

# BIOLOGY

## Chapter 1: Cell structure and Transport (Paper 1)

	Aiming for Grade 4 (C)	Aiming Grade 6 (B)	Aiming for Grade 8 (A*)
Lesson 1.1	<ul style="list-style-type: none"> <li>• Use a light microscope.</li> <li>• State why microscopes are useful in the study of cell biology.</li> <li>• Calculate total magnification.</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the difference between magnification and resolution.</li> <li>• Describe the advantages and disadvantages of using a light and an electron microscope.</li> <li>• Use the formula: magnification = size of image / size of real object.</li> </ul>	<ul style="list-style-type: none"> <li>• Compare and contrast the magnification and resolution obtained by using light and electron microscopes.</li> <li>• Justify the use of an electron microscope.</li> <li>• Rearrange the magnification formula and measure the size of cells.</li> </ul>
Lesson 1.2	<ul style="list-style-type: none"> <li>• Identify a plant and an animal cell from a diagram.</li> <li>• Name the main parts of cells.</li> <li>• Prepare a microscope slide.</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the functions of the parts of cells.</li> <li>• Compare plant and animal cells.</li> <li>• Use a microscope to study plant and algal cells.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain how the main structures of cells are related to their functions.</li> <li>• Suggest reasons why some cells do not contain all cell structures.</li> <li>• Compare the sizes of cells using units of length and standard form.</li> </ul>
Lesson 1.3	<ul style="list-style-type: none"> <li>• Identify structures in prokaryotic cells.</li> <li>• State that prokaryotic cells do not contain a nucleus and eukaryotic cells do.</li> <li>• Use orders of magnitude to correctly order objects according to size.</li> </ul>	<ul style="list-style-type: none"> <li>• Compare prokaryotic and eukaryotic cells.</li> <li>• Describe the functions of the parts of a prokaryotic cell.</li> <li>• Use orders of magnitude to compare the sizes of organisms.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain how the main structures of prokaryotic cells are related to their functions.</li> <li>• Perform calculations to work out orders of magnitude.</li> </ul>
Lesson 1.4	<ul style="list-style-type: none"> <li>• Identify specialised animal cells from diagrams.</li> <li>• Describe the function of specialised animal cells.</li> <li>• Write a basic explanation of how animal cells are adapted.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain why animals have specialised cells.</li> <li>• Compare the structure of a specialised and a generalised animal cell.</li> <li>• Write a coherent explanation of how animal cells are adapted.</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss how the structure of specialised animal cells is related to their function within an organ and the whole organism.</li> <li>• Suggest the function of an unknown specialised cell based on its structure.</li> <li>• Write an effectively structured explanation of how animal cells are adapted.</li> </ul>
Lesson 1.5	<ul style="list-style-type: none"> <li>• Identify specialised plant cells from diagrams.</li> <li>• Describe the function of specialised plant cells.</li> <li>• Use a light microscope to view a root hair cell.</li> </ul>	<ul style="list-style-type: none"> <li>• Compare the structure of a specialised and a generalised plant cell.</li> <li>• Describe the adaptations of specialised plant cells.</li> <li>• Draw a scientific drawing of a root hair cell observed using a light microscope</li> </ul>	<ul style="list-style-type: none"> <li>• Discuss how the structure of specialised plant cells is related to their function within an organ and the whole organism.</li> <li>• Design a cell, tissue, or organ to perform a certain function.</li> <li>• Measure a root hair cell observed using a light microscope.</li> </ul>
Lesson 1.6	<ul style="list-style-type: none"> <li>• State that diffusion is the spreading of the particles of any substance in solution, or particles of a gas.</li> <li>• List the factors that affect the rate of diffusion.</li> <li>• Write a simple hypothesis.</li> </ul>	<ul style="list-style-type: none"> <li>• Predict which way substances will move across a cell membrane.</li> <li>• Explain why surface area affects the rate of diffusion.</li> <li>• Write a hypothesis using scientific knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain how temperature and concentration gradient affect the rate of diffusion.</li> <li>• Write a hypothesis using detailed scientific knowledge and explain how it could be tested.</li> </ul>
Lesson 1.7	<ul style="list-style-type: none"> <li>• Describe what osmosis is.</li> <li>• State that if animal cells lose or gain too much water by osmosis they can stop working properly.</li> </ul>	<ul style="list-style-type: none"> <li>• State the differences between osmosis and diffusion.</li> <li>• Use ideas about osmosis to explain why maintaining constant internal conditions in living organisms is important.</li> <li>• Write a prediction using scientific knowledge of osmosis.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain how a model shows osmosis in a cell.</li> <li>• Use the terms isotonic, hypotonic, or hypertonic to explain the movement of water across a cell membrane.</li> </ul>
Lesson 1.8	<ul style="list-style-type: none"> <li>• State that if a plant loses too much water from its cells then they become soft.</li> <li>• Write a simple method with support.</li> <li>• Use given data to plot a suitable graph with some support.</li> </ul>	<ul style="list-style-type: none"> <li>• Use osmosis to explain the effect of placing plant tissue in salt or sugar solutions.</li> <li>• Write a suitable plan to investigate the effect of salt or sugar solutions on plant tissue.</li> <li>• Calculate percentage change and use</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the mechanisms that lead to turgid or flaccid plant cells and plasmolysis.</li> <li>• Write a detailed plan for an investigation independently.</li> <li>• Use a line graph to estimate the concentration of solution inside a plant</li> </ul>

	Aiming for Grade 4 (C)	Aiming Grade 6 (B)	Aiming for Grade 8 (A*)
		this to plot a line graph with negative numbers and draw a line of best fit.	cell.
Lesson 1.9	<ul style="list-style-type: none"> <li>Define active transport as the movement of a substance against a concentration gradient using energy.</li> <li>Identify where active transport takes place.</li> <li>Use a representational model to show active transport.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why active transport is important for living organisms.</li> <li>Explain the differences between diffusion, osmosis, and active transport.</li> <li>Suggest some limitations of/improvements to a representational model that shows active transport.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how active transport takes place.</li> <li>Suggest how a cell that carries out active transport is adapted to this function.</li> <li>Design and evaluate a representational model to show active transport.</li> </ul>
Lesson 1.10	<ul style="list-style-type: none"> <li>State the function of exchange surfaces in plants and animals.</li> <li>State that a single-celled organism has a relatively large surface area to volume ratio.</li> <li>Calculate the surface area to volume ratio of a cube.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how the effectiveness of exchange surfaces is increased.</li> <li>Use ideas about surface area to volume ratio to describe why multicellular organisms need exchange surfaces.</li> <li>Calculate the surface area to volume ratio of a cylinder.</li> </ul>	<ul style="list-style-type: none"> <li>Link ideas about diffusion to explain how the adaptations of exchange surfaces increase their effectiveness.</li> <li>Use ideas about surface area to explain the shape of a leaf.</li> <li>Calculate the surface area to volume ratio of a sphere.</li> </ul>

## Chapter 2: Cell division (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 2.1	<ul style="list-style-type: none"> <li>State that human body cells have 46 chromosomes and gametes have 23.</li> <li>State that mitosis is a stage in cell division.</li> <li>State the meaning of most of the key words – mitosis, chromosomes, gene, gametes.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why chromosomes in body cells are normally found in pairs.</li> <li>Describe situations where mitosis is occurring.</li> <li>Use the key words to describe the process of mitosis.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why genetic material must be doubled during mitosis.</li> <li>Explain in detail what happens at each stage of the cell cycle.</li> <li>Use the key words to write detailed explanations of why mitosis is an important process in living things and how characteristics are inherited.</li> </ul>
Lesson 2.2	<ul style="list-style-type: none"> <li>Define the terms growth and differentiation.</li> <li>State why plant clones are genetically identical to each other.</li> <li>Attempt to clone a plant by using apparatus correctly.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the importance of cell differentiation in multicellular organisms.</li> <li>Explain how using tissue culture creates a clone of a plant.</li> <li>Attempt to clone a plant by using apparatus correctly and following safety rules.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast differentiation in plants and animals.</li> <li>Explain why it is easier to clone a plant than an animal.</li> <li>Explain and carry out a practical accurately and safely in order to successfully clone a plant.</li> </ul>
Lesson 2.3	<ul style="list-style-type: none"> <li>State that a stem cell is a cell that is not differentiated.</li> <li>State that plant stem cells can be used to create clones.</li> <li>State ways in which stem cells can be used to treat medical conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Describe differences between embryonic and adult stem cells.</li> <li>Explain why plant clones are produced in agriculture.</li> <li>Describe how stem cells can be used to treat medical conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why embryonic stem cells are particularly useful for treating medical conditions.</li> <li>Explain how stem cells can be used to treat medical conditions.</li> </ul>
Lesson 2.4	<ul style="list-style-type: none"> <li>List some arguments for and against the use of stem cells.</li> <li>Verbally communicate simple ideas during a group discussion.</li> </ul>	<ul style="list-style-type: none"> <li>Describe what therapeutic cloning can be used for.</li> <li>Explain the reasons for ethical and religious objections to use of stem cells in medicine.</li> <li>Verbally communicate well-constructed arguments.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the process of therapeutic cloning.</li> <li>Evaluate the use of stem cells in medicine.</li> <li>Clearly communicate strong, well-researched arguments in a persuasive manner.</li> </ul>

## Chapter 3: Organisation and the digestion system (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 3.1	<ul style="list-style-type: none"> <li>State examples of cells, tissues, organs, and organ systems.</li> <li>Name organs found in a given organ system</li> <li>Order cells, tissues, organs, and organ systems according to their relative sizes.</li> </ul>	<ul style="list-style-type: none"> <li>Define the terms tissue, organ, and organ system.</li> <li>Describe the function of certain organs and organ systems.</li> <li>Identify tissues that make up organs.</li> </ul>	<ul style="list-style-type: none"> <li>Relate levels of organisation to familiar organ systems in order to give examples of cells, tissues, and organs.</li> <li>Explain why the cells of multicellular organisms are organised into tissues, organs, and organ systems.</li> <li>Suggest the function of glandular, epithelial, and muscular tissue in organs.</li> </ul>
Lesson 3.2	<ul style="list-style-type: none"> <li>Identify some of the organs of the digestive system.</li> <li>State the function of some of the organs of the digestive system.</li> <li>State simply what happens to food during digestion.</li> </ul>	<ul style="list-style-type: none"> <li>Name all of the organs of the digestive system.</li> <li>Describe the functions of the organs of the digestive system.</li> <li>Summarise the process of digestion.</li> </ul>	<ul style="list-style-type: none"> <li>Link the process of digestion to other processes in the body in order to explain its function.</li> <li>Explain in detail how the small intestine is adapted to its function.</li> <li>Explain in detail what happens to food during digestion.</li> </ul>
Lesson 3.3	<ul style="list-style-type: none"> <li>Recall that food contains the molecules carbohydrates, lipids (fats), and proteins.</li> <li>State the function of each food molecule in the diet.</li> <li>Carry out a food test and record results in a table.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the structure of simple sugars, starch, lipids, and proteins.</li> <li>Carry out multiple food tests in an organised manner.</li> <li>Design a results table to clearly record results from food tests.</li> </ul>	<ul style="list-style-type: none"> <li>Explain which food molecules are polymers.</li> <li>Apply knowledge of the function of food molecules in the body to give diet advice.</li> <li>Suggest what a food contains using results from food tests, evaluating the observed data collected</li> </ul>
Lesson 3.4	<ul style="list-style-type: none"> <li>Recall that enzymes are proteins that are biological catalysts.</li> <li>State one function of enzymes inside the body.</li> <li>State the independent variable in a given investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how enzymes are used in digestion.</li> <li>Use the lock and key theory to explain why the shape of an enzyme is vital for it to function.</li> <li>Identify the key variables in a given investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how enzymes speed up reactions.</li> <li>Explain how enzymes control metabolism.</li> <li>Plan an experiment to investigate how different catalysts affect the rate of a reaction.</li> </ul>
Lesson 3.5	<ul style="list-style-type: none"> <li>State that temperature and pH affect how well an enzyme works.</li> <li>Plot a line graph.</li> <li>State simply what a line graph shows about how temperature or pH affects the rate of an enzyme-catalysed reaction.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why high temperatures and changes in pH prevent enzymes from catalysing reactions.</li> <li>Draw a tangent to a line and calculate the rate of a reaction with guidance.</li> <li>Plot a line graph and use it to draw conclusions about how temperature and pH affect the rate of an enzyme-catalysed reaction.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how a change in temperature or pH affects the rate of an enzyme-catalysed reaction.</li> <li>Apply knowledge of enzymes to explain how some organisms can survive in extreme conditions.</li> <li>Draw tangents in order to calculate the rate of a reaction.</li> </ul>
Lesson 3.6	<ul style="list-style-type: none"> <li>State that enzymes are used in digestion to break down food molecules.</li> <li>Identify that carbohydrases break down carbohydrates, proteases break down proteins, and lipases break down lipids.</li> <li>Plan a simple method to carry out an investigation.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why enzymes are needed for digestion.</li> <li>For each food molecule, name the enzyme that acts on it, where it is produced, and which products are formed.</li> <li>Plan and carry out an investigation in order to gather accurate results.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest how to test for substrates and products in a model gut.</li> <li>Make a prediction with a clearly structured scientific explanation.</li> <li>Analyse results in order to evaluate a method and the validity of conclusions, explaining suggestions for possible improvements.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 3,7	<ul style="list-style-type: none"> <li>State that the stomach contains acid.</li> <li>State that the liver produces bile.</li> <li>Write a simple hypothesis and prediction.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the functions of bile.</li> <li>Calculate the mean rate of an enzyme-catalysed reaction.</li> <li>Analyse data in order to determine whether a hypothesis is correct.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how acid in the stomach increases the efficiency of pepsin.</li> <li>Explain how bile increases the efficiency of fat digestion.</li> <li>Explain how the rate of an enzyme-catalysed reaction shows how efficient the reaction is.</li> </ul>

## Chapter 4: Organising animals and plants (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 4.1	<ul style="list-style-type: none"> <li>State the main components in blood.</li> <li>Recognise the components of blood from photomicrographs.</li> <li>Describe the function of each component in blood.</li> </ul>	<ul style="list-style-type: none"> <li>Summarise the process of blood clotting.</li> <li>View blood under a light microscope and recognise components.</li> <li>Explain how red blood cells are adapted to their function</li> </ul>	<ul style="list-style-type: none"> <li>Suggest how white blood cells are adapted to their function.</li> <li>Estimate the diameter of a red blood cell and comment on its uncertainty.</li> <li>Evaluate in detail a model of the blood.</li> </ul>
Lesson 4.2	<ul style="list-style-type: none"> <li>State the three main types of blood vessel and recognise them from diagrams.</li> <li>Estimate heart rate.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how the structure of blood vessels relates to their function.</li> <li>Comment on how accurate estimations are.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail the importance of a double circulatory system.</li> <li>Explain how to make estimates more accurate in terms of precision of data.</li> </ul>
Lesson 4.3	<ul style="list-style-type: none"> <li>Describe the function of the heart.</li> <li>State the main structures of the human heart.</li> <li>List examples of problems that can develop in blood vessels in the human heart.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the function of the main structures of the human heart.</li> <li>Describe the problems that can develop in blood vessels in the human heart, and their treatments.</li> <li>Suggest advantages and disadvantages of using stents and statins.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how the structure of the different parts of the human heart is related to their function.</li> <li>Recognise the main structures of the heart when carrying out a heart dissection.</li> <li>Evaluate the use of stents and statins in treating problems with blood vessels.</li> </ul>
Lesson 4.4	<ul style="list-style-type: none"> <li>State that the heartbeat is maintained by a group of cells that acts as a pacemaker.</li> <li>Give some ways in which the heart can stop functioning efficiently.</li> <li>Describe why a person may need an artificial pacemaker or an artificial heart.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why an irregular heartbeat is detrimental to health.</li> <li>Describe why people may have objections to heart transplants.</li> <li>Summarise the advantages and disadvantages of different treatments for heart problems.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how a natural pacemaker maintains the heartbeat.</li> <li>Suggest how an artificial pacemaker regulates an irregular heartbeat.</li> <li>Evaluate in detail the different methods used in the treatment of heart problems.</li> </ul>
Lesson 4.5	<ul style="list-style-type: none"> <li>List the main structures of the gas exchange system.</li> <li>State that gas exchange happens in the alveoli.</li> <li>Use data in the form of percentages to describe the differences between the composition of inhaled and exhaled air.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the function of the main structures of the gas exchange system.</li> <li>Describe how alveoli are adapted for gas exchange.</li> <li>Describe the processes of ventilation and gas exchange.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate in detail a model of the lungs.</li> <li>Explain in detail how the adaptations of alveoli result in efficient gas exchange.</li> <li>Explain the differences between the composition of inhaled and exhaled air.</li> </ul>
Lesson 4.6	<ul style="list-style-type: none"> <li>Recognise examples of plant organs and state their functions.</li> <li>Use a light microscope to view a cross-section of a leaf.</li> <li>State the functions of different plant tissues.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how plant organs are involved in the transport system.</li> <li>Use a microscope to identify the different tissues in a cross-section of a leaf.</li> <li>Explain how the structures of tissues in the leaf are related to their functions</li> </ul>	<ul style="list-style-type: none"> <li>Suggest what type of plant organs unfamiliar structures are.</li> <li>Use a light microscope to draw a cross-section of a leaf and calculate scale.</li> <li>Suggest functions for unknown plant tissues.</li> </ul>
Lesson 4.7	<ul style="list-style-type: none"> <li>Describe the function of xylem and phloem tissue.</li> <li>Describe evidence for movement of water through xylem.</li> </ul>	<ul style="list-style-type: none"> <li>Describe why transport in plants is important.</li> <li>Explain how the structure of xylem and phloem is adapted to their functions.</li> </ul>	Explain in detail how the rate of transport through a plant can be measured.

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 4.8	<ul style="list-style-type: none"> <li>State that transpiration is the evaporation of water vapour from the leaves.</li> <li>State the function of stomata.</li> <li>Calculate the mean number of stomata on a given area of leaf.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how transpiration maintains the movement of water from roots to leaves.</li> <li>Describe how the opening and closing of stomata is controlled by guard cells.</li> <li>Use sampling to estimate the number of stomata on a leaf.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate drinking from a straw as a model for transpiration.</li> <li>Explain in detail how stomata control transpiration.</li> <li>Suggest reasons for differences in the number and distribution of stomata, as well as their adaptations.</li> </ul>
Lesson 4.9	<ul style="list-style-type: none"> <li>Recognise the factors that affect transpiration.</li> <li>Describe how a potometer can be used to estimate the volume of water lost by a plant.</li> <li>Identify control variables when investigating rate of transpiration.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why temperature, humidity, light intensity, and amount of air flow affect the rate of transpiration.</li> <li>Describe the differences between a moving bubble potometer and a mass potometer.</li> <li>Make a prediction using scientific knowledge when investigating rate of transpiration.</li> </ul>	<ul style="list-style-type: none"> <li>Apply particle model to explain in detail why temperature, humidity, light intensity, and amount of air flow affect the rate of transpiration.</li> <li>Summarise plant adaptations to control water loss, and explain how they work.</li> <li>Evaluate in detail the use of a potometer to measure the rate of transpiration.</li> </ul>

## Chapter 5: Communicable diseases (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 5.1	<ul style="list-style-type: none"> <li>Describe health as a state of physical and mental wellbeing.</li> <li>State some causes of ill health.</li> <li>Draw a simple conclusion from data on health.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the difference between communicable and non-communicable diseases.</li> <li>Use a scatter diagram to identify a correlation between two variables.</li> <li>Construct and interpret bar charts, frequency tables, frequency diagrams, and histograms.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest how communicable diseases are spread.</li> <li>Suggest links between lifestyle and health.</li> <li>Discuss the validity of a statement based on evidence in the form of data.</li> </ul>
Lesson 5.2	<ul style="list-style-type: none"> <li>State that pathogens are microorganisms that cause disease.</li> <li>Describe ways in which pathogens can be spread.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how bacteria and viruses cause disease.</li> <li>Explain why communicable diseases spread rapidly following a natural disaster.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why viruses are always pathogens, but not all bacteria are.</li> <li>Explain how pathogens are passed from one organism to another, and use this to suggest ways of preventing the spread.</li> </ul>
Lesson 5.3	<ul style="list-style-type: none"> <li>State that bacteria reproduce by cell division and this is called binary fission.</li> <li>Prepare a bacterial culture on agar gel.</li> <li>Follow the rules needed to prepare an uncontaminated culture.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why numbers of bacteria on an agar plate will eventually stop growing.</li> <li>Explain why it is important to use an uncontaminated culture to investigate bacterial growth.</li> <li>Describe and explain why each safety rule is needed in order to safely prepare, incubate, and dispose of a culture.</li> </ul>	<ul style="list-style-type: none"> <li>Explain what is meant by exponential growth and analyse a graph showing it.</li> <li>Suggest how to measure the growth of bacteria and discuss uncertainty.</li> <li>Plan a detailed investigation to find out how a variable affects the growth of bacteria.</li> </ul>

Lesson 5.4	<ul style="list-style-type: none"> <li>Describe the difference between antiseptics, disinfectants, and antibiotics.</li> <li>Write a prediction.</li> <li>Measure the diameter of clear areas around colonies.</li> </ul>	<ul style="list-style-type: none"> <li>Explain when an antiseptic, a disinfectant, and an antibiotic would be used.</li> <li>Calculate the number of bacteria in a population after a certain time if given the mean division time.</li> <li>Calculate the area of the clear areas around colonies using <math>\pi r^2</math>.</li> </ul>	<ul style="list-style-type: none"> <li>Write a prediction using detailed scientific knowledge.</li> <li>Calculate the number of bacteria in a sample when using a counting chamber.</li> <li>Apply knowledge of sampling techniques to ensure samples are representative.</li> </ul>
Lesson 5.5	<ul style="list-style-type: none"> <li>List some ways in which communicable diseases are spread.</li> <li>Take a role in designing a form of communication to inform the public about how to prevent the spread of a disease.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how the spread of diseases can be reduced or prevented.</li> <li>Communicate to the public about how to stop the spread of a disease.</li> </ul>	<ul style="list-style-type: none"> <li>Use scientific knowledge to explain in detail how different methods reduce or prevent the spread of disease.</li> <li>Use an example to explain how scientific method has been applied to help prevent the spread of disease.</li> </ul>
Lesson 5.6	<ul style="list-style-type: none"> <li>Name some diseases that are caused by viruses.</li> <li>Describe how measles and HIV are spread.</li> <li>Summarise information in a table.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how measles, HIV, and tobacco mosaic virus affect the infected organism.</li> <li>Interpret data to describe how the number of people infected with measles in the UK has changed over time.</li> <li>Design a table and use it to summarise information.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how measles, HIV, and tobacco mosaic virus affect the infected organism.</li> <li>Explain why viral infections are often more difficult to prevent and treat than bacterial infections.</li> <li>Write a persuasive letter to parents urging them to vaccinate their children against measles.</li> </ul>
Lesson 5.7	<ul style="list-style-type: none"> <li>Name some diseases that are caused by bacteria.</li> <li>Describe how <i>salmonella</i> and gonorrhoea are spread.</li> </ul>	<ul style="list-style-type: none"> <li>Describe similarities and differences between <i>salmonella</i> and gonorrhoea.</li> <li>Describe how the spread of <i>salmonella</i> and gonorrhoea is controlled.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest why more people die from viral diseases than from bacterial diseases.</li> <li>Explain in detail how methods to control the spread of <i>salmonella</i> and gonorrhoea work.</li> </ul>
Lesson 5.8	<ul style="list-style-type: none"> <li>State that rose black spot is caused by fungi and malaria is caused by protists.</li> <li>Use a diagram to describe the life cycle of the malaria protist.</li> <li>State some ways in which malaria is controlled.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how rose black spot affects the plant and how it is treated.</li> <li>Link ways of controlling the spread of malaria to specific parts of the protist's life cycle.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how rose black spot affects the growth of a plant.</li> <li>Explain why it is so expensive to stop the spread of malaria.</li> </ul>
Lesson 5.9	<ul style="list-style-type: none"> <li>Describe some ways in which the human body defends itself against the entry of pathogens.</li> <li>State that white blood cells help defend the body against pathogens.</li> <li>Show how one part of a model is similar to real life.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how human body defence mechanisms stop the entry of pathogens.</li> <li>Describe the role of white blood cells in the defence against disease.</li> <li>Use a model to explain how the body defends itself against disease.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how a reduced or overactive immune system can cause illness.</li> <li>Explain in detail how antibody production fights pathogens.</li> <li>Evaluate an analogy of the human defence systems against disease.</li> </ul>
Lesson 5.10	<ul style="list-style-type: none"> <li>Describe some signs of plant disease.</li> <li>Name organisms that can cause disease in plants.</li> <li>State that plants can be damaged by ion deficiency.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how a plant disease is detected, and the methods used to identify the cause.</li> <li>Explain how disease damages a plant.</li> <li>Match signs of plant disease to ion deficiency.</li> </ul>	<ul style="list-style-type: none"> <li>Analyse data on plant growth to write conclusions using scientific knowledge.</li> <li>Suggest how plant diseases affect food security.</li> <li>Explain in detail how and why ion deficiencies affect plant growth.</li> </ul>
Lesson 5.11	<ul style="list-style-type: none"> <li>State examples of plant defence responses.</li> <li>Describe why plants need to defend themselves.</li> </ul>	<ul style="list-style-type: none"> <li>Classify plant defences as physical, chemical, or mechanical.</li> <li>Carry out research using secondary resources of own choice to present examples of plant defence responses.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how plant defence responses work.</li> <li>Interpret information from a scientific article to explain how plant-to-plant communication can be used as a form of defence.</li> </ul>

## Chapter 6: Preventing and treating disease (Paper 1)

Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
--------------------	--------------------	--------------------

Lesson 6.1	<ul style="list-style-type: none"> <li>Describe why people are vaccinated.</li> <li>State that vaccines contain dead or inactive forms of a pathogen.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how vaccination works.</li> <li>Describe what an antibody and an antigen are.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why, if a large proportion of the population is vaccinated, the spread of the pathogen is reduced.</li> <li>Apply ideas about specificity of antibodies.</li> </ul>
Lesson 6.2	<ul style="list-style-type: none"> <li>Describe what an antibiotic is.</li> <li>State that viral infections cannot be treated with antibiotics.</li> <li>Decide when a painkiller or antibiotic should be used to treat an illness.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how antibiotics work.</li> <li>Describe what is meant by antibiotic-resistant bacteria.</li> <li>Explain why it is difficult to develop drugs to treat viral infections.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest a reasoned explanation for a pattern in data.</li> <li>Explain in detail how antibiotic-resistant bacteria arise.</li> <li>Explain why scientists are constantly developing new antibiotics.</li> </ul>
Lesson 6.3	<ul style="list-style-type: none"> <li>Name some drugs based on extracts from plants or microorganisms.</li> <li>Order the events that led to the development of penicillin.</li> <li>Draw a simple conclusion using data.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how new antibiotics are tested for effectiveness.</li> <li>Discuss the advantages and disadvantages of looking for new drugs from living organisms.</li> <li>Analyse data to draw conclusions on the effectiveness of new antibiotics.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest why mould naturally produces antibiotics.</li> <li>Discuss how effective herbal remedies are.</li> <li>Analyse data to evaluate the effectiveness of new antibiotics and make a reasoned decision on which one to develop further.</li> </ul>
Lesson 6.4	<ul style="list-style-type: none"> <li>State that new medical drugs have to be tested to check that they are safe and effective.</li> <li>Give the procedures used to trial a new drug in the correct order.</li> <li>Describe what is meant by a placebo.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why each procedure in drugs testing and trialling is used.</li> <li>Describe how a double blind trial is carried out.</li> <li>Explain why a placebo is used during drug trialling.</li> </ul>	<ul style="list-style-type: none"> <li>Describe in some detail how new medical drugs are tested and trialled for safety, effectiveness, toxicity, efficacy, and dose.</li> <li>Critically analyse the results from a double blind trial.</li> <li>Explain why the results of drug trials are published in journals.</li> </ul>
Lesson 6.5		<ul style="list-style-type: none"> <li>Describe what a monoclonal antibody is.</li> <li>Outline the procedure used to produce monoclonal antibodies.</li> <li>Give some uses of monoclonal antibodies.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why hybridoma cells are used to produce monoclonal antibodies.</li> <li>Explain in detail how pregnancy tests work.</li> <li>Describe how monoclonal antibodies are used to produce ELISA tests and outline how they are used.</li> </ul>
Lesson 6.6		<ul style="list-style-type: none"> <li>Describe the ways in which monoclonal antibodies can be used to treat cancer.</li> <li>Outline the advantages and disadvantages of using monoclonal antibodies.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how the methods of using monoclonal antibodies to treat cancer work.</li> <li>Evaluate the use of monoclonal antibodies in treating cancer compared to other treatments.</li> </ul>

## Chapter 7: Non-communicable diseases (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 7.1	<ul style="list-style-type: none"> <li>Name some non-communicable diseases.</li> <li>List some risk factors that are linked to an increased rate of a disease.</li> <li>Identify correlations in data.</li> </ul>	<ul style="list-style-type: none"> <li>Classify diseases as communicable or non-communicable.</li> <li>Draw conclusions from data on risk factors.</li> <li>Decide whether a link is causal.</li> </ul>	<ul style="list-style-type: none"> <li>Describe some impacts of non-communicable diseases.</li> <li>Identify risk factors from data.</li> <li>Explain why a correlation does not prove a causal mechanism.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 7.2	<ul style="list-style-type: none"> <li>Define a tumour as a mass of abnormally growing cells.</li> <li>State some causes of cancer.</li> <li>List some of the benefits and risks of chemotherapy.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the difference between benign and malignant tumours.</li> <li>Describe why carcinogens and ionising radiation increase the risk of tumours forming.</li> <li>Analyse data to assess the risks and benefits of chemotherapy.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how benign and malignant tumours can be life-threatening.</li> <li>Link a lack of control in the cell cycle to tumour formation.</li> <li>Evaluate the risks of chemotherapy in relation to data, drug testing, and consequences in order to come to an informed decision.</li> </ul>
Lesson 7.3	<ul style="list-style-type: none"> <li>Name the harmful substances found in tobacco smoke.</li> <li>State that smoking increases your risk of developing lung diseases.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the effects of the harmful substances found in tobacco smoke.</li> <li>Analyse data to describe evidence for the link between smoking and lung disease.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail the effects of the harmful substances found in tobacco smoke.</li> <li>Suggest possible causal mechanisms to explain trends shown in data, and explain how the causal link between smoking and lung cancer was identified.</li> </ul>
Lesson 7.4	<ul style="list-style-type: none"> <li>Describe some health problems caused by a poor diet and lack of exercise.</li> <li>List some ways in which people can avoid becoming overweight.</li> </ul>	<ul style="list-style-type: none"> <li>Describe causal mechanisms for the link between exercise and health.</li> <li>Suggest measures to prevent a further rise in the number of people with type 2 diabetes.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest reasons for the correlation between exercise and health, and decide which are causal.</li> <li>Explain in detail why eating a poor diet can lead to health problems.</li> </ul>
Lesson 7.5	<ul style="list-style-type: none"> <li>State that drinking too much alcohol can affect liver and brain function.</li> <li>State that alcohol can affect unborn babies.</li> <li>Define the term carcinogen.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the short- and long-term effects of drinking alcohol.</li> <li>Describe the effects of alcohol on unborn babies.</li> <li>Describe the link between ionising radiation and cancer.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how drinking alcohol affects the nervous system.</li> <li>Evaluate evidence on the effects of alcohol on a developing baby.</li> <li>Explain the link between ionising radiation and cancer.</li> </ul>

## Chapter 8: Photosynthesis (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 8.1	<ul style="list-style-type: none"> <li>Describe how plants get the materials they need for growth.</li> <li>State the word equation for photosynthesis.</li> <li>Describe why plants need light to carry out photosynthesis.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how the leaf is adapted for photosynthesis.</li> <li>Write the balanced symbol equation for photosynthesis.</li> <li>Describe an experiment to prove that plants carry out photosynthesis when exposed to light.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how adaptations of the leaf make photosynthesis efficient.</li> <li>Explain why photosynthesis is an endothermic reaction.</li> <li>Explain why chlorophyll is needed for photosynthesis.</li> </ul>
Lesson 8.2	<ul style="list-style-type: none"> <li>List the factors that affect the rate of photosynthesis (temperature, carbon dioxide concentration, light intensity, amount of chlorophyll).</li> <li>State simply the relationship between these factors and the rate of photosynthesis.</li> <li>Plot a line graph and write a simple conclusion.</li> </ul>	<ul style="list-style-type: none"> <li>Describe why low temperature, shortage of carbon dioxide, shortage of light and shortage of chlorophyll limit the rate of photosynthesis.</li> <li>Suggest which factor limits the rate of photosynthesis in a given situation.</li> <li>Interpret and explain graphs of photosynthesis rate involving one limiting factor.</li> </ul>	<ul style="list-style-type: none"> <li>Apply knowledge of enzymes to explain why a high temperature affects the rate of photosynthesis.</li> <li>Predict how the rate of photosynthesis will be affected with more than one limiting factor.</li> <li>Understand and use the inverse square law and light intensity in the context of photosynthesis.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 8.3	<ul style="list-style-type: none"> <li>List some ways in which plants use glucose.</li> <li>Test a leaf for starch and state some safety rules.</li> </ul>	<ul style="list-style-type: none"> <li>Describe all the ways in which plants use glucose, including how they make proteins.</li> <li>Evaluate risks involved in the starch test.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how carnivorous plants are adapted to their environment.</li> <li>Explain how and why plants convert glucose to starch for storage.</li> </ul>
Lesson 8.4		<ul style="list-style-type: none"> <li>Describe why greenhouses increase plant growth.</li> <li>Comment on the cost-effectiveness of adding heat, light, or carbon dioxide to greenhouses.</li> <li>Discuss the benefits of using greenhouses and hydroponics.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how using greenhouses can help control limiting factors and increase the rate of photosynthesis.</li> <li>Use data to comment on the cost-effectiveness of greenhouses.</li> <li>Evaluate the use of greenhouses and hydroponics in terms of economics.</li> </ul>

## Chapter 9: Respiration (Paper 1)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 9.1	<ul style="list-style-type: none"> <li>State the word equation for aerobic respiration.</li> <li>List ways in which living organisms use energy.</li> <li>Identify a control</li> </ul>	<ul style="list-style-type: none"> <li>Write the balanced symbol equation for respiration.</li> <li>Describe respiration as an exothermic reaction.</li> <li>Plan an investigation to include a control.</li> </ul>	<ul style="list-style-type: none"> <li>Apply understanding of respiration in new contexts.</li> <li>Explain why respiration is an exothermic reaction.</li> <li>Explain why a control is necessary in some scientific investigations.</li> </ul>
Lesson 9.2	<ul style="list-style-type: none"> <li>Describe how heart rate, breathing rate, and breath volume change with exercise.</li> <li>Draw a suitable chart/graph to display data with some support.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why heart rate, breathing rate, and breath volume change with exercise.</li> <li>Choose the best way to display data and calculate percentage changes.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why stores of glycogen change with exercise.</li> <li>Justify the choice of chart/graph used to display data.</li> </ul>
Lesson 9.3	<ul style="list-style-type: none"> <li>State the word equation for anaerobic respiration in animals, plants, and microorganisms.</li> <li>Describe the reason why cells respire anaerobically.</li> <li>Give some uses of fermentation.</li> </ul>	<ul style="list-style-type: none"> <li>Write the balanced symbol equation for anaerobic respiration in plants and microorganisms.</li> <li>Compare and contrast aerobic and anaerobic respiration.</li> <li>Explain why muscles get tired during exercise.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast anaerobic respiration in animals, plants, and microorganisms.</li> <li>Explain in detail why heart and breathing rate continue to be high for a period of time after exercise.</li> <li>Write a prediction based on scientific knowledge.</li> </ul>
Lesson 9.4	<ul style="list-style-type: none"> <li>Define metabolism as the sum of all reactions in a cell or the body.</li> <li>List some metabolic reactions.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the role of the liver in repaying the oxygen debt.</li> <li>Discuss whether it is possible to increase metabolism.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the link between protein consumption and concentration of urea in urine.</li> <li>Evaluate information to assess credibility.</li> </ul>

## Chapter 10: The Human Nervous System (Paper 2)

	<b>Aiming for Grade 4</b>	<b>Aiming for Grade 6</b>	<b>Aiming for Grade 8</b>
<b>Lesson 10.1</b>	<ul style="list-style-type: none"> <li>Name some human internal conditions that are controlled.</li> <li>Show the pathway of a control system as receptor, coordination centre, effector.</li> </ul>	<ul style="list-style-type: none"> <li>Define homeostasis.</li> <li>Explain why internal conditions need to be maintained.</li> <li>Identify stimuli, receptors, coordination centres, and effectors in examples of nervous and chemical responses.</li> </ul>	<ul style="list-style-type: none"> <li>Apply knowledge of enzymes and osmosis to explain in detail why internal conditions need to be maintained.</li> <li>Explain how drugs affect homeostasis.</li> <li>Explain how nervous and chemical responses differ.</li> </ul>
<b>Lesson 10.2</b>	<ul style="list-style-type: none"> <li>Identify the stimuli that sense organs detect.</li> <li>Describe what a neurone and a nerve are.</li> <li>Measure reactions times using repeats to increase accuracy.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the pathway of impulses from receptor to effector.</li> <li>Describe how information is passed along neurones.</li> <li>Evaluate a method and describe how accuracy could be increased.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how the nervous system coordinates a response.</li> <li>Evaluate results in detail in order to discuss precision and accuracy.</li> </ul>
<b>Lesson 10.3</b>	<ul style="list-style-type: none"> <li>Identify reflex actions</li> <li>Describe why reflex actions are important.</li> <li>Order the events involved in a reflex action.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how reflex actions are fast and automatic.</li> <li>Describe the events involved in a reflex action.</li> <li>Describe the function of synapses.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how impulses travel across a synapse.</li> <li>Apply knowledge of synapses to explain the effects of drugs.</li> </ul>
<b>Lesson 10.4</b>	<ul style="list-style-type: none"> <li>Identify the main structures of the brain.</li> <li>Display data as a suitable graph or chart.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the function of brain structures.</li> <li>Describe how regions of the brain have been mapped to particular functions.</li> <li>Choose the correct way to display data.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate in detail the benefits and risks of investigating and treating brain disorders.</li> <li>Consider ethical dilemmas surrounding brain research.</li> <li>Independently plan a method to test a hypothesis.</li> </ul>
<b>Lesson 10.5</b>	<ul style="list-style-type: none"> <li>Identify the main structures of the eye.</li> <li>Describe what happens to the eye in bright light.</li> </ul>	<ul style="list-style-type: none"> <li>Relate the structures of the eye to their functions.</li> <li>Describe how the eye focuses light.</li> </ul>	<ul style="list-style-type: none"> <li>Draw an accurate ray diagram to show how the eye focuses light.</li> <li>Explain in detail the changes to the eye in response to changes in light intensity.</li> </ul>
<b>Lesson 10.6</b>	<ul style="list-style-type: none"> <li>State that the lens changes shape to focus on near or distant objects.</li> <li>Describe what causes long- and short-sightedness.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how the lens changes shape to focus on near or distant objects.</li> <li>Describe how lenses and surgery can help with long and short sightedness.</li> </ul>	<ul style="list-style-type: none"> <li>Draw accurate ray diagrams to explain what happens during accommodation and what causes long and short sightedness.</li> <li>Evaluate the risks and benefits of surgery to treat long and short sightedness.</li> </ul>

## Chapter 11: Hormonal coordination (Paper 2)

	<b>Aiming for Grade 4</b>	<b>Aiming for Grade 6</b>	<b>Aiming for Grade 8</b>
<b>Lesson 11.1</b>	<ul style="list-style-type: none"> <li>Match the pituitary gland, pancreas, thyroid, adrenal gland, ovary, and testes to their position on a diagram of the human body.</li> <li>Describe how hormones are chemicals secreted into the bloodstream by glands, and have an effect on a target organ.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why the pituitary gland is known as a 'master gland'.</li> <li>Describe the role of hormones released by endocrine glands.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast nervous and hormonal action.</li> <li>Apply knowledge to suggest and explain how changes in hormone production could affect the body.</li> </ul>
<b>Lesson 11.2</b>	<ul style="list-style-type: none"> <li>State that blood glucose concentration is controlled by the pancreas.</li> <li>State that there are two types of diabetes.</li> </ul>	<ul style="list-style-type: none"> <li>Describe what happens when blood glucose levels become too high or too low.</li> <li>Describe the difference in the causes of Type 1 and Type 2 diabetes.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how glucagon interacts with insulin to control blood glucose levels.</li> <li>Explain why it is important to control the level of glucose in the blood.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 11.3	<ul style="list-style-type: none"> <li>State that Type 1 diabetes is normally treated with insulin injections.</li> <li>State that Type 2 diabetes can be treated by changes to diet and exercise.</li> <li>Describe data that shows a link between obesity and Type 2 diabetes.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why Type 1 diabetes is treated with insulin injections.</li> <li>Explain how Type 2 diabetes can be treated by changes to diet and exercise.</li> <li>Describe how the production of insulin for people with diabetes has developed over time.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate different treatments for Type 1 diabetes.</li> <li>Explain in detail how lifestyle choices affect the risk of developing Type 2 diabetes.</li> <li>Summarise how scientists are working to find a cure for diabetes.</li> </ul>
Lesson 11.4		<ul style="list-style-type: none"> <li>Describe the function of adrenaline and thyroxine.</li> <li>Interpret and explain diagrams of negative feedback control.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how adrenaline prepares the body for 'fight or flight'.</li> <li>Design labelled flow diagrams of negative feedback control.</li> </ul>
Lesson 11.5	<ul style="list-style-type: none"> <li>Identify oestrogen and testosterone as reproductive hormones in women and men respectively.</li> <li>Describe what happens during the menstrual cycle.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast the changes to boys and girls during puberty.</li> <li>Name the hormones involved in the menstrual cycle.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why fertility changes with age in men and women.</li> <li>Explain the role of each hormone in the menstrual cycle.</li> </ul>
Lesson 11.6		<ul style="list-style-type: none"> <li>Name the glands that produce the hormones oestrogen, progesterone, LH, and FSH.</li> <li>Describe the function of the hormones that control the menstrual cycle.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest how to test for substrates and products in a model gut.</li> <li>Make a prediction with a clearly structured scientific explanation.</li> <li>Analyse results in order to evaluate a method and the validity of conclusions, explaining suggestions for possible improvements.</li> </ul>
Lesson 11.7	<ul style="list-style-type: none"> <li>Describe what contraception is and list examples.</li> <li>Categorise contraceptives as hormonal and non-hormonal.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how contraceptives work.</li> <li>List the advantages and disadvantages of different contraceptives.</li> </ul>	<p>Apply knowledge of hormones in the menstrual cycle to suggest how</p> <ul style="list-style-type: none"> <li>hormonal contraceptives work.</li> <li>Evaluate different methods of contraception in detail.</li> </ul>
Lesson 11.8		<ul style="list-style-type: none"> <li>Describe what is meant by infertility and suggest reasons for it.</li> <li>Describe the steps used in IVF.</li> <li>Outline the issues surrounding IVF.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how FSH and IVF can be used to help treat infertility.</li> <li>Evaluate the advantages and disadvantages of IVF.</li> <li>Use different viewpoints to make an informed decision on unused IVF embryos.</li> </ul>
Lesson 11.9	<ul style="list-style-type: none"> <li>Describe that plant shoots grow towards the light and away from the force of gravity, and roots grow in the direction of the force of gravity.</li> <li>Identify plant responses as phototropism or gravitropism.</li> </ul> <p>Plan and carry out an investigation into the effect of light on plant growth, given support.</p>	<ul style="list-style-type: none"> <li>Explain why plants need tropisms.</li> <li>Use diagrams and descriptions to explain how plant shoots and roots respond to light and gravity.</li> <li>Plan and carry out an investigation into the effect of light on plant growth, with limited guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how the production and diffusion of auxin affects the growth of shoots and roots.</li> <li>Independently plan and carry out an investigation into the effect of light on plant growth.</li> <li>Predict the results of an investigation of tropisms, with detailed scientific reasons.</li> </ul>
Lesson 11.10		<ul style="list-style-type: none"> <li>Describe some uses of plant hormones (giberellins, ethene, and auxins) in agriculture, horticulture, and the food industry.</li> <li>Observe the effects of plant hormones.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how the effects of plant hormones are useful in agriculture, horticulture, and the food industry.</li> <li>Evaluate the use of synthetic plant hormones.</li> </ul>

## Chapter 12: Homeostasis in action (Paper 2)

	<b>Aiming for Grade 4</b>	<b>Aiming for Grade 6</b>	<b>Aiming for Grade 8</b>
<b>Lesson 12.1</b>	<ul style="list-style-type: none"> <li>State that the thermoregulatory centre in the brain monitors and controls body temperature.</li> <li>Predict whether certain activities will raise or lower body temperature.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how body temperature is monitored and controlled.</li> <li>Describe the mechanisms that take place if body temperature is too high or too low.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how mechanisms lower or raise body temperature.</li> <li>Explain why it is dangerous if body temperature is too high or too low.</li> </ul>
<b>Lesson 12.2</b>	<ul style="list-style-type: none"> <li>State that the level of water in the body has to be controlled.</li> <li>List the ways in which water is lost from the body.</li> <li>State that excess water, ions, and urea are removed from the body by the kidneys.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why the body needs to get rid of carbon dioxide, urea, excess ions, and water.</li> <li>Describe how the body forms the waste products carbon dioxide and urea.</li> <li>Describe the difference between urea and urine.</li> </ul>	<ul style="list-style-type: none"> <li>Calculate percentage changes in volumes of water lost or gained by the body.</li> <li>Suggest an effect of liver failure on the body.</li> <li>Explain the link between high levels of protein in the diet and an increase in urea concentration of urine.</li> </ul>
<b>Lesson 12.3</b>	<ul style="list-style-type: none"> <li>State the function of the kidneys.</li> <li>List the substances found in urine.</li> <li>Describe how the amount of liquid you drink affects your urine.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the processes of filtering and selective reabsorption in the kidneys.</li> <li>Suggest how the composition of the urine will change in given situations.</li> <li>Describe the effect of ADH on the kidneys.</li> </ul>	<ul style="list-style-type: none"> <li>Apply knowledge of the processes of filtering and selective reabsorption to diagnose problems and suggest treatments for patients using results from a urine test.</li> <li>Explain how the production of ADH will change in given situations.</li> <li>Explain how these changes will affect the amount of water in the urine.</li> </ul>
<b>Lesson 12.4</b>	<ul style="list-style-type: none"> <li>State what kidney failure is.</li> <li>Describe why kidney failure is a threat to life.</li> <li>State that kidney dialysis is a way of treating kidney failure.</li> </ul>	<ul style="list-style-type: none"> <li>Use a diagram to show how kidney dialysis works.</li> <li>List advantages and disadvantages of kidney dialysis.</li> <li>Describe how a model is similar to kidney dialysis.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest and explain suitable concentrations of substances in dialysis fluid.</li> <li>Apply knowledge of what affects the rate of diffusion to explain how dialysis made efficient.</li> <li>Evaluate in detail a model of kidney dialysis.</li> </ul>
<b>Lesson 12.5</b>	<ul style="list-style-type: none"> <li>Describe what an organ transplant is.</li> <li>List some advantages and disadvantages of kidney transplants.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why kidney donors can be living.</li> <li>Compare the advantages and disadvantages of treating kidney failure using dialysis or kidney transplant.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why family members are usually a good choice for an organ donor.</li> <li>Use economic, social, and ethical arguments to evaluate treating kidney failure by dialysis or kidney transplant.</li> </ul>

## Chapter 13: Reproduction (Paper 2)

	<b>Aiming for Grade 4</b>	<b>Aiming for Grade 6</b>	<b>Aiming for Grade 8</b>
<b>Lesson 13.1</b>	<ul style="list-style-type: none"> <li>Define sexual and asexual reproduction.</li> <li>Name some organisms that use either sexual or asexual reproduction.</li> <li>Use a model to show why variation is produced in offspring from sexual reproduction but not from asexual reproduction.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the differences between sexual reproduction.</li> <li>Describe the advantages and disadvantages of sexual and asexual reproduction.</li> <li>Design a model to show why variation is produced in offspring from sexual reproduction but not from asexual reproduction.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast sexual and asexual reproduction.</li> <li>Explain in detail why meiosis is important for sexual reproduction.</li> <li>Evaluate a model to show that variation is produced in offspring from sexual reproduction but not from asexual reproduction.</li> </ul>
<b>Lesson 13.2</b>	<ul style="list-style-type: none"> <li>State that gametes (sex cells) are formed by meiosis.</li> <li>State that meiosis halves the number of chromosomes in gametes and fertilisation restores the full number.</li> <li>Solve simple probability questions.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the processes of meiosis and mitosis.</li> <li>Explain how meiosis halves the number of chromosomes in gametes and fertilisation restores the full number.</li> <li>Solve simple probability questions.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast mitosis and meiosis.</li> <li>Explain in detail why gametes are all genetically different to each other.</li> <li>Solve complex calculations to determine the number of possible gametes formed</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
			during meiosis.
Lesson 13.3	<ul style="list-style-type: none"> <li>Name an organism that can reproduce both asexually and sexually.</li> <li>Give a simple reason why an organism reproduces sexually or asexually.</li> <li>State that flowers are a plant's reproductive organs.</li> </ul>	<p>Describe how malarial parasites and fungi reproduce both asexually and</p> <ul style="list-style-type: none"> <li>Sexually</li> <li>List the ways in which plants can reproduce asexually.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest and explain the advantages and disadvantages of using both asexual and sexual methods of reproduction.</li> <li>Explain in detail how plants reproduce sexually.</li> </ul>
Lesson 13.4	<ul style="list-style-type: none"> <li>State that DNA contains a code to build proteins.</li> <li>Describe what the Human Genome Project was.</li> <li>Give one goal of the Human Genome Project.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the relationship between DNA, genes, and chromosomes.</li> <li>Describe some of the benefits of studying the human genome.</li> <li>Explain why genome projects are costly and take a long time.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why the cost of genome sequencing has reduced since it was started.</li> <li>Explain why knowledge of the genomes of other species is useful.</li> <li>Discuss possible issues surrounding genome sequencing.</li> </ul>
Lesson 13.5	<ul style="list-style-type: none"> <li>Describe the structure of DNA.</li> <li>State that groups of three nucleotides code for an amino acid.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how the four bases make up a code.</li> <li>Explain why the correct folding of a protein is important to its function.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the steps involved in producing a protein inside the cell.</li> <li>Discuss possible issues surrounding genome sequencing.</li> <li>Explain how the order of bases determines the type of protein made.</li> </ul>
Lesson 13.6		<ul style="list-style-type: none"> <li>Describe what a mutation is.</li> <li>Explain why the correct folding of a protein is important to its function</li> </ul>	<ul style="list-style-type: none"> <li>Outline the reasons why most mutations are harmless.</li> <li>Explain in detail how a mutation can affect the function of a protein.</li> </ul>
Lesson 13.7		<ul style="list-style-type: none"> <li>Recognise examples of inherited traits.</li> <li>Recognise a genotype and a phenotype.</li> <li>Use a simple diagram to state how offspring have inherited traits.</li> </ul>	<ul style="list-style-type: none"> <li>Use the terms allele, dominant, recessive, homozygous, and heterozygous correctly.</li> <li>Describe a phenotype when given the genotype.</li> <li>Use a Punnett square diagram to predict the outcome of a</li> <li>monohybrid cross using the theory of probability.</li> </ul>
Lesson 13.8	<ul style="list-style-type: none"> <li>State that in females the sex chromosomes are XX and in males they are XY.</li> <li>Use a family tree to describe how people are related.</li> </ul>	<ul style="list-style-type: none"> <li>Carry out a genetic cross to show sex inheritance.</li> <li>Use direct proportion and simple ratios to express the outcome of a genetic cross.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why you only get the expected ratios in a genetic cross if there are large numbers of offspring.</li> <li>Use a family tree to work out whether an individual is likely to be homozygous or heterozygous for particular alleles.</li> </ul>
Lesson 13.9	<ul style="list-style-type: none"> <li>Describe what is meant by an inherited disorder and recognise examples.</li> <li>Use secondary sources of information to describe symptoms of an inherited disorder.</li> </ul>	<ul style="list-style-type: none"> <li>Name examples of inherited disorders, such as cystic fibrosis and polydactyly.</li> <li>Use a genetic cross to explain how inherited disorders are passed on.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate in detail the use of genetic engineering to cure inherited disorders.</li> <li>Use a genetic cross to predict the probability of a child inheriting a genetic disorder.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 13.10	<ul style="list-style-type: none"> <li>Give a reason why embryos might be screened.</li> <li>Describe one concern about embryo screening.</li> </ul>	<ul style="list-style-type: none"> <li>Outline the methods used to screen embryos.</li> <li>List advantages and disadvantages of embryo screening.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how screening shows whether an embryo has a genetic disorder.</li> <li>Make an informed judgement about embryo screening by evaluating in detail the economic, social, and ethical issues.</li> </ul>

## Chapter 14: Variation and Evolution (Paper 2)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 14.1	<ul style="list-style-type: none"> <li>List some examples of human variation.</li> <li>Categorise some human traits as being due to genetic causes, environmental causes, or both.</li> <li>Describe why identical twins share the same genes.</li> </ul>	<ul style="list-style-type: none"> <li>List some examples of variation in plants and categorise these as being due to genetic causes, environmental causes, or both.</li> <li>Suggest reasons why identical twins will start to show variation as they get older.</li> <li>Use data to explain why studying identical twins helps scientists investigate which traits have genetic causes.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why some traits are only due to genetic causes.</li> <li>Explain why it is so hard to get valid results from identical-twin studies.</li> <li>Discuss some of the issues scientists face when conducting twin studies.</li> </ul>
Lesson 14.2	<ul style="list-style-type: none"> <li>Describe a mutation as a change in the DNA code.</li> <li>Describe the theory of evolution by natural selection as a process by which living things have evolved from simple life forms.</li> <li>State some useful adaptations.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how a mutation may lead to a new phenotype.</li> <li>Describe the steps that take place during evolution by natural selection.</li> <li>Analyse data from an activity modelling natural selection.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why it is rare that a mutation leads to a new phenotype.</li> <li>Apply the theory of evolution by natural selection to suggest how a specific organism evolved.</li> <li>Explain how a change in a model can make it useful for explaining something else.</li> </ul>
Lesson 14.3	<ul style="list-style-type: none"> <li>Describe selective breeding as a process where humans choose which plants or animals to breed together.</li> <li>Give one example where selective breeding has been used.</li> <li>Choose organisms to breed together to result in desired traits in the offspring.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the process of selective breeding.</li> <li>Explain why humans have used selective breeding.</li> <li>Explain what inbreeding is, and why it is a problem in dog breeding.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast natural and artificial selection.</li> <li>Explain in detail how the variation of alleles in a population is reduced through selective breeding.</li> <li>Explain in detail why the reduction of variation in a population through selective breeding is a problem.</li> </ul>
Lesson 14.4	<ul style="list-style-type: none"> <li>Describe GM organisms as containing a gene from another organism, and order the stages of genetic engineering.</li> <li>Give examples of GM organisms and describe why they are useful to humans.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the steps used in genetic engineering to produce GM organisms.</li> <li>Analyse data to describe why growing GM crops may be beneficial to a farmer.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the process of genetic engineering using technical vocabulary (e.g., plasmid, vector, restriction enzymes, marker genes, recombinant DNA).</li> <li>Explain how genetic engineering could be used to cure people with inherited disorders, and discuss the limitations.</li> </ul>
Lesson 14.5	<ul style="list-style-type: none"> <li>Describe how to take stem and leaf cuttings of plants.</li> <li>Define the term clone, and use a diagram to describe why embryo transplants are clones.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the benefits for plant growers of reproduction using cuttings or tissue culture rather than seeds.</li> <li>Describe how embryo transplants are undertaken, and why they produce clones.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the benefits of embryo transplants over sexual reproduction for farmers.</li> <li>Compare and contrast tissue culture in plants and embryo transplantation in animals.</li> </ul>
Lesson 14.6	<ul style="list-style-type: none"> <li>Describe adult cell cloning as producing a complete clone of an adult animal.</li> <li>Describe the process of adult cell cloning using a diagram.</li> <li>Give one reason why scientists may want to clone an adult animal.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why the animal produced using adult cell cloning is a clone.</li> <li>Design a flow chart to describe the process of adult cell cloning.</li> <li>List some benefits and drawbacks of adult cell cloning.</li> </ul>	<ul style="list-style-type: none"> <li>Use advanced terminology to explain the process of adult cell cloning.</li> <li>Compare and contrast the processes of adult cell and embryo cloning.</li> <li>Evaluate the possible uses of adult cell cloning.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 14.7	<ul style="list-style-type: none"> <li>Give one concern people may have about growing GM crops.</li> <li>Describe why some people are against the cloning of animals.</li> </ul>	<ul style="list-style-type: none"> <li>Outline the potential benefits and risks of genetic engineering.</li> <li>Describe economic and ethical concerns that people may have about cloning animals.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the potential benefits and risks of genetic engineering.</li> <li>Explain in detail the significance of events in the field of genetics.</li> </ul>

## Chapter 15: Genetics and Evolution (Paper 2)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 15.1	<ul style="list-style-type: none"> <li>Use an example to describe the results from Mendel's experiments.</li> <li>Describe some important discoveries in gene theory.</li> </ul>	<ul style="list-style-type: none"> <li>Discuss why the importance of Mendel's work was not recognised until after his death.</li> <li>Correctly order important discoveries in gene theory.</li> </ul>	<ul style="list-style-type: none"> <li>Use a Punnett square to draw conclusions from the results of Mendel's experiments.</li> <li>Suggest why Mendel's work was not recognised during his lifetime, but the work of Watson and Crick was.</li> </ul>
Lesson 15.2	<ul style="list-style-type: none"> <li>Define the term evolution.</li> <li>State that Charles Darwin proposed the theory of evolution by natural selection.</li> <li>Describe the stages of evolution by natural selection.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast Darwin and Lamarck's theories of evolution.</li> <li>Describe the theory of inheritance of acquired characteristics proposed by Jean-Baptiste Lamarck.</li> <li>Design a storyboard to highlight important events that helped Darwin develop his theory.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why Lamarck's theory is no longer accepted in the vast majority of cases.</li> <li>Describe an example of where Lamarck's theory could be correct.</li> <li>Explain how and why theories, such as how evolution takes place, change over time.</li> </ul>
Lesson 15.3	<ul style="list-style-type: none"> <li>Describe how finches have different-shaped beaks so they can eat Different foods.</li> <li>Give one piece of evidence that support's Darwin's theory of natural selection.</li> <li>State one reason why most people did not accept Darwin's theory when it was first published.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how finches on different islands evolved different-shaped beaks by natural selection.</li> <li>Describe several reasons why most people did not accept Darwin's theory when it was first published.</li> <li>Explain why it was important that Darwin collected a variety of evidence</li> </ul>	<ul style="list-style-type: none"> <li>Explain how the finch species on the different Galapagos Islands are evidence for evolution by natural selection.</li> <li>Discuss why Darwin was conflicted over publishing his theory.</li> <li>Explain why scientists eventually accepted Darwin's theory.</li> </ul>
Lesson 15.4	<ul style="list-style-type: none"> <li>Describe what a species is.</li> <li>Define speciation as the process by which new species form.</li> <li>Give an example of an important discovery by Wallace.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the steps in the process of speciation.</li> <li>Explain why there are species living on Madagascar that share some similarities with species found elsewhere.</li> <li>Carry out research to describe other examples of speciation.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the relationship between the length of isolation and the number of unique species that evolve.</li> <li>Suggest how new species of organisms evolved.</li> <li>Explain why Wallace's work prompted Darwin to publish <i>The Origin of Species</i>.</li> </ul>
Lesson 15.5	<ul style="list-style-type: none"> <li>Describe what a fossil is and give an example.</li> <li>Recognise that fossils are evidence for evolution by natural selection.</li> <li>Order geological events.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how fossils are formed.</li> <li>Describe how fossils are evidence for evolution by natural selection.</li> <li>Explain why the fossil record is not complete.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the use of fossils as evidence for evolution by natural selection and how life first formed.</li> <li>Use standard form to discuss the large timescales used when considering the evolution of life.</li> <li>Create a geological timeline to scale.</li> </ul>
Lesson 15.6	<ul style="list-style-type: none"> <li>Describe what is meant by extinction.</li> <li>Describe one way that an animal could become extinct.</li> <li>Order fossil diagrams to show the evolution of the horse.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how other organisms can cause an animal or plant to become extinct.</li> <li>Suggest a hypothesis for why an organism became extinct.</li> <li>Explain how fossil diagrams show how the horse has evolved.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest alternative hypotheses for why an organism became extinct.</li> <li>Evaluate in detail the need to conserve endangered plants.</li> <li>Apply knowledge of speciation to explain why dodos were only found on one island.</li> </ul>
Lesson 15.7	<ul style="list-style-type: none"> <li>Describe what a mass extinction is.</li> <li>State that environmental change and a catastrophic event are two possible causes of mass extinction.</li> <li>Describe one theory that explains why the dinosaurs became extinct.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest the effects of an asteroid, comet, or meteorite strike on Earth.</li> <li>Explain how environmental change can cause mass extinctions.</li> <li>Identify strengths and weaknesses in two different theories of mass extinction.</li> </ul>	<ul style="list-style-type: none"> <li>Link ideas to give a scientific explanation of why an asteroid could have caused the dinosaurs to become extinct.</li> <li>Suggest why mass extinctions are important for the evolution of life on Earth.</li> <li>Evaluate two theories to come to a</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
			conclusion about which is more believable, and explain why scientists are not sure what caused the extinction of dinosaurs or mammoths.
Lesson 15.8	<ul style="list-style-type: none"> <li>Describe what is meant by an antibiotic resistant bacteria.</li> <li>Describe why scientists want to slow down the rate of development of new strains of antibiotic resistant bacteria.</li> <li>List some ways in which scientists can slow down the development of new strains of antibiotic resistant bacteria.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how antibiotic resistant bacteria evolve.</li> <li>Explain why scientists need to develop new antibiotics.</li> <li>Create an information sheet outlining important facts about antibiotic resistant bacteria to the public.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how a fast reproduction rate is linked to the development of antibiotic resistance strains of bacteria.</li> <li>Explain how antibiotic resistant bacteria are evidence for evolution.</li> <li>Summarise the reasons why the development of new antibiotics is unlikely to keep up with the emergence of new strains of antibiotic resistant bacteria.</li> </ul>
Lesson 15.9	<ul style="list-style-type: none"> <li>Describe what classification is.</li> <li>Classify animals into groups based on their shared characteristics.</li> </ul> <p>Write an organism's name correctly using the binomial system.</p>	<ul style="list-style-type: none"> <li>Describe the classification system developed by Carl Linnaeus, to include the order of the taxonomic groups.</li> <li>Identify genus and species from a scientific name.</li> <li>Explain why a binomial naming system is useful.</li> </ul>	<ul style="list-style-type: none"> <li>Use the Linnaean system to name the groups that given organisms belong to.</li> <li>Suggest why hybrids are not assigned scientific names using the binomial system.</li> </ul>
Lesson 15.10	<ul style="list-style-type: none"> <li>Name the three domains.</li> <li>Recognise that ideas about classification have changed over time.</li> <li>Draw a conclusion from a simple evolutionary tree.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how organisms are divided in the three-domain system.</li> <li>Describe why the three-domain system was proposed.</li> <li>Draw several conclusions from a simple evolutionary tree.</li> </ul>	<ul style="list-style-type: none"> <li>Compare and contrast the Linnaean system with the three-domain system.</li> <li>Outline how ideas about classification have developed over time.</li> <li>Draw conclusions from a more complex evolutionary tree.</li> </ul>

## Chapter 16: Genetics and Evolution (Paper 2)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 16.1	<ul style="list-style-type: none"> <li>Describe what is meant by ecosystem, population, and community.</li> <li>List some resources that living things need.</li> <li>Use a given example to describe why one species relies on another.</li> </ul>	<ul style="list-style-type: none"> <li>Define the terms community, population, habitat, ecosystem, abiotic factor, biotic factor.</li> <li>Describe what a stable community is and give an example.</li> <li>Suggest how one species relies on another.</li> </ul>	<ul style="list-style-type: none"> <li>Link key words to explain why a community is stable and important.</li> <li>Use evidence to write hypotheses about why populations have changed in a community.</li> <li>Explain why interdependence is important in maintaining a stable community.</li> </ul>
Lesson 16.2	<ul style="list-style-type: none"> <li>Identify factors as biotic or abiotic</li> <li>Use an instrument to measure an abiotic factor.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how a factor influences the distribution of organisms.</li> <li>Record measurements of abiotic factors.</li> </ul>	<ul style="list-style-type: none"> <li>Describe in detail how to measure the pH and water content of soil.</li> <li>Analyse data in detail and draw appropriate conclusions.</li> </ul>
Lesson 16.3	<ul style="list-style-type: none"> <li>Describe the function of a quadrat and a transect.</li> <li>Follow a method to estimate a population using a sampling technique.</li> <li>Calculate the mean of a set of results.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how to use a quadrat and a transect to estimate population sizes.</li> <li>Design a method to estimate a population using a sampling technique.</li> <li>Calculate range, mean, median, and mode in order to analyse results.</li> </ul>	<ul style="list-style-type: none"> <li>Discuss what factors determine the size of the quadrat used.</li> <li>Design independently an investigation based around a question or hypothesis.</li> <li>Evaluate in detail the use of sampling to estimate population size.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 16.4	<ul style="list-style-type: none"> <li>Recognise that animals compete with each other for resources.</li> <li>List resources that animals compete with each other for.</li> <li>Describe what will happen to an animal if it cannot compete for resources.</li> </ul>	<ul style="list-style-type: none"> <li>Use information to suggest factors that animals are competing for in a given habitat.</li> <li>Explain tactics that help an animal compete for a resource.</li> <li>Describe how the distribution of a species has changed because of competition.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate a model of competition between organisms.</li> <li>Use the terms inter-specific and intra-specific competition, and give examples of each.</li> <li>Suggest and explain how animals are adapted to compete for resources.</li> </ul>
Lesson 16.5	<ul style="list-style-type: none"> <li>List resources that plants compete with each other for.</li> <li>Describe what seed dispersal is and give some ways in which plants carry it out.</li> <li>Make measurements of seedlings.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest factors that plants are competing for in a given habitat.</li> <li>Explain why plants use seed dispersal.</li> <li>Describe the methods plants use to outcompete others or avoid competition.</li> </ul>	<ul style="list-style-type: none"> <li>Plan a method to investigate competition between cress seeds.</li> <li>Analyse data to explain the effects of overcrowding.</li> <li>Suggest the problems caused by plants that can easily outcompete others.</li> </ul>
Lesson 16.6	<ul style="list-style-type: none"> <li>Describe one example of how an organism is adapted.</li> <li>Define an extremophile.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest features that an organism may have in order to survive in a given habitat.</li> <li>Explain how adaptations allow an organism to survive in its habitat.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest and explain in detail how an organism in an extreme location might evolve to become better adapted to its habitat.</li> <li>Apply knowledge of extremophiles to discuss why scientists believe there could be life on other planets (or moons).</li> </ul>
Lesson 16.7	<ul style="list-style-type: none"> <li>Describe one example of an animal adaptation.</li> <li>Describe why it is important that most animals maintain the correct body temperature.</li> </ul> <p>Describe why fur or feathers can be used to maintain a warm body temperature.</p>	<ul style="list-style-type: none"> <li>Classify adaptations as structural, behavioural, or functional.</li> <li>Calculate surface area to volume ratio.</li> <li>Describe how animals are adapted to live in hot, dry, and cold habitats.</li> </ul>	<p>Suggest structural, behavioural, or functional adaptations.</p> <p>Explain and illustrate how surface area to volume ratio is linked to maintaining the correct body temperature.</p> <p>Discuss how and why climate change is affecting the distribution of animals.</p>
Lesson 15.8	<ul style="list-style-type: none"> <li>Describe one example of a plant adaptation.</li> <li>Describe why plants need a constant supply of water.</li> <li>Draw a graph to display data, with guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how a plant adaptation allows it to survive in its habitat.</li> <li>Explain why plants need to reduce water loss by transpiration.</li> <li>Display data using a graph and describe what it shows.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how an unfamiliar plant is adapted and give reasons for its adaptations.</li> <li>Link and explain rate of transpiration to leaf structure.</li> <li>Suggest and explain why a cactus would not survive in a cold climate.</li> </ul>

## Chapter 17: Organisation of the ecosystem (Paper 2)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 17.1	<ul style="list-style-type: none"> <li>State the meaning of the terms producer, consumer, predator, and prey, and give examples of each.</li> <li>Identify producers, consumers, predators, and prey in a food chain.</li> <li>Describe what a graph shows about how the numbers of predators and prey change over time.</li> </ul>	<ul style="list-style-type: none"> <li>Identify producers, primary consumers, secondary consumers, tertiary consumers, predators, and prey in a food web.</li> <li>Describe what happens to a population in a food web when another population changes.</li> <li>Plot data as a line graph and explain the pattern of predator and prey populations.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail why all living things depend on producers.</li> <li>Evaluate in detail food chains/webs as models to show feeding relationships.</li> <li>Make predictions based on data on a predator–prey relationship.</li> </ul>
Lesson 17.2	<ul style="list-style-type: none"> <li>Describe what a decomposer is and give examples.</li> <li>Name some substances that are recycled in the living world.</li> <li>Describe the events in the water cycle.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why decomposers are important to a stable ecosystem.</li> <li>Explain the importance of recycling substances.</li> <li>Describe the events in the decay cycle.</li> </ul>	<ul style="list-style-type: none"> <li>Explain how detritivores increase the rate of decay using ideas about surface area.</li> <li>Explain how substances change as they decay.</li> <li>Comment on the limitations of a simple model of decay.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 17.3	<ul style="list-style-type: none"> <li>Recognise that carbon atoms are moved around the Earth (recycled).</li> <li>Give one reason why we need to recycle carbon.</li> <li>Use a diagram of the carbon cycle to describe the main processes involved.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the events in the carbon cycle.</li> <li>Explain why the carbon cycle is vital to life on Earth.</li> <li>Write word equations for photosynthesis, respiration, and combustion.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail why the concentration of carbon dioxide in the atmosphere is rising, and why this is an issue.</li> <li>Explain the links between photosynthesis, respiration, and combustion in the carbon cycle.</li> <li>Write balanced symbol equations for photosynthesis, respiration, and combustion.</li> </ul>
Lesson 17.4	<ul style="list-style-type: none"> <li>List the factors that affect the rate of decay.</li> <li>Choose a suitable independent variable and a way of changing it.</li> <li>Plot a line graph with more than one line plotted on the same axes, with guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Identify factors that speed up or slow down decay.</li> <li>Choose a suitable dependent variable and plan a way to measure it accurately.</li> <li>Plot a line graph with more than one line plotted on the same axes.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why factors speed up or slow down decay.</li> <li>Apply factors which affect the rate of decay to real life situations (e.g., compost making, preserving food).</li> <li>Calculate percentage change and rate of decay.</li> </ul>

## Chapter 18: Biodiversity and ecosystems (Paper 2)

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 18.1	<ul style="list-style-type: none"> <li>Describe what biodiversity means.</li> <li>List some resources that humans are using up.</li> <li>Describe some ways that air, water, and land are polluted.</li> </ul>	<ul style="list-style-type: none"> <li>Describe why a good level of biodiversity is important to the future of the human species.</li> <li>Describe some effects of human population growth.</li> <li>Analyse and interpret data and information concerning human population growth.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail why a high level of biodiversity is important to the stability of ecosystems.</li> <li>Explain why human population change differs from population change of other animals.</li> <li>Suggest and evaluate solutions to the problems caused by human population growth.</li> </ul>
Lesson 18.2	<ul style="list-style-type: none"> <li>List some substances that pollute water and land.</li> <li>Describe some effects of rubbish, pesticides, and sewage on land and water.</li> <li>Display data appropriately with guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how sewage, fertilisers, pesticides, and herbicides pollute the land and water.</li> <li>Describe the processes of eutrophication and bioaccumulation.</li> <li>Draw conclusions from data.</li> </ul>	<ul style="list-style-type: none"> <li>Explain in detail how pollution affects biodiversity.</li> <li>Explain how pesticides in water can kill top predators in food chains.</li> <li>Consider a land- or water-based pollution issue, stating opinions with reasoning.</li> </ul>
Lesson 18.3	<ul style="list-style-type: none"> <li>State that acid rain is caused as a result of burning some fuels.</li> <li>List some effects of acid rain on plants and animals.</li> <li>Analyse observations and data, with guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Describe how acid rain is formed.</li> <li>Plan an investigation to find out how acid rain affects the germination of seeds.</li> <li>Choose a suitable method for analysing data.</li> </ul>	<ul style="list-style-type: none"> <li>Use word and symbol equations to show how burning some fuels produces acidic gases.</li> <li>Explain what causes global dimming and smog, and describe their effects.</li> <li>Analyse in detail data showing sulfur emissions over the last 30 years, and suggest reasons for the trend.</li> </ul>
Lesson 18.4	<ul style="list-style-type: none"> <li>Define deforestation</li> <li>Describe an effect of deforestation</li> <li>Give a use for peat</li> </ul>	<ul style="list-style-type: none"> <li>Explain the effects of deforestation and peat removal.</li> <li>Categorise reasons for and effects of deforestation as environmental, social, economic, and/or political.</li> <li>Describe why there is a conflict between using peat to increase food production and the need to conserve peat bogs.</li> </ul>	<p>Explain in detail how deforestation and peat removal increase the amount of carbon dioxide in the air.</p> <p>Analyse data to describe a trend in deforestation rate, and give an explanation.</p> <p>Explain the conflict between using peat to increase food production and the need to conserve peat bogs.</p>
Lesson 18.5	<ul style="list-style-type: none"> <li>Describe how global warming is caused by increased levels of carbon dioxide and methane in the atmosphere.</li> <li>Give one biological consequence of global warming.</li> </ul>	<ul style="list-style-type: none"> <li>Use the terms greenhouse effect, global warming, and climate change correctly.</li> <li>Describe in detail the biological consequences of global warming.</li> </ul>	<ul style="list-style-type: none"> <li>Produce scale diagrams showing some of the contributors to the greenhouse effect.</li> <li>Explain in detail the causes and effects of rising carbon dioxide and methane levels in the atmosphere.</li> </ul>

	Aiming for Grade 4	Aiming for Grade 6	Aiming for Grade 8
Lesson 18.6		<ul style="list-style-type: none"> <li>State some examples of environmental changes that affect the distribution of species in an ecosystem.</li> <li>Explain how humans can cause environmental changes.</li> <li>Describe an example of how environmental change has affected the distribution of a species.</li> </ul>	<ul style="list-style-type: none"> <li>Categorise environmental changes as due to seasonal changes, geographical changes, human interaction, or a combination.</li> <li>Explain how people are attempting to reduce the problems caused by a change in distribution of organisms.</li> <li>Predict and explain how an environmental change will affect the distribution of an organism.</li> </ul>
Lesson 18.7	<ul style="list-style-type: none"> <li>List some ways in which people can help maintain biodiversity.</li> <li>Describe the reasons why some habitats are at risk.</li> </ul>	<ul style="list-style-type: none"> <li>Describe programmes to reduce negative effects on ecosystems and explain how they work.</li> <li>Use information to explain the conflicting pressures on maintaining biodiversity.</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the conflicting pressures on maintaining biodiversity in some habitats.</li> <li>Link ideas to suggest why recycling can help protect habitats.</li> </ul>
Lesson 18.8	<ul style="list-style-type: none"> <li>Identify a producer, primary consumer, and secondary consumer from a food chain and pyramid of biomass.</li> <li>Identify organisms using a chart and group organisms into feeding types.</li> <li>Draw a pyramid of biomass, with guidance.</li> </ul>	<ul style="list-style-type: none"> <li>Number the trophic levels in a food chain, food web, and pyramid of biomass.</li> <li>Describe how decomposers feed.</li> <li>Use data to draw a pyramid of biomass and explain what it shows.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why pyramids of biomass are always pyramid shaped.</li> <li>Evaluate a method for collecting information about biomass.</li> <li>Calculate the percentage of biomass passed between trophic levels.</li> </ul>
Lesson 18.9	<ul style="list-style-type: none"> <li>Describe the energy transfer that occurs during photosynthesis.</li> <li>Calculate the percentage of biomass passed between trophic levels, with guidance.</li> <li>Give a reason why not all biomass is passed from one trophic level to the next.</li> </ul>	<ul style="list-style-type: none"> <li>Calculate the percentage of biomass passed between trophic levels.</li> <li>Calculate the efficiency of transfers, with guidance.</li> <li>Explain how the loss of biomass at each trophic level affects the number of organisms at each level.</li> </ul>	<ul style="list-style-type: none"> <li>Calculate the efficiency of energy transfers.</li> <li>Explain in detail the reasons why not all biomass is passed from one trophic level to the next.</li> <li>Link the reduction in biomass to energy transfers, and evaluate a model used to represent this.</li> </ul>
Lesson 18.10	<ul style="list-style-type: none"> <li>Describe what food security and malnutrition mean.</li> <li>List some factors that reduce food security.</li> <li>Present information in a debate.</li> </ul>	<ul style="list-style-type: none"> <li>Define sustainable food production and describe how it could help increase food security.</li> <li>Explain how factors affect food security.</li> <li>Present information based on research.</li> </ul>	<ul style="list-style-type: none"> <li>Suggest and explain how events could affect food security.</li> <li>Consider whether malnutrition is just a problem in developing countries.</li> <li>Present information clearly with supporting evidence.</li> </ul>
Lesson 18.11	<ul style="list-style-type: none"> <li>Describe the difference between free-range and factory farming of chickens.</li> <li>List some advantages and disadvantages of free-range and factory farming of chickens.</li> </ul>	<ul style="list-style-type: none"> <li>Explain why there could be more food for everyone if we ate less meat.</li> <li>Explain why there are ethical objections to some factory farming techniques.</li> <li>Explain how factory farming techniques increase rate of growth.</li> </ul>	<ul style="list-style-type: none"> <li>Use viewpoints from a range of people during a debate on farming.</li> <li>Explain in detail why, in terms of food production efficiency, it is a good idea to reduce meat in the diet or replace it with insects.</li> </ul>
Lesson 18.12	<ul style="list-style-type: none"> <li>Give one reason why fish stocks in the oceans are decreasing.</li> <li>Describe one reason why a reduction in fish stocks is a problem.</li> <li>Describe what mycoprotein is.</li> </ul>	<ul style="list-style-type: none"> <li>Describe the reasons why fish stocks in the oceans are decreasing.</li> <li>Describe the techniques used to conserve fish stocks.</li> <li>Describe how mycoprotein is produced.</li> </ul>	<ul style="list-style-type: none"> <li>Explain the negative impacts of fishing restrictions on communities.</li> <li>Compare and contrast the production of mycoprotein with intensive farming.</li> <li>Explain the advantages of eating mycoprotein for the individual and for society as a whole.</li> </ul>