Y10 Combined Science - Physics and Chem – HT
Personal Learning Checklist (PLC)

Physics

		Dates		
	Learning Objectives:			
1.	**Energy**			
	Conservation and Dissipation of Energy (Kerboodle Chapter 1)			
1.1.	Describe the ways in which energy can be stored.			
1.2.	Describe how energy can be transferred for example: • when an object falls; • when an object hits an obstacle and stops moving; • in bringing water to the boil in a kettle; • on a trampoline; • on a rollercoaster.			
1.3.	Explain what is meant by "conservation of energy"			
1.4.	Explain what is meant by a "closed system"			
1.5.	Calculate the following: o the work done by a force; o the change in gravitational potential energy when an object is moved up or down; o the kinetic energy of an object; o the amount of energy in an elastic potential energy store.			
1.6.	Explain why it is easier to lift an object on the moon than on the earth.			
1.7.	Describe what happens to work that is done to overcome friction.			
1.8.	Describe what is meant by useful and wasted energy.			
1.9.	Describe what happens to "wasted" energy in a system.			
1.10.	Describe what is meant by efficiency.			
1.11.	Calculate the efficiency of an energy transfer in terms of energy or of power.			
1.12.	Explain what is meant by power and how to calculate the power of an appliance.			
1.13.	Explain how energy transfers can be made more efficient (HT only)			
	Energy Transfer by Heating (Kerboodle Chapter 2)			
1.14.	Write down which materials make the best conductors.			
1.15.	Write down which materials make the best insulators.			
1.16.	Describe how the thermal conductivity of a material affects the rate of energy transfer through it by conduction.			
1.17.	Describe how the thickness of a layer of material affects the rate of energy transfer through it by conduction.			
1.18.	Describe what the specific heat capacity of a substance means.			
1.19.	Calculate the energy needed to change the temperature of an object.			
1.20.	Describe how the mass of a substance affects how quickly its temperature changes when you heat it.			

1.21.	*Core practical: describe how to measure the specific heat capacity of a substance.*			
1.22.	Describe how homes are heated.			
1.23.	Describe how you can reduce the rate of energy transfer from your home.			
1.24.	Describe what cavity wall insulation is.			
	Energy Resources (Kerboodle Chapter 3)			
1.25.	Describe how most energy demands are met today.			
1.26.	Name the energy resources that are used.			
1.27.	Describe how nuclear fuels are used in power stations.			
1.28.	Name the other fuels that are used in power stations.			
1.29.	Name the other fuels that are used to generate electricity.			
1.30.	Describe what a wind turbine is made up of.			
1.31.	Describe how waves can be used to generate electricity.			
1.32.	Name the type of power station that uses water running downhill to generate electricity.			
1.33.	Describe how the tides can be used to generate electricity.			
1.34.	Describe what solar cells are and how they are used.			
1.35.	Describe the difference between a panel of solar cells and a solar heating panel.			
1.36.	Describe what geothermal energy is.			
1.37.	Describe how geothermal energy can be used to generate electricity.			
1.38.	Describe what fossil fuels do to the environment.			
1.39.	Explain why people are concerned about nuclear power.			
1.40.	Describe the advantages and disadvantages of renewable energy resources.			
1.41.	Evaluate the use of different energy resources.			
1.42.	Describe how best to use electricity supplies to meet variations in demand.			
1.43.	Compare the economic costs of different energy resources.			
1.44.	Name energy resources that need to be developed to meet people's energy needs in the future.			

3.	**Particle Model of Matter**			
	Molecules and matter (Kerboodle Chapter 6)			
3.1.	Define density and write down its unit.			
3.2.	*Core practical: describe how to measure the density of a solid object or a liquid.*			
3.3.	Use the density equation to calculate the mass or the volume of an object or a sample.			
3.4.	Describe how to tell from its density if an object will float in water.			
3.5.	Describe the different properties of solids, liquids, and gases.			
3.6.	Describe the arrangement of particles in a solid, a liquid, and a gas.			
3.7.	Explain *why* gases are less dense than solids and liquids.			
3.8.	Explain why the mass of a substance that changes state stays the same.			
3.9.	Write down what the melting point of and the boiling point of a substance mean.			
3.10.	Describe what you need to do to melt a solid or to boil a liquid.			
3.11.	Explain the difference between boiling and evaporation.			
3.12.	Use a temperature-time graph to find the melting point or the boiling point of a substance.			

3.13.	Describe how increasing the temperate of a substance affects its internal energy.			
3.14.	Explain the different properties of a solid, a liquid, and a gas.			
3.15.	Describe how the energy of the particles of a substance changes when it is heated.			
3.16.	Explain in terms of particles why a gas exerts pressure.			
3.17.	Write down what latent heat means as a substance changes its state.			
3.18.	Write down what specific latent heat of fusion and of vaporisation mean.			
3.19.	Use specific latent heat in calculations.			
3.20.	Describe how to measure the specific heat latent heat of ice and of water.			
3.21.	Describe how a gas exerts pressure on a surface.			
3.22.	Describe how changing the temperature of a gas in a sealed container affects the pressure of the gas.			
3.23.	Explain why raising the temperature of a gas in a sealed container affects the pressure of the gas.			
3.24.	Describe how to see evidence of gas molecules moving around at random.			

4.	**Atomic Structure**			
	Radioactivity (Kerboodle Chapter 7)			
4.1.	Write down what a radioactive substance is.			
4.2.	Write down the types of radiation given out from a radioactive substance.			
4.3.	Write down what happens when a radioactive source emits radiation (radioactive decay).			
4.4.	Write down the different types of radiation emitted by radioactive sources.			
4.5.	Describe how the nuclear model of the atom was established, (including Bohr's and Chadwick's contributions).			
4.6.	Explain why the 'plum pudding' model of the atom was rejected.			
4.7.	Describe what conclusions were made about the atom from experimental evidence.			
4.8.	Explain why the nuclear model was accepted.			
4.9.	Write down what an isotope is.			
4.10.	Describe how the nucleus of an atom changes when it emits an alpha particle or a beta particle.			
4.11.	Represent the emission of an alpha particle from the nucleus.			
4.12.	Represent the emission of a beta particle from the nucleus.			
4.13.	Write down how far each type of radiation can travel in air.			
4.14.	Describe how different materials absorb alpha, beta, and gamma radiation.			
4.15.	Describe the ionising power of alpha, beta and gamma radiation.			
4.16.	Explain why alpha, beta, and gamma radiation are dangerous.			
4.17.	Write down what the half-life of a radioactive source means.			
4.18.	Write down what the count rate from a radioactive source means.			
4.19.	Be able to calculate count rate after a given number of half-lives. (HT only.)			
4.20.	Describe how to choose a radioactive isotope for a particular job.			

2.	**Electricity**

	Electric Circuits (Kerboodle Chapter 4)			
2.1.	Describe how electric circuits are shown as diagrams.			
2.2.	Write down the difference between a battery and a cell.			
2.3.	Describe what determines the size of an electric current.			
2.4.	Calculate the size of an electric current from the charge flow and the time taken.			
2.5.	Write down what is meant by potential difference.			
2.6.	Write down what resistance is and what its unit is.			
2.7.	Write down Ohm's law.			
2.8.	Describe what happens when you reverse the potential difference across a resistor.			
2.9.	Describe what happens to the resistance of a filament lamp as its temperature increases.			
2.10.	Describe how the current through a diode depends on the potential difference across it.			
2.11.	*Core practical: investigating I-V characteristics of a resistor, bulb and diode.*			
2.12.	Describe what happens to the resistance of a temperature-dependent resistor as its temperature increases.			
2.13.	Describe what happens to the resistance of a light-dependent resistor as the light level increases.			
2.14.	Describe the current, potential difference, and resistance for each component in a series circuit.			
2.15.	Describe the potential difference of several cells in series.			
2.16.	Calculate the total resistance of two resistors in series.			
2.17.	Explain why adding resistors in series increase the total resistance.			
2.18.	Describe the currents and potential differences for components in a parallel circuit.			
2.19.	Calculate the current through a resistor in a parallel circuit.			
2.20.	Explain why the total resistance of two resistors in parallel is less than the resistance of the smaller individual resistor.			
2.21.	Explain why adding resistors in parallel decrease the total resistance.			

	Equations that I need to know:			
I.	$\mathbf{work\ done} = \mathbf{force} \times \mathbf{distance}$ (J) (N) (m)			
II.	$\mathbf{kinetic\ energy} = {}^{1}/_{2} \times \mathbf{mass} \times \mathbf{speed}^2$ (J) (kg) (m/s)			
III.	$\mathbf{weight} = \mathbf{mass} \times \mathbf{gravitational\ field\ strength}$ (N) (kg) (N/kg)			
IV.	$\mathbf{gravitational\ potential\ energy} = \mathbf{mass} \times \mathbf{gravitational\ field\ strength} \times \mathbf{change\ in\ height}$ (J) (kg) (N/kg) (m)			
V.	$\mathbf{energy\ transferred} = \mathbf{power} \times \mathbf{time}$ (J) (W) (s)			

VI.	$\textbf{efficiency} = \dfrac{\textbf{useful output energy transfer}}{\textbf{total input energy transfer}}$			
VII.	**charge flow (*Q*) = current (*I*) x time taken (*t*)** (coulombs, C) (amperes, A) (seconds, s)			
VIII.	**potential difference across a component (*V*) = energy transferred *(E)*** (joules, J) / **charge (*Q*)** (coulombs, C)			
IX.	**resistance (*R*) = potential difference (*V*)** (volts, V) / (ohms, Ω) **current (*I*)** (coulombs, C)			
X.	**power supplied (*P*) = current (*I*) x potential difference (*V*)** (watts, W) (amperes, A) (volts, V)			
XI.	**Power (*P*)** (watts, W) **= energy transferred *(E)*** (joules, J) / **time (*t*)** (seconds, s)			
XII.	**power (*P*) = current^2 (I^2) x resistance (*R*)** (watts, W) (amperes, A) (ohms, Ω)			
XIII.	**charge flow (*Q*) = current (*I*) x time taken (*t*)** (coulombs, C) (amperes, A) (seconds, s)			
XIV.	**Density (ρ)= mass (m)** (kg) / (kg/m^3) **volume (V)** (m^3)			

Chemistry (Paper 1)

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

		Learning Objectives:	Confidence		
Elements, Compounds and Mixtures (Y9)	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 (Y9)	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 (Y9)	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.			

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	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.			
Relative formula mass	3.5	Calculate the relative formula mass (M_r) of a compound.			
	3.6	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.			
	3.7	Calculate the % by mass of an element in a compound.			
Concentration in Solutions	3.8	Describe what is meant by concentration and give possible units.			
	3.9	Calculate the mass of solute in a given volume of solution from the concentration.			
	3.10	Explain how the mass of a solute and the volume of a solution are related to the concentration of the solution. (**HT only**)			

4. Energy Changes (Paper 1)

Energy Changes	4.1	Describe what exothermic and endothermic reactions are.			
	4.2	Identify exothermic and endothermic reactions from temperature changes.			
	4.3	Identify exothermic and endothermic reactions from energy profiles.			
	4.4	Evaluate uses of exothermic and endothermic reactions.			
	4.5	**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.			