AQA GCSE Combined Science: Trilogy
Topic Checklists

5.3 Quantitative Chemistry

5.3.1 Chemical Measurements, Conservation of Mass and the Quantitative Interpretation of Chemical Equations				
Topic	**Success Criteria**	**Progress**		
Conservation of Mass and Balanced Chemical Equations	I can explain what is meant by 'conservation of mass' in chemical reactions.			
	I can balance symbol equations in terms of the numbers of atoms of each element involved on both sides of the equations.			
	I can explain the use of multipliers in equations in normal script before a formula and in subscript within a formula.			
Relative Formula Mass	I can explain how to calculate the relative formula mass (M_r) of a compound.			
	I can describe how the sum of the relative formula masses of the reactants relates to the sum of the relative formula masses of the products in a balanced chemical equation.			
	I can calculate the percentage by mass of an element in a compound given the relative formula mass and the relative atomic masses.			
Mass Changes when a Reactant or Product is a Gas	I can explain why some reactions may appear to involve a change in mass.			
	I can give some examples of chemical reactions that result in an apparent change in mass.			
	I can explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle model.			
Chemical Measurements	I can represent the distribution of results and make estimations of uncertainty.			
	I can use the range of a set of measurements about the mean as a measure of uncertainty.			

5.3.2 Use of Amount of Substance in Relation to Masses of Pure Substances				
Topic	**Success Criteria**	**Progress**		
Moles (HT Only)	I can give a definition for the term 'mole'.			
	I can give the symbol for the unit mole.			
	I can describe how the mass of one mole of a substance in grams relates to its relative formula mass.			
	I can recall the value of the Avogadro constant.			
	I can use the relative formula mass of a substance to calculate the number of moles in a given mass of that substance and vice versa.			
Amounts of Substances in Equations (HT Only)	I can interpret chemical equations in terms of moles.			
	I can calculate the masses of reactants and products from balanced symbol equations.			
	I can calculate the masses of reactants and products from the balanced symbol equation and the mass of a given reactant or product.			
Using Moles to Balance Equations (HT Only)	I can balance a symbol equation given the masses of reactants and products.			
	I can change the subject of a mathematical equation.			
Limiting Reactants (HT Only)	I can explain why it is common to use an excess of one of the reactants in a chemical reaction.			
	I can explain what is meant by the term 'limiting reactant'.			
	I can explain how limiting the quantity of a reactant affects the amount of product it is possible to obtain.			
	I can calculate the number of moles or mass of product formed given the mass of the limiting reactant.			
Concentration of Solutions	I can calculate the concentration of a solution in grams per dm^3 (g/dm^3).			
	I can calculate the mass of solute in a given volume of solution of known concentration.			
	(HT only) I can 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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5.4 Chemical Changes

5.4.1 Reactivity of Metals				
Topic	**Success Criteria**	**Progress**		
Metal Oxides	I can state the product of reactions between metals and oxygen.			
	I can explain reduction and oxidation in terms of loss and gain of oxygen.			
The Reactivity Series	I can explain how the reactivity of a metal is determined.			
	I can recall the order of reactivity of the metals potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper.			
	I can recall the position of the non-metals hydrogen and carbon in the reactivity series.			
	I can describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids.			
	I can explain how the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive ion.			
	I can deduce an order of reactivity of metals based on experimental results.			
Extraction of Metals and Reduction	I can explain how unreactive metals such as gold are usually found.			
	I can explain why most metals require chemical reactions to extract them.			
	I can describe how metals less reactive than carbon can be extracted from their oxides.			
	I can interpret or evaluate specific metal extraction processes when given appropriate information.			
	I can identify the substances which are oxidised or reduced in terms of gain or loss of oxygen.			
Oxidation and Reduction in Terms of Electrons (HT Only)	I can describe oxidation in terms of electrons.			
	I can describe reduction in terms of electrons.			
	I can write ionic equations for displacement reactions.			
	I can identify which species are oxidised and which are reduced in a given reaction, symbol equation or half equation.			

5.4.2 Reactions of Acids				
Topic	**Success Criteria**	**Progress**		
Reactions of Acids with Metals	I can state the products of reactions between metals and acids.			
	(HT only) I can explain in terms of gain or loss of electrons, that the reactions between metals and acids are redox reactions.			
	(HT only) I can identify which species are oxidised and which are reduced in given chemical equations.			
Neutralisation of Acids and Salt Production	I can state the products of neutralisation of acids by alkalis and bases.			
	I can state the products of neutralisation of acids by metal carbonates.			
	I can name the salt produced by a neutralisation reaction from the name of the acid used and the positive ions in the base, alkali or carbonate.			
	I can predict products from given reactants.			
	I can use formulae of common ions to deduce the formulae of salts.			
Soluble Salts	I can describe how soluble salts can be made from acids.			
	I can describe how solid salts can be obtained from salt solutions.			
	I can describe how to make pure, dry samples of named soluble salts from information provided (required practical activity 8).			

Topic	Success Criteria	Progress		
The pH Scale and Neutralisation	I can state the type of ion produced by acids in aqueous solutions.			
	I can state the type of ion found in aqueous solutions of alkalis.			
	I can describe what the pH scale shows.			
	I can describe how the pH of a solution can be measured.			
	I can state the pH of neutral solutions.			
	I can describe where acidic solutions are found on the pH scale.			
	I can describe where alkaline solutions are found on the pH scale.			
	I can use the pH scale to identify acidic or alkaline solutions.			
Strong and Weak Acids (HT Only)	I can give some examples of strong and weak acids.			
	I can describe how the hydrogen ion concentration of a solution changes when the pH decreases by one unit.			
	I can explain the terms dilute and concentrated in relation to acids in terms of amount of substance.			
	I can explain the terms strong and weak in relation to acids in terms of the degree of ionisation in aqueous solution.			
	I can describe neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH.			

5.4.3 Electrolysis				
Topic	**Success Criteria**	**Progress**		
The Process of Electrolysis	I can explain why ionic compounds are able to conduct electricity when melted or dissolved in water.			
	I can describe the direction of movement of ions when an electric current is passed through an electrolyte.			
	I can describe how elements are produced from ions by electrolysis.			
	(HT only) I can write half equations for the reactions occurring at the electrodes during electrolysis.			
	(HT only) I can complete and balance supplied half equations.			
Electrolysis of Molten Ionic Compounds	I can predict the products of electrolysis of a simple ionic compound in its molten state.			
Using Electrolysis to Extract Metals	I can describe how electrolysis can be used to extract metals more reactive than carbon.			
	I can explain why large amounts of energy are required for electrolysis.			
	I can explain why a mixture of aluminium oxide and cryolite is used as the electrolyte in the extraction of aluminium.			
	I can explain why the positive electrode must be continually replaced in the extraction of aluminium.			
Electrolysis of Aqueous Solutions	I can state the product formed at the negative electrode in the electrolysis of an aqueous solution if the metal is more reactive than hydrogen.			
	I can state the product formed at the positive electrode in the electrolysis of an aqueous solution if the solution does not contain halide ions.			
	I can state the product formed at the positive electrode in the electrolysis of an aqueous solution if the solution contains halide ions.			
	I can explain why these products are formed in the electrolysis of aqueous solutions.			
	I can predict the products of the electrolysis of aqueous solutions containing a single ionic compound.			
	I can describe a method to investigate what happens when aqueous solutions are electrolysed using inert electrodes (required practical activity 9).			

Topic	Success Criteria	Progress		
Representation of Reactions at Electrodes as Half Equations (HT Only)	I can describe the reactions at the cathode and anode in terms of oxidation and reduction.			
	I can write half equations to represent reactions at electrodes.			

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5.5 Energy Changes

5.5.1 Exothermic and Endothermic Reactions				
Topic	**Success Criteria**	**Progress**		
Energy Transfer during Exothermic and Endothermic Reactions	I can explain what is meant by 'conservation of energy' in chemical reactions.			
	I can describe the transfer of energy in an exothermic reaction.			
	I can give some examples of exothermic reactions.			
	I can describe some everyday uses of exothermic reactions.			
	I can describe the transfer of energy in an endothermic reaction.			
	I can give some examples of endothermic reactions.			
	I can describe an everyday use of endothermic reactions.			
	I can distinguish between exothermic and endothermic reactions based on the temperature change of the surroundings.			
	I can evaluate uses and applications of exothermic and endothermic reactions given appropriate information.			
	I can investigate the variables that affect temperature changes in reacting solutions (required practical activity 10).			
Reaction Profiles	I can give a definition for the term 'activation energy'.			
	I can explain what must happen to the reacting particles in order for a chemical reaction to occur.			
	I can 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.			
	I can use reaction profiles to identify reactions as exothermic or endothermic.			

Topic	Success Criteria	Progress		
The Energy Change of Reactions (HT Only)	I can calculate the energy needed to break bonds and the energy released when bonds are formed using bond energies supplied.			
	I can calculate the overall energy change of a reaction from the sum of the energy needed to break bonds in the reactants and the sum of the energy released when bonds in the products are formed.			
	I can describe how the energy released from forming new bonds compares to the energy needed to break existing bonds in exothermic and endothermic reactions.			

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5.1 Atomic Structure and the Periodic Table

5.1.1 A Simple Model of the Atom, Symbols, Relative Atomic Mass, Electronic Charge and Isotopes				
Topic	**Success Criteria**	**Progress**		
Atoms, Elements and Compounds	I can give a definition for the term 'atom'.			
	I can give a definition for the term 'element'.			
	I can identify an element from its chemical symbol using the periodic table.			
	I can use the names and symbols of the first 20 elements, the elements in Groups 1 and 7 and other key elements.			
	I can give a definition for the term 'compound'.			
	I can explain how compounds are formed.			
	I can name compounds from given formulae or symbol equations.			
	I can write word equations for given chemical reactions.			
	I can write formulae and balanced symbol equations for given chemical reactions.			
	(HT only) I can write balanced half equations and ionic equations where appropriate.			
Mixtures	I can give a definition for the term 'mixture'.			
	I can describe the physical processes used to separate mixtures.			
	I can explain how each process works to separate a mixture.			
	I can give examples of mixtures that can be separated by each of the processes.			
	I can suggest suitable separation and purification techniques for mixtures when given appropriate information.			
	I can safely use a range of equipment to separate chemical mixtures.			

Topic	Success Criteria	Progress		
The Development of the Model of the Atom	I can describe what atoms were thought to be like before the discovery of the electron.			
	I can describe the difference between the plum pudding model of the atom and the nuclear model of the atom.			
	I can describe how the results from the alpha particle scattering experiment led to the nuclear model.			
	I can describe how Niels Bohr adapted the nuclear model.			
	I can describe how developments in scientific methods led to the discovery of protons and neutrons.			
Relative Electrical Charges of Subatomic Particles	I can state the relative electrical charge of a proton.			
	I can state the relative electrical charge of a neutron.			
	I can state the relative electrical charge of an electron.			
	I can explain why atoms have no overall electrical charge.			
	I can describe how the number of protons in an element relates to its atomic number.			
	I can use the nuclear model to describe atoms.			
Size and Mass of Atoms	I can state the radius of an atom.			
	I can describe how the radius of a nucleus compares to the radius of an atom.			
	I can state the relative mass of a proton.			
	I can state the relative mass of a neutron.			
	I can state the relative mass of an electron.			
	I can describe how the number of protons and neutrons in an atom relate to its mass number.			
	I can give a definition for the term ‘isotope’.			
	I can identify the atomic number and mass number of an atom of an element using the periodic table.			
	I can calculate the number of protons, neutrons and electrons in an atom or ion, given its atomic number and mass number.			
	I can relate the size and scale of atoms to objects in the physical world.			

Topic	Success Criteria	Progress		
Relative Atomic Mass	I can explain how relative atomic mass is calculated based on the abundance of the isotopes of the element.			
	I can calculate the relative atomic mass of an element given the percentage abundance of its isotopes.			
Electronic Structure	I can represent the electronic structures of the first 20 elements of the periodic table in numerical form.			
	I can represent the electronic structures of the first 20 elements of the periodic table as a diagram.			

5.1.2 The Periodic Table				
Topic	**Success Criteria**	**Progress**		
The Periodic Table	I can describe how elements are arranged in the periodic table.			
	I can explain why elements in the same group of the periodic table have similar chemical properties.			
	I can 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.			
	I can predict possible reactions and probable reactivity of elements from their positions in the periodic table.			
Development of the Periodic Table	I can describe how scientists attempted to classify the elements before the discovery of protons, neutrons and electrons.			
	I can describe some of the problems with early periodic tables.			
	I can explain how Mendeleev overcame some of the problems with early periodic tables.			
Metals and Non-Metals	I can state the charge of ions formed by elements that are metals.			
	I can state the charge of ions formed by elements that are non-metals.			
	I can describe where metals are found on the periodic table.			
	I can describe where non-metals are found on the periodic table.			
	I can explain the differences between metals and non-metals on the basis of their characteristic physical and chemical properties.			
	I can explain how the atomic structure of metals and non-metals relates to their position in the periodic table.			
	I can explain how the reactions of elements are related to the arrangement of electrons in their atoms and hence to their atomic number.			

Topic	Success Criteria	Progress		
Group 0	I can recall the general name for the elements in Group 0 of the periodic table.			
	I can state the number of electrons in the outer shell of the noble gases (excluding helium).			
	I can describe how helium differs from the other elements in the group.			
	I can explain why the noble gases are unreactive and do not easily form molecules.			
	I can describe how the boiling points of the noble gases change as you go down the group.			
	I can explain how the properties of the noble gases depend on the outer shell of electrons of the atoms.			
	I can predict properties from given trends down the group.			
Group 1	I can recall the general name of the elements in Group 1 of the periodic table.			
	I can state the number of electrons in the outer shell of the alkali metals.			
	I can describe the reactions of the first three alkali metals with oxygen.			
	I can describe the reactions of the first three alkali metals with chlorine.			
	I can describe the reactions of the first three alkali metals with water.			
	I can describe how the reactivity of the alkali metals changes as you go down the group.			
	I can explain how the properties of the alkali metals depend on the outer shell of electrons of the atoms.			
	I can predict properties from given trends down the group.			

Topic	Success Criteria	Progress		
Group 7	I can recall the general name for the elements in Group 7 of the periodic table.			
	I can state the number of electrons in the outer shell of the halogens.			
	I can describe the nature of the compounds formed when chlorine, bromine and iodine react with metals.			
	I can describe the nature of the compounds formed when chlorine, bromine and iodine react with non-metals.			
	I can describe how the relative molecular mass, melting point and boiling point of the halogens change as you go down the group.			
	I can describe how the reactivity of the halogens changes as you go down the group.			
	I can describe what happens when a more reactive halogen reacts with an aqueous solution of a salt containing a less reactive halogen.			
	I can explain how the properties of the halogens depend on the outer shell of electrons of the atoms.			
	I can predict properties from given trends down the group.			

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5.2 Bonding, Structure and the Properties of Matter

5.2.1 Chemical Bonds, Ionic, Covalent and Metallic				
Topic	**Success Criteria**	**Progress**		
Chemical Bonds	I can name the three types of strong chemical bonds.			
	I can describe how the different types of bonds join particles together.			
	I can state the types of elements that ionic bonding occurs between.			
	I can state the types of elements that covalent bonding occurs between.			
	I can state the types of elements that metallic bonding occurs between.			
	I can explain chemical bonding in terms of electrostatic forces and the transfer or sharing of electrons.			
Ionic Bonding	I can describe what happens to the atoms involved when ionic bonds are formed.			
	I can draw dot and cross diagrams to represent the electron transfer during the formation of ionic compounds by metals in Groups 1 and 2 with non-metals in Groups 6 and 7.			
	I can work out the charge on the ions of metals and non-metals from the group number of the element, limited to the metals in Groups 1 and 2, and non-metals in Groups 6 and 7.			
Ionic Compounds	I can describe how ionic compounds are held together.			
	I can deduce that a compound is ionic from a diagram of its structure.			
	I can describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure.			
	I can work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure.			
	I am familiar with the structure of sodium chloride.			

Topic	Success Criteria	Progress		
Covalent Bonding	I can describe how covalent bonds are formed.			
	I can recognise common substances that consist of small molecules from their chemical formula.			
	I can recognise substances as small molecules, polymers or giant structures from diagrams showing their bonding.			
	I can draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane.			
	I can represent the covalent bonds in a small molecule, using a line to represent a single bond.			
	I can represent the covalent bonds in the repeating units of a polymer, using a line to represent a single bond.			
	I can represent the covalent bonds in a part of a giant covalent structure, using a line to represent a single bond.			
	I can describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent molecules or giant structures.			
	I can deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule.			
Metallic Bonding	I can describe how the atoms are arranged in a metal.			
	I can explain how the sharing of delocalised electrons gives rise to strong metallic bonds.			
	I can recognise substances as metallic giant structures from diagrams showing their bonding.			

5.2.2 How Bonding and Structure Are Related to the Properties of Substances				
Topic	**Success Criteria**	**Progress**		
The Three States of Matter	I can name the three states of matter.			
	I can name the changes of state that take place at the melting point of a substance.			
	I can name the changes of state that take place at the boiling point of a substance.			
	I can represent the three states of matter using a simple particle model.			
	I can explain melting, boiling, freezing and condensing using particle theory.			
	I can describe how the amount of energy needed to change the state of a substance relates to the strength of the forces between the particles of the substance.			
	(HT only) I can describe the limitations of the particle model being used to represent the three states of matter.			
	I can predict the states of substances at different temperatures given appropriate data.			
	I can explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding.			
	I can recognise that atoms themselves do not have the bulk properties of materials.			
	(HT only) I can explain the limitations of the particle theory in relation to changes of state.			
State Symbols	I can recall the state symbols used in chemical equations to represent the three states of matter and aqueous solutions.			
	I can include appropriate state symbols when writing chemical equations.			
Properties of Ionic Compounds	I can describe the structure of ionic compounds.			
	I can explain why ionic compounds have high melting points and high boiling points.			
	I can explain why ionic compounds conduct electricity when melted or dissolved in water.			
Properties of Small Molecules	I can describe the general properties of small molecules.			
	I can explain what happens when a substance consisting of small molecules melts or boils.			
	I can explain why larger molecules have higher melting and boiling points.			
	I can explain why small molecules do not conduct electricity.			

Topic	Success Criteria	Progress		
Polymers	I can describe how the atoms in a polymer are linked to other atoms.			
	I can explain why polymers are solids at room temperature.			
	I can recognise polymers from diagrams showing their bonding and structure.			
Giant Covalent Structures	I can give some examples of giant covalent structures.			
	I can describe the general properties of giant covalent structures.			
	I can describe how the atoms in a giant covalent structure are linked to other atoms.			
	I can explain what must happen to the bonds in order to melt or boil a giant covalent structure.			
	I can recognise giant covalent structures from diagrams showing their bonding and structure.			
Properties of Metals and Alloys	I can describe the structure of metals.			
	I can explain why most metals have high melting and boiling points.			
	I can explain why metals can be bent and shaped.			
	I can explain why pure metals are mixed with other elements to make alloys.			
	I can explain why alloys are harder than pure metals.			
Metals as Conductors	I can explain why metals are good conductors of electricity.			
	I can explain why metals are good conductors of thermal energy.			

5.2.3 Structure and Bonding of Carbon				
Topic	**Success Criteria**	**Progress**		
Diamond	I can describe the bonding between the carbon atoms in diamond.			
	I can explain the properties of diamond in terms of its structure and bonding.			
Graphite	I can describe the bonding between the carbon atoms in graphite.			
	I can explain the properties of graphite in terms of its structure and bonding.			
	I can describe the properties that make graphite similar to metals.			
Graphene and Fullerenes	I can describe the structure of graphene.			
	I can explain how the properties of graphene make it useful in electronics and composites.			
	I can explain the properties of graphene in terms of its structure and bonding.			
	I can describe the structure of fullerenes.			
	I can name and give the formula of the first fullerene to be discovered.			
	I can describe the structure of carbon nanotubes.			
	I can explain how the properties of carbon nanotubes make them useful for nanotechnology, electronics and materials.			
	I can recognise graphene and fullerenes from diagrams and descriptions of their bonding and structure.			
	I can give examples of the uses of fullerenes, including carbon nanotubes.			