Combined Science - Chemistry Paper 1 HT
Personal Learning Checklist (PLC)

1. Atomic Structure and the Periodic Table (Paper 1+2)

		Learning Objectives:	Confidence		
Elements, Compounds and Mixtures	1.1	Describe what an elements, compounds and mixtures are.			
	1.2	Name compounds from their formulae.			
	1.3	Write word and balanced symbol equations for the reactions you have studied.			
	1.4	Write balanced half equations and ionic equations. **(HT only)**			
	1.5	Describe how mixtures are separated by filtration, crystallisation, simple distillation, fractional distillation and chromatography.			
	1.6	Explain how these separation methods work and why they are physical processes rather than chemical reactions.			
	1.7	Suggest suitable separation and purification techniques for a given mixture.			
Atomic Structure	1.8	Describe the differences between the plum pudding model and the nuclear model for the atom (as for Physics).			
	1.9	Describe why the new evidence from the scattering experiment led to a change in the atomic model (as for Physics).			
	1.10	Describe the structure of an atom.			
	1.11	Recall the masses and charges of protons, neutrons and electrons.			
	1.12	Identify the number of protons, neutrons and electrons in an atom using the periodic table.			
	1.13	Explain why atoms are electrically neutral.			
	1.14	Explain what an isotope is.			
	1.15	Calculate the relative atomic mass of an element.			
	1.16	Give the approximate size of an atom and a nucleus.			
Electronic Structure	1.17	Draw 'dot and cross' diagrams for the electronic structures for the first 20 elements of the periodic table.			
	1.18	Write electronic structures in numbers for the first 20 elements of the periodic table.			
	1.19	Explain why elements in the same group of the periodic table have similar chemical properties.			
	1.20	Explain why elements in group 0 are unreactive.			

Periodic Table and Patterns in Reactivity	1.21	Describe how elements are arranged on the periodic table in terms of their electron structure.			
	1.22	Describe how the periodic table was developed (early periodic table and Mendeleev).			
	1.23	Describe where metals and non-metals are found on the periodic table and explain why.			
	1.24	Describe the properties of metals and non-metals.			
	1.25	Explain why elements in the same group do similar chemical reactions.			
	1.26	Identify and predict trends in the physical properties of group 0 elements.			
	1.27	Describe trends in physical properties and reactivity of group 1 and use it to predict the properties of a given element.			
	1.28	Describe and write equations for the reactions of the first three group 1 elements with oxygen, chlorine and water.			
	1.29	Describe trends in physical properties and reactivity of group 7 and use it to predict the properties of a given element.			
	1.30	Explain and write equations to show what happens when a halogen is mixed with a salt of a different halogen.			

2. Bonding, Structure and Properties of Matter (Paper 1+2)

Chemical Bonding	2.1	Name the three types of chemical bond and state whether they are between metals only, non-metals only or a metal and a non-metal.			
	2.2	Explain why atoms form chemical bonds.			
	2.3	Describe how atoms bond together in ionic bonding.			
	2.4	Draw dot-and-cross diagrams to represent ionic bonding.			
	2.5	Deduce the formulae of ionic compounds.			
	2.6	Describe how atoms bond together in covalent bonding.			
	2.7	Draw dot-and-cross diagrams to represent covalent bonding.			
States of Matter	2.8	Predict the states of substances (solid, liquid or gas) at different temperatures.			
	2.9	Explain the different temperatures at which changes of state occur in terms of energy transfers and types of bonding.			
	2.10	Recognise that atoms themselves do not have the bulk properties of materials.			
	2.11	Explain the limitations of the particle theory in relation to changes of state when particles are represented by solid inelastic spheres which have no forces between them.			

	2.12	Use state symbols - (s), (l), (g) and (aq).			
Structures and their Properties	2.13	Describe the two types of covalent structure.			
	2.14	Describe the structure of ionic compounds.			
	2.15	Describe the structure of metals.			
	2.16	Describe graphene, fullerenes and carbon nanotubes.			
	2.17	List the properties of each type of structure.			
	2.18	Explain each property in terms of the structure and bonding.			
	2.19	Relate the properties of substances to their uses.			
	2.20	Identify the type of structure from its properties.			
	2.21	Evaluate the different ways of representing structures.			

3. Quantitative Chemistry (Paper 1+2)

Conservation of mass and balanced chemical equations	3.1	Recall the law of conservation of mass.			
	3.2	Balance chemical equations.			
	3.3	Explain what the multipliers (big numbers before a symbol/formula) mean and what the subscript (small) numbers within a formula mean.			
	3.4	Explain why a reaction in a non-enclosed system may appear to involve a change in mass, e.g. oxidation and thermal decomposition.			
	3.5	Describe what a limiting reactant is and explain the effect on the amount of product that can be obtained (in moles or grams). (**HT only**)			
Relative formula mass	3.6	Calculate the relative formula mass (M_r) of a compound.			
	3.7	Show that the sum of the relative formula masses of the reactants equals the sum of the relative formula masses of the products in the quantities shown if an equation is balanced.			
	3.8	Calculate the % by mass of an element in a compound.			
Moles (HT only)	3.9	Define the term 'mole'. (**HT only**)			
	3.10	Give the mass of one mole of a substance from its A_r or M_r. (**HT only**)			
	3.11	Calculate the number of moles of a substance from its mass and vice versa. (**HT only**)			
Calculations based on equations	3.12	Calculate the mass of a reactant or product from a balanced equation when given the mass of one of the other reactants or products. (**HT only**)			
	3.13	Balance an equation by calculating the molar ratio from given masses of reactants and products. (**HT only**)			
	3.14	Describe what a limiting reactant is and explain how this affects the amount of product that can be formed. (**HT only**)			

Concentration in Solutions	3.15	Describe what is meant by concentration and give possible units.			
	3.16	Calculate the mass of solute in a given volume of solution from the concentration.			
	3.17	Explain how the mass of a solute and the volume of a solution are related to the concentration of the solution. (**HT only**)			
Chemical Measurements	3.18	Appreciate that whenever a measurement is made there is some uncertainty.			
	3.19	Represent the distribution of results and make estimations of uncertainty.			
	3.20	Use the range of a set of measurements about the mean as a measure of uncertainty.			

4. Chemical Changes (Paper 1)

Oxidation and Reduction	4.1	Name the reaction between metals and oxygen and name the product formed.			
	4.2	Explain oxidation and reduction in terms of loss or gain of oxygen.			
	4.3	Explain oxidation and reduction in terms of gain or loss of electrons (**HT only**).			
	4.4	Identify which species are oxidised and which are reduced from given symbol equations or half equations (**HT only**).			
Reactivity Series of Metals	4.5	Describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acid (as appropriate) and explain how these reactions can be used to put these metals in order of reactivity (reactivity series).			
	4.6	Explain how the reactivity of metals with water or dilute acids is related to the tendency of a metal atom to form a positive ion.			
	4.7	Deduce the order of reactivity of metals based on experimental results.			
	4.8	Describe what happens in a displacement reaction.			
	4.9	Write ionic equations for displacement reactions (**HT only**).			
Extraction of Metals	4.10	Explain why most metals need to be extracted and describe how the method used depends on the reactivity of the metal.			
	4.11	Describe how metals are extracted from their oxides by reduction with carbon.			
	4.12	Interpret or evaluate specific metal extraction processes from given information.			
pH Scale	4.13	Name the ions produced by acids and the ions that alkalis contain.			
	4.14	Use the pH scale to identify acidic, alkaline and neutral solutions.			
	4.15	Describe how universal indicator (or another wide range indicator) can be used to measure the approximate pH of a solution.			
Strong	4.16	Explain the terms dilute and concentrated acid in terms of amount of substance.			

	4.17	Explain the terms weak and strong acid in terms of the degree of ionisation.			
	4.18	Describe the terms neutrality and relative acidity in terms of the effect on hydrogen ion concentration and the numerical value of pH (whole numbers only).			
Reactions of Acids	4.19	Name the products of the reaction between a **metal** and an acid.			
	4.20	Identify metals that will react with an acid safely.			
	4.21	Explain why this is a redox reaction in terms of gain or loss of electrons (**HT only**).			
	4.22	Name the products of the **neutralisation** reactions between acids and **alkalis** (e.g. soluble metal hydroxides), **bases** (e.g. insoluble metal hydroxides and metal oxides) and metal **carbonates**.			
	4.23	Predict the products from given reactants.			
	4.24	Use the formulae of common ions to deduce the formulae of salts.			
	4.25	Recall the ionic equation for neutralisation.			
	4.26	Describe how to make a pure, dry sample of a named soluble salt from information provided.			
	4.27	**Required Practical –** Prepare 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.			
Electrolysis	4.28	Explain why the ionic compound must be molten or in solution to be electrolysed.			
	4.29	Describe what happens when a molten ionic compound is electrolysed.			
	4.30	Predict the products of the electrolysis of a molten binary ionic compound.			
	4.31	Identify metals that are extracted by electrolysis and explain why.			
	4.32	Explain why extracting metals by electrolysis requires large amounts of energy.			
	4.33	Describe how aluminium is extracted using electrolysis – explain why a mixture is used as the electrolyte and why the positive electrode must be continually replaced.			
	4.34	Predict the products of the electrolysis of an aqueous solution of an ionic compound and explain why these products are made.			
	4.35	**Required Practical –** Investigate what happens when aqueous solutions are electrolysed using inert electrodes.			
	4.36	Describe what happens to the ions at the positive and negative electrodes during electrolysis and write half equations to represent these reactions (**HT only**).			

5. Energy Changes (Paper 1)

Energy Changes	5.1	Describe what exothermic and endothermic reactions are.			
	5.2	Identify exothermic and endothermic reactions from temperature changes.			
	5.3	Identify exothermic and endothermic reactions from energy profiles.			
	5.4	Evaluate uses of exothermic and endothermic reactions.			
	5.5	Describe the energy changes in a reversible reaction.			
	5.6	Calculate the energy transferred in a chemical reaction using bond energies.			
	5.7	**Required Practical –** Investigate the variables that affect temperature changes in reacting solutions, such as acid plus metal, neutralisation and displacement reactions of metals.			

Mathematical Skills (Paper 1+2)

Arithmetic and Numerical Computation	A.	Express numbers in decimal form.			
	B.	Express numbers in standard form.			
	C.	Use ratios, fractions and percentages.			
	D.	Make estimates of the results of simple calculations.			
Handling Data	E.	Use an appropriate number of significant figures.			
	F.	Calculate the mean.			
	G.	Understand the terms mean, mode and median.			
	H.	Make order of magnitude calculations.			
Algebra	I.	Understand and use the symbols: =, <, <<, >>, >, ∝, ~			
	J.	Change the subject of an equation.			
	K.	Substitute numerical values into equations using appropriate units.			
Graphs	L.	Understand that $y = mx+c$ represents a linear relationship.			
	M.	Plot a line graph from experimental data, including drawing a line of best fit.			
	N.	Determine the gradient and intercept of a linear graph.			
	O.	Draw a tangent to a curve and calculate its gradient as a measure of the rate of change.			
Geometry and Trigonometry	P.	Visualise and represent 2D and 3D forms.			
	Q.	Calculate areas of triangles and rectangles.			
	R.	Calculate surface areas and volumes of cubes.			