

Chemistry 1		Separate Chemistry	
Red 	Amber 	Green 	
1. Atomic Structure	State that everything is made of atoms and recall what they are		
	Describe what elements, compounds and mixtures are		
	Use symbols to represent elements and compounds.		
	Write word equations and balanced symbol equations for chemical reactions, including using appropriate state symbols		
	State that mass is conserved and explain why.		
	Name and describe how to separate mixtures using filtration, crystallization, distillation and chromatography.		
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)		
	Describe the difference between the plum pudding model of the atom and the nuclear model of the atom		
	State the relative charge of protons, neutrons and electrons and describe the overall charge of an atom		
	State the relative masses of protons, neutrons and electrons and describe the distribution of mass in an atom		
	Calculate the number of protons, neutrons and electrons in an atom when given its atomic number and mass number		
	Describe isotopes as atoms of the same element with different numbers of neutrons		
	Define the term relative atomic mass and why it takes into account the abundance of isotopes of the element		
	Calculate the relative atomic mass of an element given the percentage abundance of its isotopes		
	Describe how electrons fill energy levels in atoms, and represent the electron structure of elements using diagrams and numbers		
2. The Periodic Table	Recall how the elements in the periodic table are arranged		
	Explain why elements in the same group have similar properties and how to use the periodic table to predict the reactivity of elements		
	Describe the early attempts to classify elements		
	Explain the creation and attributes of Mendeleev's periodic table		
	Identify metals and non-metals on the periodic table, compare and contrast their properties		
	Explain how the atomic structure of metals and non-metals relates to their position in the periodic table		
	Describe the properties of noble gases, including how their properties depend on the outer shell of electrons		
	Describe the reactivity and properties of group 1 alkali metals with reference to their electron arrangement and predict their reactions		
	Describe the reactions of group 7 halogens with metals and non-metals		
	Describe the properties of group 7 halogens and how their properties relate to their electron arrangement, including trends		
	Chem only: Describe the properties of transition metals and compare them with group 1 elements, (for CR, Mn Fe, Co, Ni & Cu)		

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3. Structure & Bonding	Name the three States of matter, identify them from a simple model and state which changes of state happen at melting and boiling points		
	Explain changes of state using particle theory and describe factors that affect the melting and boiling point of a substance		
	HT only: Discuss the limitations of particle theory		
	Describe the three main types of bonds: ionic bonds, covalent bonds and metallic bonds in terms of electrostatic forces and the transfer or sharing of electrons		
	Describe how the ions produced by elements in some groups have the electronic structure of a noble gas and explain how the charge of an ion relates to its group number		
	Describe the structure of ionic compounds, including the electrostatic forces of attraction, and represent ionic compounds using dot and cross diagrams		
	Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure		
	Work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure		
	Describe covalent bonds and identify different types of covalently bonded substances, such as small molecules, large molecules and substances with giant covalent structures		
	Represent covalent bonds between small molecules, repeating units of polymers and parts of giant covalent structures using diagrams		
	Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane		
	Describe the arrangement of atoms and electrons in metallic bonds and draw diagrams the bonding in metals		
	Explain how the structure of ionic compounds affects their properties, including melting and boiling points and conduction of electricity (sodium chloride structure only)		
	Explain how the structure of small molecules affects their properties		
	Explain how the structure of polymers affects their properties		
	Explain how the structure of giant covalent structures affects their properties		
	Explain how the structure of metals and alloys affects their properties, including explaining why they are good conductors		
	Explain why alloys are harder than pure metals in terms of the layers of atoms		
	Explain the properties of graphite, diamond and graphene in terms of their structure and bonding		
	Describe the structure of fullerenes, and their uses, including Buckminsterfullerene and carbon nanotubes		
Chem ONLY: Compare the dimensions of nanoparticles to other particles and explain the effect of their surface area to volume ratio on their properties			
Chem ONLY: Discuss the applications of nanoparticles and their advantages and disadvantages, including uses in medicine, cosmetics, fabrics and the development of catalysts			

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4. Chemical Calculations	Describe what the relative formula mass (Mr) of a compound is and calculate the relative formula mass of a compound, given its formula		
	Calculate the relative formula masses of reactants and products to prove that mass is conserved in a balanced chemical equation		
	HT only: State that chemical amounts are measured in moles (mol) and explain what a mol is with reference to relative formula mass and Avogadro's constant		
	HT only: Use the relative formula mass of a substance to calculate the number of moles in a given mass of the substance		
	HT only: Calculate the masses of reactants and products when given a balanced symbol equation		
	HT only: Use moles to write a balanced equation when given the masses of reactants and products (inc changing the subject of the equation)		
	HT only: Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams		
	Chem ONLY: Explain why it is not always possible to obtain the calculated or expected amount of a product		
	Chem ONLY: Calculate the theoretical amount of a product and percentage yield of a product using the formula % yield = mass of product made/max theoretical mass of product x 100		
	Chem & HT ONLY: Calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction		
	Chem ONLY: Describe atom economy as a measure of the amount of reactants that end up as useful products		
	Chem ONLY: Calculate the percentage atom economy of a reaction to form a desired product using the equation % atom economy = RfM of desired product/sum of RfM of all reactants x 100		
	Chem & HT ONLY: Explain why a particular reaction pathway is chosen to produce a specified product, given appropriate data		
	Chem & HT ONLY: Calculate the amount of solute (in moles or grams) in a solution from its concentration in mol/dm³		
	Chem & HT ONLY: Calculate the concentration of a solution when it reacts completely with another solution of a known concentration		
	Chem & HT ONLY: Describe how to carry out titrations of strong acids and strong alkalis and calculate quantities in titrations involving concentrations in mol/dm³ and g/dm³		
	Chem & HT ONLY: Explain how the concentration of a solution in mol/dm³ is related to the mass of the solute and the volume of the solution		
	Chem & HT ONLY: Explain what the volume of one mole of any gas at room temperature is		
	Chem & HT ONLY: Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass		
	Chem ONLY: Describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids to find the reacting volumes accurately)		
Chem & HT ONLY: Calculate the chemical quantities in titrations involving concentrations in mol/dm³ and in g/dm³			
Chem ONLY: Required practical: determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration			
HT ONLY: Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution			

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5. Chemical Changes	Describe how metals react with oxygen and state the compound they form, define oxidation and reduction		
	Describe the arrangement of metals in the reactivity series, including carbon and hydrogen, and use the reactivity series to predict the outcome of displacement reactions		
	Recall and describe the reactions of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids		
	Relate the reactivity of metals to its tendency to form positive ions and be able to deduce an order of reactivity of metals based on experimental results		
	HT ONLY: Write balanced half equations and ionic equations		
	Predict the salt produced in a neutralisation reaction based on the acid used and the positive ions in the base, alkali or carbonate and use the formulae of common ions to deduce the formulae of the salt		
	Describe how soluble salts can be made from acids and how pure, dry samples of salts can be obtained		
	<i>Required practical: preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution</i>		
	HT ONLY: Describe oxidation and reduction in terms of loss and gain of electrons		
	HT ONLY: Write ionic equations for displacement reactions, and identify which species are oxidised and reduced from a symbol or half equation		
	HT ONLY: Explain in terms of gain or loss of electrons that the reactions between acids and some metals are redox reactions, and identify which species are oxidised and which are reduced (Mg, Zn, Fe + HCl & H₂SO₄)		
	Recall what native metals are and explain how metals can be extracted from the compounds in which they are found in nature by reduction with carbon		
	Evaluate specific metal extraction processes when given appropriate information and identify which species are oxidised or reduced		
	Explain that acids can be neutralised by alkalis, bases and metal carbonates and list the products of each of these reactions		
	HT ONLY: Use and explain the terms dilute and concentrated (in terms of amount of substance) and weak and strong (in terms of the degree of ionisation) in relation to acids		
	HT ONLY: Explain how the concentration of an aqueous solution and the strength of an acid affects the pH of the solution and how pH is related to the hydrogen ion concentration of a solution		
	Recall what the pH scale measures and describe the scale used to identify acidic, neutral or alkaline solutions		
Define the terms acid and alkali in terms of production of hydrogen ions or hydroxide ions (in solution), define the term base			
Describe the use of universal indicator to measure the approximate pH of a solution and use the pH scale to identify acidic or alkaline solutions			

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6. Electrolysis	Describe how ionic compounds can conduct electricity when dissolved in water and describe these solutions as electrolytes		
	Describe the process of electrolysis		
	Describe the electrolysis of molten ionic compounds and predict the products at each electrode of the electrolysis of binary ionic compounds		
	Explain how metals are extracted from molten compounds using electrolysis and use the reactivity series to explain why some metals are extracted with electrolysis instead of carbon		
	Describe the electrolysis of aqueous solutions and predict the products of the electrolysis of aqueous solutions containing single ionic compounds		
	HT ONLY: Describe the reactions at the electrodes during electrolysis as oxidation and reduction reactions and write balanced half equations for these reactions		
	<i>Required practical: investigate what happens when aqueous solutions are electrolysed using inert electrodes</i>		
7. Energy Changes	Describe how energy is transferred to or from the surroundings during a chemical reaction		
	Explain exothermic and endothermic reactions on the basis of the temperature change of the surroundings and give examples of everyday uses		
	<i>Required practical: investigate the variables that affect temperature changes in reacting solutions</i>		
	Describe what the collision theory is and define the term activation energy		
	HT ONLY: Explain the energy changes in breaking and making bonds and calculate the overall energy change using bond energies		
	Interpret and draw reaction profiles of exothermic and endothermic reactions, inc identifying the relative energies of reactants and products, activation energy and overall energy change		
	Chem only: Describe what a simple cell and a battery is and how they produce electricity		
	Chem only: Describe why alkaline batteries are non-rechargeable, state why some cells are rechargeable and evaluate the use of cells		
	Chem only: Describe fuel cells and compare fuel cells to rechargeable cells and batteries		
	Chem only: Describe the overall reaction in a hydrogen fuel cell		
Chem only: Write half equations for the electrode reactions in a hydrogen fuel cell			