Y10 Combined Science Bio and Chem – Higher Tier
Personal Learning Checklist (PLC)

	Can you…?	Dates		
1.	**Cell Biology**			
	Cell Structure (Year 9)			
1.1.	Name the main organelles of plant and animal cells (eukaryotic cells).			
1.2.	Recall the relative size of bacterial cells (prokaryotic cells).			
1.3.	Describe the difference in how the genetic material is found within eukaryotic and prokaryotic cells.			
1.4.	Explain how the main sub-cellular structures, including the nucleus, cell membranes, mitochondria, cell wall and chloroplasts in plant cells and plasmids in bacterial cells are related to their functions.			
1.5.	Explain how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism. Including sperm cells, nerve cells and muscle cells in animals and root hair cells, xylem and phloem cells in plants.			
1.6.	Describe cell differentiation.			
1.7.	Describe the differences in magnification and resolution between electron and light microscopes.			
	Transport in Cells (Year 9)			
1.8.	Explain how substances may move into and out of cells across the cell membranes via diffusion.			
1.9.	Describe diffusion.			
1.10.	Recall that some of the substances transported in and out of cells by diffusion are oxygen and carbon dioxide in gas exchange, and of the waste product urea from cells into the blood plasma for excretion in the kidney.			
1.11.	Describe factors the affect the rate of diffusion.			
1.12.	Recall that a single-celled organism has a relatively large surface area to volume ratio to allow sufficient transport of molecules into and out of the cell.			
1.13.	Explain how the small intestine and lungs in mammals, gills in fish, and the roots and leaves in plants, are adapted for exchanging materials.			
1.14.	List factors that increase the effectiveness of an exchange surface.			
1.15.	Describe osmosis.			
1.16.	Recall that active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This requires energy from respiration.			
1.17.	Link the structure of a root hair cell to its function.			
1.18.	Describe a use for active transport in both plants and animals.			
1.19.	Explain the difference between diffusion, osmosis and active transport.			

2.	Organisation			
	Principles of Organisation			
2.1.	Explain organisational hierarchy.			
2.2.	Define a cell, tissue, organ and organism.			
	Animal Tissues, Organs and Organ Systems			
2.3.	Know that digestive system is an example of an organ system in which several organs work together to digest and absorb food.			
2.4.	Relate knowledge of enzymes to metabolism.			
2.5.	Describe the structure function and optimum conditions for enzymes.			
2.6.	Define denaturation.			
2.7.	Recall the sites of production and the action of amylase, proteases and lipases.			
2.8.	Know that digestive enzymes convert food into small soluble molecules that can be absorbed into the bloodstream.			
2.9.	State that the products of digestion are used to build new carbohydrates, lipids and proteins. Some glucose is used in respiration.			
2.10.	Recall where bile is made and stored and its pH and function.			
2.11.	State conditions that increase the rate of fat breakdown by lipase.			
2.12.	Recall the structure and functioning of the human heart and lungs, including how lungs are adapted for gaseous exchange.			
	Organising Animals and Plants			
2.13.	Recall that the heart is an organ that blood around the body in a double circulatory system. The right ventricle pumps blood to the lungs where gas exchange takes place. The left ventricle pumps blood around the rest of the body.			
2.14.	Name the major blood vessels.			
2.15.	Describe the structure of the lungs.			
2.16.	Explain natural and artificial pacemakers.			
2.17.	Name the three different types of blood vessel and explain how the structure of these vessels relates to their functions.			
2.18.	Describe the components of blood and who they are adapted to function.			

	Plant Tissues, Organs and Systems			
2.19.	Know the function of epidermal tissues palisade mesophyll, spongy mesophyll, xylem and phloem and meristem tissue.			
2.20.	Describe the structures of tissues in the leaf and relate to their functions.			
2.21.	Explain how root hair cells are adapted for the efficient uptake of water and mineral ions.			
2.22.	Know the structure and function of xylem tissue.			
2.23.	Define factors which affect the rate of transpiration.			
2.24.	Explain the role of stomata and guard cells.			
2.25.	Explain the role of phloem tissue and name this process.			

3.	**Infection and Response**			
	Communicable Diseases			
3.1.	Explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants.			
3.2.	Define the term pathogen.			
3.3.	Explain how bacteria and viruses may reproduce in the body and why they make you fell ill.			
3.4.	Give examples of how the spread of diseases can be reduced.			
3.5.	Know that Measles is a viral disease and describe the symptoms.			
3.6.	Explain the effects of HIV and how it is transmitted.			
3.7.	Describe tobacco mosaic virus (TMV).			
3.8.	Know that Salmonella food poisoning is spread by bacteria ingested in food, or on food prepared in unhygienic conditions.			
3.9.	Describe the symptoms of salmonella food poisoning.			
3.10.	Know how Gonorrhoea is a transmitted and how its spread can be reduced.			
3.11.	State the cause of Gonorrhoea and describe the symptoms and how it is treated.			
3.12.	Describe rose black spot and state its cause.			
3.13.	Know how rose black spot is spread in the environment and how it can be treated.			
3.14.	Describe malaria and state its cause.			
3.15.	Know how malaria is spread and how to reduce the spread of the disease.			
3.16.	Define some of body's natural defences to infection.			
3.17.	Explain to role of white blood cells.			
	Preventing and Treating Disease			
3.18.	Describe the process of vaccination.			
3.19.	Explain "herd immunity".			
3.20.	State what antibiotics can treat and explain the development of antibiotic resistance bacteria.			
3.21.	Define painkillers.			
3.22.	Explain why it is difficult to develop drugs that kill viruses.			
3.23.	Know that traditionally drugs were extracted from plants and microorganisms and give some common examples including who discovered Penicillin and from what.			
3.24.	State that most new drugs are synthesised by chemists in the pharmaceutical industry. However, the starting point may still be a chemical extracted from a plant.			
3.25.	For new medicinal drugs explain the stages in preclinical and clinical trial .			
3.26.	Define placebo.			
3.27.	Explain double blind trials.			

	Non-communicable Diseases			
3.28.	Describe coronary heart disease: a non-communicable disease			
3.29.	State that health is the state of physical and mental wellbeing.			
3.30.	Know that defects in the immune system mean that an individual is more likely to suffer from infectious diseases.			
3.31.	Recall that immune reactions initially caused by a pathogen can trigger allergies such as skin rashes and asthma.			
3.32.	Know that severe physical ill health can lead to depression and other mental illness.			
3.33.	Explain the effect of lifestyle on some non-communicable diseases and that they can be caused by and their increased by the interaction of a number of factors,			
3.34.	Recall that benign tumours and malignant tumours result from uncontrolled cell division. Malignant tumour cells are cancers.			
3.35.	Know lifestyle risk factors for various types of cancer including smoking, obesity, common viruses and UV exposure. There are also genetic risk factors for some cancers.			

	Cell Division			
1.20	Recall that the nucleus of a cell contains chromosomes made of DNA molecules. Each chromosome carries a large number of genes. In body cells the chromosomes are normally found in pairs.			
1.21	Give an overview of mitosis.			
1.22	Understand that Cell division by mitosis is important in the growth and development of multicellular organisms.			
1.23	Recognise and describe situations where mitosis is occurring.			
1.24	Define a stem cell.			
1.25	Recall that stem cells from human embryos and adult bone marrow can be cloned and made to differentiate into many different types of human cells.			
1.26	Name some conditions which may be helped by treatment with stem cells.			
1.27	Discuss the ethical or religious objections and potential risk of stem cell use.			
1.28	Recall that stem cells from meristems in plants can be used to produce clones of plants quickly and economically and describe possible uses.			

5.	Homeostasis and Response			
	Homeostasis			
5.1	Define homeostasis.			
5.2	Name three levels maintained by homeostasis.			
5.3	State that automatic control systems may involve nervous responses or chemical responses.			
5.4	Define receptors, coordination centres and effectors.			
	The Human Nervous System			
5.5	Explain how the structure of the nervous system is adapted to its functions.			
5.6	State the main function of the nervous system.			
5.7	Describe how information from receptors is carried to the brain to coordinate the response.			
5.8	Describe the roles of sensory neurones, relay neurones, motor neurones, synapses and effectors in a reflex action, and state that reflex actions are automatic and rapid.			

7.	Ecology			
	B16 Adaptations, Interdependence and Competition			
7.1.	Suggest the factors for which organisms are competing in a given habitat.			
7.2.	Suggest how organisms are adapted to the conditions in which they live.			
7.3.	Define an ecosystem.			
7.4.	Define interdependence.			
7.5.	Explain what is meant by a 'stable community'.			
7.6.	Explain how a change in an abiotic factor would affect a given community.			
7.7.	List abiotic factors.			
7.8.	Explain how a change in a biotic factor might affect a given community.			
7.9.	List biotic factors.			
7.10.	Explain how organisms are adapted to live in their natural environment.			
	Organisation of an Ecosystem			
7.11.	Define a producer, primary consumers, secondary consumers and tertiary consumers.			
7.12.	Construct food chains.			
7.13.	Explain the use of transects and quadrats.			
7.14.	Explain why, in a stable community, the numbers of predators and prey rise and fall in cycles.			
7.15.	Recall the carbon cycle.			
7.16.	Recall the water cycle.			
7.17.	Explain the role of microorganisms in cycling materials through an ecosystem.			
7.18.	Recall that biogas generators can be used to produce methane gas as a fuel.			
7.19.	State some environmental changes.			

Required Practicals

RP1	Use a light microscope to observe, draw and label a selection of plant and animal cells. A magnification scale must be included.			
RP2	Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.			
RP3	Use qualitative reagents to test for a range of carbohydrates, lipids and proteins.			
RP4	Investigate the effect of pH on the rate of reaction of amylase enzyme.			
RP6	Plan and carry out an investigation into the effect of a factor on human reaction time.			
RP7	Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species.			

Mathematical Skills (Paper 1+2) (BIO and CHEM)

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: =, <, <<, >>, >, α, ~			
	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.			

Combined Science - Chemistry End of Year Higher Tier Personal Learning Checklist (PLC)

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

		Learning Objectives:	Confidence		
Elements, Compounds and Mixtures (Y10)	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.			
Periodic Table and Patterns in Reactivity (Y10)	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.			

8. Chemical Analysis (Paper 2)

		Learning Objectives:	**Confidence**		
Chemical Analysis	8.1	Describe what is meant by the term 'pure' in chemistry and in everyday language.			
	8.2	Use melting and boiling point data to distinguish between pure and impure substances.			
	8.3	Describe what a formulation is and identify formulations from given information.			
	8.4	Describe how to test for the following gases (and the results of the tests): hydrogen, oxygen, carbon dioxide and chlorine.			
Chromatography	8.5	Describe and explain how paper chromatography can be used to separate mixtures.			
	8.6	Explain how to identify pure and impure substances by chromatography.			
	8.7	Interpret chromatograms and calculate R_f values from chromatograms.			
	8.8	**Required Practical –** Investigate how paper chromatography can be used to separate and tell the difference between coloured substances. Calculate R_f values.			

7. Organic Chemistry (Paper 2)

		Learning Objectives:	Confidence		
Crude Oil and Alkanes	7.1	Describe what crude oil is.			
	7.2	Define the terms mixture and hydrocarbon.			
	7.3	State the properties of hydrocarbons and describe the trends in these properties.			
	7.4	Describe how crude oil is separated.			
	7.5	Explain why crude oil is separated and how the technique works.			
	7.6	Name some of the useful products obtained from crude oil.			
	7.7	Describe what an alkane is.			
	7.8	Identify an alkane from its name, molecular formula or displayed formula.			
Fuels and Combustion	7.9	Name the elements that fuels contain.			
	7.10	List the products of combustion (complete and incomplete) and identify the problems associated with these products.			
	7.11	State what type of chemical reaction combustion is and explain why.			
	7.12	Write and balance symbol equations for combustion reactions.			
Cracking and Alkenes	7.13	Explain what cracking is and why it is carried out.			
	7.14	Describe how steam and catalytic cracking are carried out, name the products and identify some uses of these products.			
	7.15	Balance symbol equations for cracking.			
	7.16	Describe what an alkene is.			
	7.17	Identify an alkene from its name, molecular formula or displayed formula.			
	7.18	State the general formula of an alkene.			
	7.19	Describe how to test for an alkene using bromine water.			
	7.20	Explain why bromine reacts with alkenes but not alkanes in terms of reactivity.			
	7.21	Explain how modern life depends on the uses of hydrocarbons.			

9. Chemistry of the Atmosphere (Paper 2)

		Learning Objectives:	Confidence		
Chemistry of the Atmosphere	9.1	Recall the proportions of the gases that currently make up the Earth's atmosphere.			
	9.2	Describe the main changes to the Earth's atmosphere over the past 4.6 billion years and some of the likely causes of these changes.			
	9.3	Explain why evidence for this is limited.			
	9.4	Interpret evidence that is provided to evaluate different theories about the Earth's early atmosphere.			
	9.5	Explain how oxygen increased in the atmosphere (including an equation).			
	9.6	Explain how carbon dioxide decreased.			
	9.7	Describe and explain the formation of deposits of limestone, coal, crude oil and natural gas.			
	9.8	Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter.			
	9.9	Explain how the greenhouse effect enables the Earth to support life.			
	9.10	Name three greenhouse gases.			
	9.11	Recall two human activities that increase greenhouse gases in the atmosphere.			
	9.12	Evaluate the quality of evidence (from provided information) for global climate change.			
	9.13	Describe uncertainties in the evidence base.			
	9.14	Recognise the importance of peer review of results and of communicating results to a wide range of audiences.			
	9.15	Describe briefly four potential effects of global climate change.			
	9.16	Discuss the scale, risk and environmental implications of global climate change.			
	9.17	State what is meant by the term 'carbon footprint'.			
	9.18	Describe actions to reduce emissions of carbon dioxide and methane.			
	9.19	Give reasons why actions may be limited.			
	9.20	Describe how carbon monoxide, soot (carbon particles), sulfur dioxide and oxides of nitrogen are produced by burning fuels			
	9.21	Describe and explain the problems caused by increased amounts of these pollutants in the air			

10. Using Resources

		Learning Objectives:	Confidence		
Using Resources	10.1	State examples of natural products that are supplemented or replaced by agricultural and synthetic products.			
	10.2	Distinguish between finite and renewable resources given appropriate information.			
	10.3	Extract and interpret information about resources from charts, graphs and tables.			
	10.4	Use orders of magnitude to evaluate the significance of data.			
	10.5	State what is meant by the term 'potable water'.			
	10.6	Distinguish between potable water and pure water.			
	10.7	Describe the differences in treatment of ground water and salty water.			
	10.8	Give reasons for the steps used to produce potable water.			
	10.9	**Required Practical –** Analysis and purification of water samples from different sources, including pH, dissolved solids and distillation.			
	10.10	Describe some of the processes involved in sewage and waste water treatment.			
	10.11	Comment on the relative ease of obtaining potable water from waste, ground and salt water.			
	10.12	Describe how metals can be obtained by phytomining and bioleaching (**HT only**).			
	10.13	Explain why alternative methods of extracting metals are necessary (**HT only**).			
	10.14	Evaluate alternative biological methods of metal extraction, given appropriate information (**HT only**).			
	10.15	Describe what a life cycle assessment (LCA) is and state the four stages that are considered.			
	10.16	Explain why an LCA is not purely objective.			
	10.17	Discuss how a LCA can be used to evaluate a product, but how it can also be misused, e.g. to support claims for advertising purposes.			
	10.18	Give three reasons why reducing the use of/reusing/recycling materials is important.			
	10.19	Give examples of materials that are produced from limited raw materials.			
	10.20	Describe how glass can be reused or recycled.			
	10.21	Describe how metals can be recycled.			
	10.22	Evaluate ways of reducing the use of limited resources, given appropriate information.			