AQA GCSE Combined Science: Trilogy Topic Checklists **4.1 Cell Biology**

4.1.1 Cell Structure				
Topic	**Success Criteria**	**Progress**		
Eukaryotes and Prokaryotes	I can name and identify the main parts present in a eukaryotic cell.			
	I can name and identify the main parts present in a prokaryotic cell.			
	I can describe how genetic material is stored in bacterial cells.			
	I can compare the relative sizes of prokaryotic cells and eukaryotic cells.			
	I can make order of magnitude calculations, including the use of standard form.			
Animal and Plant Cells	I can name and identify the main parts present in most animal cells.			
	In addition to the parts found in animal cells, I can name and identify the main parts present in most plant cells.			
	I can explain how the main sub-cellular structures are related to their functions.			
	I can describe how to use a light microscope to observe, draw and label a selection of plant and animal cells (required practical activity 1).			
Cell Specialisation	I can give some examples of specialised animal cells.			
	I can give some examples of specialised plant cells.			
	I can explain how the structure of different types of cells relate to their function in a tissue, an organ or organ system, or the whole organism.			
Cell Differentiation	I can describe when differentiation occurs in most types of animal cells and in many types of plant cells.			
	I can describe the main purpose of cell division in mature animals.			
	I can explain the importance of cell differentiation.			

Topic	Success Criteria	Progress		
Microscopy	I understand how microscopy techniques have developed over time.			
	I can explain how electron microscopy has increased understanding of sub-cellular structures.			
	I can carry out calculations involving magnification, real size and image size using the formula: $\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$			
	I can express answers in standard form where appropriate.			

4.1.2 Cell Division				
Topic	**Success Criteria**	**Progress**		
Chromosomes	I can describe where chromosomes are located in a human body cell.			
	I can explain the difference between chromosomes, DNA and genes.			
	I can give the number of chromosomes present in a human body cell and how these are arranged.			
Mitosis and the Cell Cycle	I can describe what happens to the genetic material in cells during the cell cycle.			
	I can describe the stages of the cell cycle, including mitosis.			
	I can explain why cell division by mitosis is important in multicellular organisms.			
	I can recognise and describe situations where mitosis occurs.			
Stem Cells	I can give a definition for the term 'stem cell'.			
	I can describe the function of stem cells in embryos, in adult animals and in the meristems in plants.			
	I can describe how stem cells in embryos can be cloned and made to differentiate into most different types of human cells.			
	I can describe the process of therapeutic cloning.			
	I can explain how treatment with stem cells may be able to help conditions such as diabetes and paralysis.			
	I can describe how stem cells from adult bone marrow can form many types of cells including blood cells.			
	I can evaluate the practical risks and benefits, as well as social and ethical issues, of the use of stem cells in medical research and treatments.			
	I can describe how meristem tissue in plants can differentiate into any type of plant cell, throughout the life of the plant.			
	I can give examples of how stem cells from meristems in plants can be used.			

4.1.3 Transport in Cells				
Topic	**Success Criteria**	**Progress**		
Diffusion	I can describe how substances are transported into and out of cells by diffusion.			
	I can give examples of some substances that are transported in and out of cells by diffusion.			
	I can explain how the following factors affect the rate of diffusion: • difference in concentration (concentration gradient); • temperature; • surface area of the membrane.			
	I can explain how the surface area to volume ratio of a single-celled organism allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.			
	I can calculate and compare surface area to volume ratios.			
	I can explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area to volume ratio.			
	I can describe how the small intestine and lungs in mammals, gills in fish and the roots and leaves in plants are adapted for exchanging materials.			
	I can explain why surfaces and organ systems in multicellular organisms are specialised.			
	I can explain how the effectiveness of an exchange surface is increased by: • having a large surface area; • a membrane that is thin, to provide a short diffusion path; • (in animals) having an efficient blood supply; • (in animals, for gaseous exchange) being ventilated.			

Topic	Success Criteria	Progress		
Osmosis	I can describe how substances are transported into and out of cells by osmosis.			
	I can describe an experiment to investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue (required practical activity 2).			
	I can use simple compound measures of rate of water uptake.			
	I can use percentages and calculate percentage gain and loss of mass of plant tissue.			
	I can plot, draw and interpret graphs to show the gain or loss of mass of plant tissue.			
Active Transport	I can describe how substances are transported into and out of cells by active transport.			
	I can explain why active transport is used to absorb mineral ions into plant root hairs.			
	I can explain why active transport is used to absorb sugar molecules from the gut into the blood.			
	I can explain the differences between diffusion, osmosis and active transport.			

AQA GCSE Combined Science: Trilogy Topic Checklists **4.2 Organisation**

4.2.1 Principles of Organisation				
Topic	**Success Criteria**	**Progress**		
Principles of Organisation	I can explain the differences between cells, tissues, organs and organ systems.			

4.2.2 Animal Tissues, Organs and Organ Systems				
Topic	**Success Criteria**	**Progress**		
The Human Digestive System	I can describe how the organs of the digestive system work together to digest and absorb food.			
	I can describe how to test for sugars, starch, proteins and lipids using qualitative reagents, including the expected results (required practical activity 3).			
	I can describe the role of enzymes in digestion.			
	I can describe how enzyme activity is affected by temperature and pH changes.			
	I can carry out rate calculations for chemical reactions.			
	I can explain enzyme action using the 'lock and key theory', including the specificity of the active site.			
	I can recall the sites of production and the action of amylase, proteases and lipases.			
	I can give the reactants and products of the reactions catalysed by carbohydrases (including amylase), proteases and lipases.			
	I can describe a method to investigate the effect of pH on the rate of reaction of amylase enzyme (required practical activity 4).			
	I can explain what the products of digestion are used for in the body.			
	I can give the sites of production and storage of bile.			
	I can describe the function of bile and explain why it is alkaline.			

Topic	Success Criteria	Progress		
The Heart and Blood Vessels	I can name and identify the main structures associated with the lungs.			
	I can explain how the lungs are adapted for gaseous exchange.			
	I can name and identify the four chambers of the heart.			
	I can explain the role of the heart in a double circulatory system.			
	I can name and identify the main blood vessels associated with the heart.			
	I can explain how resting heart rate is controlled.			
	I can describe the function of artificial pacemakers.			
	I can identify the three different types of blood vessel present in the body.			
	I can explain how the structure of arteries, veins and capillaries relates to their function.			
	I can use simple compound measures such as rate and carry out rate calculations for blood flow.			
Blood	I can name the four components of blood.			
	I can describe the functions of each of the components of blood.			
	I can recognise the different types of blood cells in a photograph or diagram.			
	I can explain how the different types of blood cells are adapted to their functions.			
	I can evaluate the risks related to the use of blood products.			

Topic	Success Criteria	Progress		
Coronary Heart Disease: A Non-Communicable Disease	I can describe what happens to the coronary arteries in coronary heart disease and explain how this affects the heart muscle.			
	I can describe how stents are used to treat coronary heart disease.			
	I can describe how statins are used to treat coronary heart disease.			
	I can describe how heart valves may become faulty and explain the consequences of faulty heart valves.			
	I can describe how faulty heart valves can be replaced using biological or mechanical valves.			
	I can describe how a donor heart, or heart and lungs can be transplanted in the case of heart failure.			
	I can explain when an artificial heart might be used.			
	I can evaluate the advantages and disadvantages of treating cardiovascular diseases by drugs (statins), mechanical devices (stents) or transplant.			
Health Issues	I can give a definition for the term 'health'.			
	I can give some factors that contribute to ill physical and mental health.			
	I can describe how different types of diseases may interact.			
	I can construct and interpret frequency tables and diagrams, bar charts and histograms, and use a scatter diagram to identify a correlation between two variables.			

Topic	Success Criteria	Progress		
The Effect of Lifestyle on Some Non-Communicable Diseases	I can discuss the human and financial cost of some non-communicable diseases to an individual, a local community, a nation or globally.			
	I can give some examples of risk factors that are linked to an increased rate of a disease.			
	I can explain the effect of lifestyle factors including diet, alcohol and smoking on the incidence of non-communicable diseases at local, national and global levels.			
	I can explain that many diseases are caused by the interaction of a number of factors.			
	I can extract and interpret information from charts, graphs and tables, and use a scatter diagram to identify a correlation between two variables in terms of risk factors.			
Cancer	I can give a definition for the term 'cancer'.			
	I can explain the difference between benign and malignant tumours.			
	I can give some lifestyle and genetic risk factors for various types of cancer.			

4.2.3 Plant Tissues, Organs and Systems				
Topic	**Success Criteria**	**Progress**		
Plant Tissues	I can name and identify the main tissues present in plants.			
	I can explain how the structures of plant tissues are related to their functions.			
	I can describe the structure of a leaf.			
Plant Organ System	I can name the parts of a plant that form an organ system for the transport of substances around the plant.			
	I can explain how the structure of root hair cells is adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.			
	I can describe the role of xylem tissue in plants.			
	I can explain how the structure of xylem tissue is adapted for the transport of water in the transpiration stream.			
	I can describe the role of stomata and guard cells in leaves.			
	I can explain the effect of the following factors on the rate of transpiration: • temperature; • humidity; • air movement; • light intensity.			
	I can describe the role of phloem tissue in plants.			
	I can explain how the structure of phloem tissue is adapted for the transport of sugars by translocation.			

AQA GCSE Combined Science: Trilogy
Topic Checklists **4.3 Infection and Response**

4.3.1 Communicable Diseases				
Topic	**Success Criteria**	**Progress**		
Communicable (Infectious) Diseases	I can give a definition for the term 'pathogen' and give some examples of pathogens.			
	I can describe some ways that diseases caused by viruses, bacteria, protists and fungi are spread.			
	I can explain how the spread of diseases can be reduced or prevented.			
	I can describe how bacteria and viruses reproduce inside the body.			
	I can explain how bacteria can make us feel ill.			
	I can explain how viruses can cause cell damage.			
Viral Diseases	I can describe how measles is spread.			
	I can describe the symptoms of measles.			
	I can explain why most young children are vaccinated against measles.			
	I can describe how HIV is spread.			
	I can describe the initial symptoms of HIV infection.			
	I can explain when late-stage HIV infection (AIDS) occurs.			
	I can describe the signs of tobacco mosaic virus (TMV) infection in plants.			
	I can explain how TMV affects the growth of plants.			
Bacterial Diseases	I can describe how *Salmonella* food poisoning is spread.			
	I describe the symptoms of *Salmonella* food poisoning and explain how they are caused.			
	I can explain how the spread of *Salmonella* in poultry is controlled in the UK.			
	I can describe how gonorrhoea is spread.			
	I can describe the symptoms of gonorrhoea.			
	I can explain how the spread of gonorrhoea can be controlled.			
	I can explain why gonorrhoea is no longer easily treated with the antibiotic penicillin.			

Topic	Success Criteria	Progress		
Fungal Diseases	I can describe how rose black spot is spread in the environment.			
	I can describe the signs of rose black spot in plants.			
	I can explain how rose black spot affects the growth of plants.			
	I can explain how rose black spot can be treated.			
Protist Diseases	I can describe how malaria is spread.			
	I can describe the symptoms of malaria.			
	I can explain how the spread of malaria can be controlled.			
Human Defence Systems	I can describe the non-specific defence systems of the human body against pathogens.			
	I can explain the role of the immune system in the defence against disease.			
	I can explain how white blood cells help to defend against pathogens by: • phagocytosis; • antibody production; • antitoxin production.			
Vaccination	I can explain how vaccination prevents illness.			
	I can explain how the spread of pathogens can be reduced by immunising a large proportion of the population (herd immunity).			
Antibiotics and Painkillers	I can describe how antibiotics, such as penicillin help to cure bacterial disease.			
	I can explain why it is important that specific bacteria are treated using specific antibiotics.			
	I can explain why the emergence of strains resistant to antibiotics is of great concern.			
	I can explain why antibiotics cannot be used to treat viral infections.			
	I can explain what painkillers are used for.			
	I can explain why it is difficult to develop drugs that kill viruses.			

Topic	Success Criteria	Progress		
Discovery and Development of Drugs	I can recall the plant or microorganism from which the following drugs were extracted: • the heart drug digitalis; • the painkiller aspirin; • the antibiotic penicillin.			
	I can describe how new drugs are synthesised.			
	I can explain why new drugs have to be tested and trialled before being used.			
	I can describe how preclinical testing is done in a laboratory.			
	I can describe the stages of a clinical trial using healthy volunteers and patients.			
	I can explain the use of a placebo in a double-blind trial.			

AQA GCSE Combined Science: Trilogy Topic Checklists **4.4 Bioenergetics**

4.4.1 Photosynthesis				
Topic	**Success Criteria**	**Progress**		
Photosynthetic Reaction	I can write a word equation to represent photosynthesis.			
	I can name the substances represented by the chemical symbols CO_2, H_2O, O_2 and $C_6H_{12}O_6$.			
	I can explain why photosynthesis is an endothermic reaction.			
Rate of Photosynthesis	I can explain the effect of the following factors on the rate of photosynthesis: • temperature; • light intensity; • carbon dioxide concentration; • amount of chlorophyll.			
	I can describe an experiment to investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed (required practical activity 5).			
	I can measure and calculate rates of photosynthesis.			
	I can extract and interpret graphs of photosynthetic rate involving one limiting factor.			
	I can plot and draw appropriate graphs, selecting an appropriate scale for axes.			
	(HT only) I can explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor.			
	(HT only) I can use inverse proportion – the inverse square law and light intensity in the context of photosynthesis.			
	(HT only) I can explain why limiting factors are important in the economics of enhancing the conditions in greenhouses.			
Uses of Glucose from Photosynthesis	I can describe some ways that the glucose produced in photosynthesis may be used.			
	I can explain how plants produce proteins.			

4.4.2 Respiration				
Topic	**Success Criteria**	**Progress**		
Aerobic and Anaerobic Respiration	I can explain why cellular respiration is an exothermic reaction.			
	I can explain how the energy transferred by respiration in cells is used by the organism.			
	I can compare the processes of aerobic and anaerobic respiration with regard to the need for oxygen, the differing products and the relative amounts of energy transferred.			
	I can write a word equation to represent aerobic respiration.			
	I can name the substances represented by the chemical symbols $C_6H_{12}O_6$, O_2, CO_2 and H_2O.			
	I can write a word equation to represent anaerobic respiration in muscles.			
	I can explain the difference in the amount of energy transferred in anaerobic respiration compared to aerobic respiration.			
	I can write a word equation to represent anaerobic respiration in plant and yeast cells.			
	I can describe some commercial uses of anaerobic respiration in yeast cells (fermentation).			
Response to Exercise	I can describe how the human body reacts to the increased demand for energy during exercise.			
	I can explain what type of respiration takes place if insufficient oxygen is supplied and the effect this has on muscles.			
	(HT only) I can describe what happens to accumulated lactic acid after exercise.			
	(HT only) I can give a definition for the term 'oxygen debt'.			
Metabolism	I can explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids.			
	I can give a definition for the term 'metabolism'.			
	I can give some examples of metabolism in living organisms.			