



Curriculum Map for Science Biology Year 12

YEAR 12	Autumn 1	Autumn 2
Topics	Biological Molecules Cell Structure	Transport Across The Cell Membrane Cell Recognition & The Immune System
Substantive Knowledge – The Knowledge and Content Taught By The Teacher	<ul style="list-style-type: none">Students will learn that biological molecules are the building blocks of all cells and organisms.They will learn that these biologically important molecules are all carbon-based and are:<ul style="list-style-type: none">CarbohydratesLipidsProteinsStudents will learn how these molecules are involved in our metabolism.Students will learn about the two main types of cells:<ul style="list-style-type: none">ProkaryoticEukaryotic cells	<ul style="list-style-type: none">Students will learn how substances move through the cell membrane.Students will learn about infections and how the body's defence mechanisms exist to protect it from infection and to fight infection if a pathogen does enter the body.Students will learn about the proteins in the cell-surface membrane.They will learn that the immune system of the body is able to recognise cells that are from the same organism (self) and from other organisms (non-self). This allows them to identify potential threats to the health of the organism and to respond.
Disciplinary Knowledge – The Knowledge Scientists Need So They Can Collect, Understand and Evaluate Scientific Evidence	<ul style="list-style-type: none">The History and Discovery of DNA and its Development Over Time - Uses and ApplicationDevelopment of the Microscope	<ul style="list-style-type: none">HIV - Discovery, Treatment and Searches for a CureVaccination - Discovery, Uses and FutureDiseases of the Immune System, Treatments and Cures
Skills	<ul style="list-style-type: none">Students will use and interpret the results of qualitative tests for reducing sugars, non-reducing sugars and starch.Students will use chromatography, with known standard solutions, to separate a mixture of monosaccharides and identify their components.Students will produce a dilution series of glucose solution and use colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown solution.Students will use and interpret the results of the emulsion test for lipids.Students will use and interpret the results of a biuret test for proteins.	<ul style="list-style-type: none">Students will plot the data from their investigations in an appropriate format.Students will determine the water potential of plant tissues using the intercept of a graph of, e.g., water potential of solution against gain/loss of mass.

	<ul style="list-style-type: none"> • Students will use chromatography with known standard solutions, to separate a mixture of amino acids and identify their components. • Students will identify the variables that must be controlled in their investigation into rate of reaction. • Students will calculate the uncertainty of their measurements of the rate of reaction. • Students will select an appropriate format for the graphical presentation of the results of their investigation into the rate of enzyme-controlled reactions. • Students will use a tangent to find the initial rate of an enzyme-controlled reaction. • Students will use incomplete information about the frequency of bases on DNA strands to find the frequency of other bases. • Students will use iodine in potassium iodide solution to identify starch grains in plant cells. • Students will calculate a mitotic index. 	
Links To Prior Learning	<ul style="list-style-type: none"> • GCSE Content - Food Tests (also covered in Years 7 and 8) • GCSE Content - Structure of DNA and DNA Replication (Triple Biology only) • Microscope Structure - introduced at Year 7 and developed at Year 9 	<ul style="list-style-type: none"> • Diffusion, Osmosis, Active Transport introduced early in Year 9 • Fighting Infection in Years 7 and 8 plus Triple and Combined Science
Literacy/ Numeracy	<ul style="list-style-type: none"> • Literacy - building on structure of long answer questions • Practical Write Up Skills - focus on hypothesis and methods • Essay Development • Numeracy - focus on plotting graphs, tangents and calculations around chromatography and mitosis 	<ul style="list-style-type: none"> • Literacy - building on structure of describe questions • Practical Write Up Skills - focus on risk assessments • Numeracy - focus on interpretations of graphs and using intercepts of graphs
Cross Curricular	<ul style="list-style-type: none"> • Food & Nutrition - Biological Molecules • History - Discovery of DNA and Medicine Through Time 	<ul style="list-style-type: none"> • PSHE - HIV Discovery, Treatment and Safe Sex • PSHE - Vaccination
Assessment	<ul style="list-style-type: none"> • Biological Molecules Assessment • Cell Structure Assessment 	<ul style="list-style-type: none"> • Transport Across the Cell Membrane Assessment • Cell Recognition and the Immune System Assessment

YEAR 12	Spring 1	Spring 2
Topics	Genetic Information, Variation & Relationships Between Organisms	Organisms Exchange Substance With Their Environment
Substantive Knowledge –	<ul style="list-style-type: none"> • Students will learn of the information needed for an organism to be created 	<ul style="list-style-type: none"> • Students will learn about exchange.

<p>The Knowledge and Content Taught By The Teacher</p>	<p>and to function is encoded in the DNA found in every cell.</p> <ul style="list-style-type: none"> • Students will learn that all organisms use the same genetic code and that the information encoded in the DNA is used to make proteins. Students will learn how this code is used to make proteins. • Students will learn about mutations and that they are the basis of genetic change and variation. • They will learn that this results in differences in the genes between every individual. • Students will learn that certain genes will enable individuals to survive and reproduce. • They will learn how variation makes it possible for animals to adapt. 	<ul style="list-style-type: none"> • Students will learn how exchange surfaces are adapted to their functions. • Students will learn how single-celled organisms rely on diffusion to transport into and out of the cell. • They will learn about multicellular organisms and how they are usually too large for diffusion to be an effective transport system and so they have mass transport systems. • Students will learn how important substances travel around larger organisms such as animals and plants.
<p>Disciplinary Knowledge – The Knowledge Scientists Need So They Can Collect, Understand and Evaluate Scientific Evidence</p>	<ul style="list-style-type: none"> • DNA Discovery, Development and Uses • Protein Synthesis Discovery, Development and Uses • Genetic Diversity and Adaptation - Relation and Linking into Evolution • Practical Techniques for Quantitative Investigations and their Development 	<ul style="list-style-type: none"> • Heart Structure, Treatments for Diseases and Development • Gas Exchange, Treatment for Diseases and Development
<p>Skills</p>	<ul style="list-style-type: none"> • Students will examine meiosis in prepared slides of suitable plant or animal tissue. • Students will use the expression $2n$ to calculate the possible number of different combinations of chromosomes following meiosis, without crossing over. • Students will use a logarithmic scale when dealing with data relating to large numbers of bacteria in a culture. • Students will be given data from which to calculate an index of diversity and interpret the significance of the calculated value of the index. • Students will use standard scientific calculators to calculate the mean values of data they have collected or have been given. • Students will calculate and interpret the values of the standard deviations of their mean values. 	<ul style="list-style-type: none"> • Students will use agar blocks containing indicator to determine the effect of surface area to volume ratio and concentration gradient on the diffusion of an acid or alkali. • Students will be given the dimensions of cells with different shapes from which to calculate the surface area to volume ratios of these cells. • Students will dissect mammalian lungs, the gas exchange system of a bony fish or of an insect. • Students will use an optical microscope to examine prepared mounts of gas exchange surfaces of a mammal, fish and insect, or temporary mounts of gills. • Students will use three-way taps, manometers and simple respirometers to measure volumes of air involved in gas exchange. • Students will be given values of pulmonary ventilation rate (PVR) and one other measure, requiring them to change the subject of the equation: $PV R = \text{tidal volume} \times \text{breathing rate}$. • Students will design and carry out an investigation into the effect of a named variable on human pulse rate or on the

		<p>heart rate of an invertebrate, such as Daphnia.</p> <ul style="list-style-type: none"> • Students will be given values of cardiac output (CO) and one other measure, requiring them to change the subject of the equation: $CO = \text{stroke volume} \times \text{heart rate}$. • Students will set up and use a potometer to investigate the effect of a named environmental variable on the rate of transpiration.
Links To Prior Learning	<ul style="list-style-type: none"> • DNA structure and mutations covered in GCSE. • Quantitative methods for looking at diversity introduced at Triple Biology GCSE. • DNA structure in Years 7 and 8 content. 	<ul style="list-style-type: none"> • Gas exchange in lungs at Years 7 and 8. • Gas exchange in plants at GCSE Biology. • Enzymes and digestion - introduced in Years 7 and 8 and developed in GCSE Combined and Triple. • Heart structure - GCSE content.
Literacy/ Numeracy	<ul style="list-style-type: none"> • Literacy - development of explain questions and how to approach/ answer them. • Practical Write Up Skills - focus on analysis of data and conclusion. • Numeracy - calculations, logarithms, mean and standard deviation. 	<ul style="list-style-type: none"> • Literacy - development of essay structure and how to approach the essay questions based around the topics so far. • Practical Write Up Skills - focus on background research and referencing. • Numeracy - surface area to volume ratio calculations, PVR calculations and cardiac output calculations.
Cross Curricular	<ul style="list-style-type: none"> • Geography - Biodiversity Investigations 	<ul style="list-style-type: none"> • PE - Heart and Lung Function and Cardiac Output • Geography - Water Quality for Plant and Insect Life/Biodiversity
Assessment	<ul style="list-style-type: none"> • Control of Gene Expression Assessment 	<ul style="list-style-type: none"> • Organisms Exchange Substance with their Environment Assessment

YEAR 12	Summer 1	Summer 2
Topics	Photosynthesis	Respiration
Substantive Knowledge – The Knowledge and Content Taught By The Teacher	<ul style="list-style-type: none"> • Students will learn that almost all life on Earth depends on photosynthesis. • Students will learn how photosynthesis works in detail and the limiting factors that effect it. 	<ul style="list-style-type: none"> • Students will learn about respiration how a series of chemical reactions allow cells to release energy. • Students will learn about the four stages of respiration: Glycolysis The Link Reaction The Krebs Cycle The Electron Transport Chain
Disciplinary Knowledge – The Knowledge Scientists Need So They Can Collect, Understand	<ul style="list-style-type: none"> • The link between Photosynthesis and Respiration. 	<ul style="list-style-type: none"> • The link between Respiration and Photosynthesis.

and Evaluate Scientific Evidence		
Skills	<ul style="list-style-type: none"> Students will devise and carry out experiments to investigate the effect of named environmental variables on the rate of photosynthesis using aquatic plants, algae or immobilised algal beads. 	<ul style="list-style-type: none"> Students will use a redox indicator to investigate dehydrogenase activity.
Links To Prior Learning	<ul style="list-style-type: none"> Photosynthesis is introduced and developed in Science during Years 7 to 11. 	<ul style="list-style-type: none"> Respiration is introduced and developed in Science during Years 7 to 11.
Literacy/ Numeracy	<ul style="list-style-type: none"> Literacy - development of use of key words in answers and understanding mark schemes. Practical Write Up Skills – focus on evaluation. Numeracy - graphical representation from practical and subsequent calculations from key parts of data. 	<ul style="list-style-type: none"> Literacy - development of analytical skills with graphs and tables. Practical Write Up Skills – focus on full scientific reports and how to present them. Numeracy - calculations from respiration and using them in analysis.
Cross Curricular	<ul style="list-style-type: none"> Geography - Conditions for Photosynthesis 	<ul style="list-style-type: none"> PE - Aerobic and Anaerobic Respiration and Calculations Food & Nutrition - Anaerobic Respiration Products
Assessment	<ul style="list-style-type: none"> Photosynthesis Assessment 	<ul style="list-style-type: none"> Respiration Assessment Mock Exam Paper