
Recall that cells contain chemicals which react to produce electricity.			
State how a simple cell can be made.			
State factors that affect the voltage produced by a cell.			
State what a battery is.			
Explain the difference between rechargeable and non-rechargeable cells.			
Recall that alkaline batteries are non-rechargeable.			
Interpret data for relative reactivity of different metals and evaluate the use of cells.			
5.2.2 Fuel cells (Chemistry only)			
Describe what a fuel cell is and how they function.			
State the equation for the overall reaction in a hydrogen fuel cell.			
Recall that hydrogen fuel cells offer a potential alternative to rechargeable cells and batteries.			
Evaluate the use of hydrogen fuel cells in comparison with rechargeable cells and batteries.			
Write the half equations for the electrode reactions in the hydrogen fuel cell. (HT only)			

Chemistry 6: Rate and Extent of Chemical Change Checklist

Assessment Guidance

At the end of studying each topic you will be assessed on some of the following criteria form your exam board. The assessment will last for 45 miutes and be worth 45 marks, it will include a range of questions, including some multiple choice questions, some short answer questions and some questions which require longer answers. To access the highest marks for your test, use as many key scientific words as possible.

Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
6.1.1 Calculating rates of reactions			
State how the rate of a chemical reaction can be measured.			
Calculate mean rate of reaction using the quantity of reactant used or product formed.			
State the units of rate of reaction.			
Draw graphs showing the quantity of product formed or reactant used up against time.			
Interpret these graphs and describe the changing rate of reaction.			
Draw tangents to curves on these graphs and use the slope as a measure of the rate of reaction.			
Calculate the gradient of a tangent to determine the rate of reaction at a specific time.			
6.1.2 Factors which affect the rates of chemical reactions			
State the factors which affect the rate of reaction.			
Describe how changing each factor affects the rate of reaction.			
6.1.3 Collision theory and activation energy			
State the definition of activation energy.			
Predict and explain the effect of changing factors on reaction rate using collision theory.			
Predict and explain the effects of changes in the size of pieces of a reacting solid on reaction rate in terms of surface area to volume ratio.			
Use simple ideas about proportionality when using collision theory to explain the effect of a factor on the rate of a reaction.			
6.1.4 Catalysts			
State what a catalyst is and what it does.			
Draw a reaction profile for a reaction with a catalyst and without a catalyst.			

Can you…?	☺	😐	☹
Identify catalysts in reactions from their effect on the rate of reaction and because they are not included in the chemical equation for the reaction.			
Explain catalytic action in terms of activation energy.			
6.2.1 Reversible reactions			
State what a reversible reaction is.			
Recall that the direction of reversible reactions can be changed by changing the conditions. For example: $\text{ammonium chloride} \underset{\text{cool}}{\overset{\text{heat}}{\rightleftharpoons}} \text{ammonia + hydrogen chloride}$			
6.2.2 Energy changes and reversible reactions			
Recall that If a reversible reaction is exothermic in one direction, it is endothermic in the opposite direction. The same amount of energy is transferred in each case. For example: $\text{hydrated copper sulfate (blue)} \underset{\text{exothermic}}{\overset{\text{endothermic}}{\rightleftharpoons}} \text{anhydrous copper sulfate (white)} + \text{water}$			
6.2.3 Equilibrium			
Explain what is meant by equilibrium.			
6.2.4 The effect of changing conditions on equilibrium (HT only)			
Recall that the relative amounts of all the reactants and products at equilibrium depend on the conditions of the reaction.			
Recall that if a system is at equilibrium and a change is made to any of the conditions, then the system responds to counteract the change.			
Recall that the effects of changing conditions on a system at equilibrium can be predicted using Le Chatelier's Principle.			
Make qualitative predictions about the effect of changes on systems at equilibrium when given appropriate information.			
6.2.5 The effect of changing concentration (HT only)			
Recall that if the concentration of one of the reactants or products is changed, the system is no longer at equilibrium and the concentrations of all the substances will change until equilibrium is reached again.			
Describe the effect of changing concentrations of products or reactants on a system in equilibrium.			
Interpret appropriate given data to predict the effect of a change in concentration of a reactant or product on given reactions at equilibrium.			
6.2.6 The effect of temperature changes on equilibrium (HT only)			
Describe the effect of increasing the temperature on a system in equilibrium.			
Describe the effect of decreasing the temperature on a system in equilibrium.			

Can you…?	☺	😐	☹
Interpret appropriate given data to predict the effect of a change in temperature on given reactions at equilibrium.			
6.2.6 The effect of temperature changes on equilibrium (HT only)			
Describe the effect of increasing the pressure on a system in equilibrium.			
Describe the effect of increasing the pressure on a system in equilibrium.			
Interpret appropriate given data to predict the effect of pressure changes on given reactions at equilibrium.			

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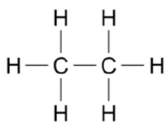
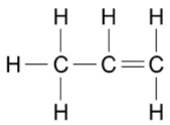
Chemistry 7: Organic Chemistry Checklist

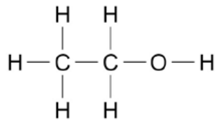
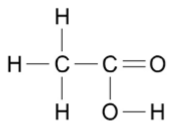
Assessment Guidance

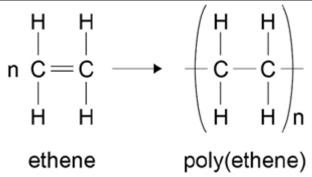
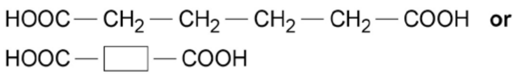
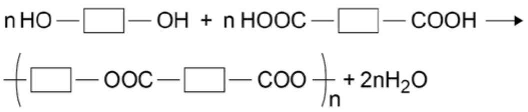
At the end of studying each topic you will be assessed on some of the following criteria form your exam board. The assessment will last for 45 miutes and be worth 45 marks, it will include a range of questions, including some multiple choice questions, some short answer questions and some questions which require longer answers. To access the highest marks for your test, use as many key scientific words as possible.

Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
7.1.1 Crude oil, hydrocarbons and alkanes			
State what crude oil was formed from.			
Describe what crude oil contains.			
State what a hydrocarbon is.			
Define the term saturated in relation to a hydrocarbon.			
State the general formula for an alkane and identify them from their name, formula or structure.			
State the names of the first four members of the homologous series of alkanes and represent their structure in the following forms. C_2H_6 			
Explain what a homologous series is.			
7.1.2 Fractional distillation and petrochemicals			
Explain the process of fractional distillation of crude oil in terms of evaporation and condensation.			
Describe what a fraction is and state the uses of fractions.			
State the name of fuels we depend on which are produced from crude oil.			
State useful materials which are produced by the petrochemical industry and describe their function.			
State why there is large variety of natural and synthetic carbon compounds.			
7.1.3 Properties of hydrocarbons			
Explain how the size of hydrocarbon molecules affect their boiling point, viscosity and flammability.			
Explain how the properties of a hydrocarbon affects its use as a fuel.			

Can you…?	☺	😐	☹
Describe what happens during the combustion of a hydrocarbon.			
Write balanced equations for the complete combustion of hydrocarbons with a given formula.			
7.1.4 Cracking and alkenes			
Describe cracking in general terms as an example of thermal decomposition.			
Describe in general terms the conditions for catalytic cracking.			
Describe in general terms the conditions for steam cracking.			
Identify the products of cracking.			
Balance chemical equations as examples of cracking given the formulae of the reactants and products.			
Explain how to test for an alkene.			
Explain why cracking is used and give examples to illustrate its usefulness.			
State what the alkenes produced from cracking are used for.			
Explain how modern life depends on the use of hydrocarbons.			
7.2.1 Structure and formulae of alkenes (Chemistry only)			
State the general formula for an alkene and identify them from their name, formula or structure.			
State the names of the first four members of the homologous series of alkenes and represent their structure in the following forms. C_3H_6 			
Define the term unsaturated in relation to a hydrocarbon.			
7.2.2 Reactions of alkenes (Chemistry only)			
Explain what a functional group is and why It is important.			
State the functional group of an alkene.			
Describe how alkenes react with oxygen and how this differs from how alkanes react.			
Describe in general terms the addition reactions of alkenes.			
Describe the reactions and conditions for the addition of hydrogen to alkenes.			
Describe the reactions and conditions for the addition of water to alkenes.			
Describe the reactions and conditions for the addition of halogens to alkenes.			
Draw the displayed structure and formulae of the first four alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine.			

Can you…?	☺	😐	☹
7.2.3 Alcohols (Chemistry only)			
State the functional group of an alcohol.			
Identify an alcohol from their name, formula or structure.			
State the names of the first four members of the homologous series of alcohols and represent their structure in the following forms. CH_3CH_2OH 			
Describe what happens when any of the first four alcohols react with sodium.			
Describe what happens when any of the first four alcohols burn in air.			
Describe what happens when any of the first four alcohols are added to water.			
Describe what happens when any of the first four alcohols react with an oxidising agent.			
State the main uses of alcohols.			
Describe how ethanol is produced using fermentation, including the conditions for the reaction.			
Write balanced chemical equations for the combustion reactions of alcohols.			
7.2.4 Carboxylic acids (Chemistry only)			
State the functional group of a carboxylic acid.			
Identify a carboxylic acid from their name, formula or structure.			
State the names of the first four members of the homologous series of carboxylic acids and represent their structure in the following forms. CH_3COOH 			
Describe what happens when any of the first four carboxylic acids react with carbonates.			
Describe what happens when any of the first four carboxylic acids dissolve in water.			
Describe what happens when any of the first four carboxylic acids react with alcohols.			
Explain why carboxylic acids are weak acids in terms of ionisation and pH.			
State the name of the ester made when ethanoic acids reacts with ethanol.			
7.3.1 Addition polymerisation (Chemistry only)			
Describe polymerisation reactions in general terms by reference to monomers.			
Describe addition polymerisation reactions of alkenes and recognise the molecules involved, for example.			

Can you...?	☺	😐	☹
			
State that no other molecule is formed in addition polymerisation reactions.			
Recognise addition polymers and monomers from diagrams.			
Draw diagrams to represent the formation of a polymer from a given alkene monomer.			
Relate the repeating unit to the monomer.			
7.3.2 Condensation polymerisation (Chemistry only) (HT only)			
Describe condensation polymerisation reactions using the example below. ethane diol  and hexanedioic acid  polymerise to produce a polyester: 			
State what the simplest examples of condensation polymers are made from.			
State the monomers used to make a polyester.			
Explain the basic principles of condensation polymerisation by reference to the functional groups in the monomers and the repeating units in the polymers.			
7.3.3 Amino acids (Chemistry only) (HT only)			
State the main features of an amino acid.			
Describe the condensation polymerisation of amino acids using the example below. Glycine is H_2NCH_2COOH and polymerises to produce the polypeptide $(\text{-}HNCH_2COO\text{-})n$ and n H_2O.			
State how amino acids can be used to make proteins.			
7.3.4 DNA (deoxyribonucleic acid) and other naturally occurring polymers (Chemistry only)			
Describe the function of DNA.			
Describe the basic structure of DNA by reference to the monomers, the polymer chains and the shape.			
State the names of naturally occurring polymers which are important for life.			

Can you...?	☺	😐	☹
Name the types of monomers from which these naturally occurring polymers are made.			

Chemistry 8: Chemical Analysis Checklist

Assessment Guidance

At the end of studying each topic you will be assessed on some of the following criteria form your exam board. The assessment will last for 45 miutes and be worth 45 marks, it will include a range of questions, including some multiple choice questions, some short answer questions and some questions which require longer answers. To access the highest marks for your test, use as many key scientific words as possible.

Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
8.1.1 Pure Substances			
Describe what a that a pure substance is.			
Explain how melting and boiling point data can be used to identify pure and impure substances.			
Use melting and boiling point data to distinguish pure substances from impure substances.			
Describe what a ‘pure substance’ can mean in everyday language.			
8.1.2 Formulations			
Describe what a formulation is.			
Describe how a formulation is made.			
State examples of formulations.			
Identify formulations given appropriate information.			
8.1.3 Chromatography			
State the uses of chromatography.			
Describe how paper chromatography is carried out.			
Explain how paper chromatography separates substances.			
Explain how chromatography can be used to distinguish pure substances from impure substances.			
Interpret chromatograms and calculate Rf values.			
Explain how Rf values can be used to identify substances.			
8.2 Test for common gases			
Describe and explain the test for hydrogen.			
Describe and explain the test for oxygen.			

Can you…?	☺	😐	☹
Describe and explain the test for carbon dioxide.			
Describe and explain the test for chlorine.			
Interpret the results of gas tests.			
8.3.1 Flame tests [Chemistry only]			
Describe how to test for metal ions using flame tests.			
Identify the following metal ions from the colours that their compounds produce in flame tests: lithium, sodium, potassium, calcium and copper.			
Explain why it can be hard to identify metal ions in a mixture.			
Interpret the results of flame tests.			
8.3.2 Metal Hydroxides [Chemistry only]			
Describe and explain how to test for metal ions using precipitation reactions and state the name of the precipitates formed.			
Describe the appearance of the precipitates that are formed from the reactions of aluminium, calcium and magnesium ions.			
State which of the above precipitates dissolves in excess sodium hydroxide.			
Identify copper (II), iron (II) and iron (III) ions from the colours of precipitates that they form.			
Interpret the results of metal hydroxide tests.			
8.3.3 Carbonates [Chemistry only]			
Describe and explain how to test for carbonate ions.			
Interpret the results of carbonate tests.			
8.3.4 Halides [Chemistry only]			
Describe and explain how to test for halide ions.			
Identify halide ions in solution from the colours of precipitates formed.			
Interpret the results of halide tests.			
8.3.5 Sulfates [Chemistry only]			
Describe and explain how to test for sulfate ions.			
Interpret the results of sulfate tests.			
8.3.6 Instrumental methods [Chemistry only]			
Describe the advantages of using instrumental methods over chemical tests.			
8.3.7 Flame emission spectroscopy [Chemistry only]			

Can you…?	☺	😐	☹
Describe the how flame emission spectroscopy is carried out.			
Explain what a flame emission spectrum shows and how it can be used.			
Interpret flame emission spectroscopy data.			

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Chemistry: Chemistry of the Atmosphere Checklist

Assessment Guidance

At the end of studying each topic you will be assessed on some of the following criteria form your exam board. The assessment will last for 45 miutes and be worth 45 marks, it will include a range of questions, including some multiple choice questions, some short answer questions and some questions which require longer answers. To access the highest marks for your test, use as many key scientific words as possible.

Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
9.1.1 The proportions of different gases in the atmosphere			
Outline the proportions of the main gases in the atmosphere, as they have been for 200 million years.			
9.1.2 The Earth's Early Atmosphere			
Explain why evidence for the early atmosphere is limited.			
Describe the composition of the early Earth's atmosphere and name the planets it may have been similar to.			
Outline one theory for the formation of the atmosphere, including the gases thought to be found in the early atmosphere and those that gradually built up, and how the oceans were formed.			
Describe how oceans reduced the amount of carbon dioxide in the atmosphere.			
Interpret evidence and evaluate theories about the Earth's early atmosphere.			
9.1.3 How oxygen increased			
Name organisms that produced the oxygen in the atmosphere and the reaction within these organisms that produced it.			
State the word and symbol for this reaction.			
State when algae first produced oxygen that appeared in the atmosphere.			
Explain how algae, followed by the evolution of plants, were important for the evolution of other organisms.			
9.1.4 How carbon dioxide decreased			
Describe how algae and plants decreased the percentage of carbon dioxide in the atmosphere.			
Describe other process that have decreased the percentage of carbon dioxide in the atmosphere.			
Describe the main changes in the atmosphere over time and some likely causes of these changes.			

Can you…?	☺	😐	☹
Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas.			
9.2.1 Greenhouse gases			
Name the three main greenhouse gases.			
Explain why they are important for life.			
Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.			
9.2.2 Human activities which contribute to an increase in greenhouse gases in the atmosphere			
Describe two human activities which have increased the amount of carbon dioxide in the atmosphere.			
Describe two human activities which have increased the amount of methane in the atmosphere.			
Explain what is meant by peer reviewed evidence, and why many scientists believe that human activities is causing global warming and global climate change.			
Explain why it is difficult to model climate change and the consequences of this on how it is presented in the media.			
Evaluate the quality of evidence in a report about global climate change			
Describe uncertainties in the evidence base.			
Explain the importance of peer review of results and of communicating results to a wide range of audiences.			
9.2.3 Global climate change			
State the major cause of global climate change.			
Describe briefly four potential effects of global climate change.			
Discuss the scale, risk and environmental implications of global climate change.			
9.2.4 The carbon footprint and its reduction			
State what a carbon footprint is.			
Describe actions to reduce emissions of carbon dioxide.			
Describe actions to reduce emissions of methane.			
Give reasons why actions to reduce emissions may be limited.			
9.3.1 Atmospheric pollutants from fuels			
State the major sources of atmospheric pollutants.			
State the elements which fuels may contain.			
State what gases may be released into the atmosphere by combustion of a fuel.			

Can you…?	☺	😐	☹
Describe how these are produced by combustion of fuels.			
Predict the products of combustion given information about the composition of the fuel and the conditions in which it is used.			
9.3.2 Properties and effects of atmospheric pollutants			
Name pollutants produced by combustion of fuels.			
Describe and explain the problems caused by increased amounts of these pollutants in the air.			

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Chemistry 10: Using Resources Checklist

Assessment Guidance

At the end of studying each topic you will be assessed on some of the following criteria form your exam board. The assessment will last for 45 miutes and be worth 45 marks, it will include a range of questions, including some multiple choice questions, some short answer questions and some questions which require longer answers. To access the highest marks for your test, use as many key scientific words as possible.

Equipment you will need: pen, pencil, calculator, ruler, compass and protractor.

Can you…?	☺	😐	☹
10.1.1 Using the Earth's resources and sustainable development			
Recall that humans use the Earth’s resources to provide warmth, shelter, food and transport.			
Recall that natural resources, are supplemented by agriculture, provide food, timber, clothing and fuels.			
Recall that finite resources from the Earth, oceans and atmosphere are processed to provide energy and materials.			
State the definition of sustainable development.			
State examples of natural products that are supplemented or replaced by agricultural and synthetic products.			
Distinguish between finite and renewable resources given appropriate information.			
Extract and interpret information about resources from charts, graphs and tables.			
Use orders of magnitude to evaluate the significance of data.			
10.1.2 Potable water			
Recall that potable water is water that is safe to drink.			
Distinguish between potable water and pure water.			
State the important features of potable water.			
Recall that the methods used to produce potable water depend on available supplies of water and local conditions.			
Describe how potable water is produced in the UK and give reasons for the steps.			
State sterilising agents used to produce potable water.			
State what is meant by desalination and why it may be used in some countries.			
Outline the processes that can be used for desalination and the disadvantage of these processes.			

Can you…?	☺	😐	☹
Describe the differences in treatment of ground water and salty water.			
10.1.3 Waste water treatment			
Recall that urban lifestyles and industrial processes produce large amounts of waste water that require treatment before being released into the environment.			
State what may need to be removed from sewage and agricultural waste water.			
State what may need to be removed from industrial waste water.			
Describe how sewage is treated.			
Comment on the relative ease of obtaining potable water from waste, ground and salt water.			
10.1.4 Alternative methods of extracting metals (HT only)			
State why new ways of extracting copper are required.			
Outline the process of phytomining.			
Outline the process of bioleaching.			
Recall that these processes avoid traditional mining methods of digging, moving and disposing of large amounts of rock.			
Describe how the metal compounds from these processes can be processed to obtain the metal.			
Evaluate alternative biological methods of metal extraction, given appropriate information.			
4.10.2.1 Life cycle assessment			
State what a life cycle assessment is.			
State the stages of a products life cycle that are assessed.			
Recall that the use of water, resources, energy sources and production of some wastes can be fairly easily quantified.			
Recall that allocating numerical values to pollutant effects is less straightforward and requires value judgements, so LCA is not a purely objective process.			
Explain how selective or abbreviated LCAs can be misused.			
Carry out simple comparative LCAs for shopping bags made from plastic and paper.			
10.2.2 Ways of reducing the use of resources			
Recall that the reduction in use, reuse and recycling of materials by end users reduces the use of limited resources, use of energy sources, waste and environmental impacts.			
Metals, glass, building materials, clay ceramics and most plastics are produced from limited raw materials. Much of the energy for the processes comes from limited resources. Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts.			
Describe how glass can be recycled and reused.			

Can you...?	☺	😐	☹
Describe how metals can be recycled and reused.			
Recall that the amount of separation required for recycling depends on the material and the properties required of the final product.			
Recall that some scrap steel can be added to iron from a blast furnace to reduce the amount of iron that needs to be extracted from iron ore.			
Evaluate ways of reducing the use of limited resources, given appropriate information.			
10.3.1 Corrosion and its prevention (chemistry only)			
State what corrosion is.			
Describe what rusting is and what is required for it to occur.			
Describe ways in which corrosion can be prevented.			
Explain why aluminium does not corrode like other metals.			
Explain sacrificial protection in terms of relative reactivity.			
Recall that zinc is used to galvanise iron.			
Describe experiments and interpret results to show that both air and water are necessary for rusting.			
10.3.2 Alloys as useful materials (chemistry only)			
Recall that most metals in everyday use are alloys.			
State what bronze is made from.			
State what brass is made from.			
State the metals used in alloys with gold for jewellery.			
Describe how the proportion of gold of alloys is measure in carats.			
State what steel is made from.			
Describe the composition and properties of different types of steel.			
State the properties of aluminium alloys.			
Recall a use of each of the alloys above.			
Interpret and evaluate the composition and uses of alloys other than those above given appropriate information.			
10.3.3 Ceramics, polymers and composites (chemistry only)			
Describe how soda-lime glass is made.			
Describe how borosilicate glass is made and how its properties differ from those of soda-lime glass.			
Describe how clay ceramics are made.			

Can you…?	☺	😐	☹
Recall that the properties of polymers depend on what monomers they are made from and the conditions under which they are made.			
Explain how low density poly(ethene) is made from ethene.			
Explain how high density poly(ethene) is made from ethene.			
Describe and explain the difference between thermosoftening and thermosetting polymers in terms of their structures.			
Describe what composites are made from and their structure.			
Describe some examples of composites.			
Compare quantitatively the physical properties of glass and clay ceramics, polymers, composites and metals when given appropriate information.			
Explain how the properties of materials are related to their uses and select appropriate materials when given appropriate information.			
10.4.1 The Haber process (chemistry only)			
Recall that the Haber process is used to manufacture ammonia, which can be used to produce nitrogen-based fertilisers.			
State a source for the nitrogen and a source for the hydrogen used in the Haber process.			
Describe the Haber process, with reference to the reaction conditions, catalyst used, removal of ammonia and recycling of hydrogen and nitrogen.			
Interpret graphs of reaction conditions versus rate.			
Apply the principles of dynamic equilibria to the Haber process.			
Explain the trade-off between the rate of production and the 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.			
10.4.2 Production and uses of NPK fertilisers (chemistry only)			
Describe that an NPK fertiliser is.			
Recall that ammonia can be used to manufacture ammonium salts and nitric acid.			
Recall that potassium chloride, potassium sulfate and phosphate rock are obtained by mining, but phosphate rock cannot be used directly as a fertiliser.			
Recall that phosphate rock is treated with nitric acid or sulfuric acid to produce soluble salts that can be used as fertilisers.			
State 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 appropriate information.			