



KS4 Curriculum Map – Biology:

Topic	Knowledge <i>Substantive knowledge:</i> This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Skills <i>Disciplinary knowledge:</i> This is the action taken within a particular topic in order to gain substantive knowledge.	Assessment Opportunities What assessments will be used to measure student progress?
Cells and magnification	<ul style="list-style-type: none"> • Microscopy. • Animal and plant cells. • Eukaryotic and Prokaryotic cells. • Specialisation in animal and plant cells. • Movement across membranes. • Growing bacteria in the lab. • Preventing bacterial growth and infections. • Exchanging materials. • Cell cycle and mitosis. • Aerobic and anaerobic respiration equation • Growth and differentiation. • Stem cells and ethics. 	<ul style="list-style-type: none"> • Compare microscope slides and calculate magnification. • Conversion of units. • Label plant, animal, eukaryotic, prokaryotic and specialised cells and link to function. • To calculate how bacteria grow by binary fission. • Use aseptic techniques to grow bacteria safely in the laboratory. • Describe diffusion and explain factors that affect them. • Stages of the cell cycle including mitosis. • Identification of DNA and how it is organised in the nucleus. • Identify the differences between the differentiation of plant and animal cells. • Identify similarities and differences between embryonic and adult stem cells. • Describe the process of therapeutic cloning. • Evaluate the use of stem cells in medicine and the ethics behind their use. • Respiration as an exothermic reaction and explain the need for it 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback. • Exam style questions. • Appropriate use of keywords. • Extended writing for evaluation questions. • Required practical 1 Using a light microscope to observe and record animal and plant cells • Required practical 2 Investigation disinfectants • Ch1 Cells topic test linked with ARE • Mathematical skills: Size and number

<p>Photosynthesis</p>	<ul style="list-style-type: none"> • Photosynthesis equation. • Limiting factors of photosynthesis. • Uses of glucose in plants. • Tissues, organs and transport systems in plants. • Transpiration and translocation 	<ul style="list-style-type: none"> • Describe photosynthesis as an endothermic reaction. • Label a cross section of a leaf and describe how the structure links to its function. • Sketch and label graphs showing limiting factors of photosynthesis. • Describe and explain the five different uses of glucose in plants. • Explain how photosynthesis can be optimised for industry. • Describe tissues and organs are organised in plants. • To describe the role of stomata and guard cells in controlling transpiration and factors that affect the rate of transpiration. 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback • Exam style questions. • Apply knowledge to design own greenhouse or analyse data to relate limiting factors to cost-effectiveness. • Appropriate use of keywords. • Extended writing for transpiration and translocation • Testing leaves for starch • Observing stomata under a microscope • Required practical 3 Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organisms such as pondweed. • Practical testing leaves for starch. • Practical observing plant transport vessels under a microscope. • Ch2 Photosynthesis topic test linked with ARE • Mathematical skills: Surface area to volume ratio
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<p>Moving and changing materials</p>	<ul style="list-style-type: none"> • The digestive system and how it works. • Enzymes as catalysts and factors affecting enzyme action. • Osmosis and active transport. • Making digestion efficient. • Composition of the blood. • Blood vessels. • The structure and function of the heart. • Helping the heart. • Breathing and gas exchange. 	<ul style="list-style-type: none"> • Describe osmosis and explain the consequences of osmosis in cells with reference to appropriate keywords. • Explain surface area to volume ratio and its relationship with exchange. • Identify when active transport is appropriate and describe the process. • To be able to explain how enzymes work using the lock and key theory. • Use data to interpret the effect of temperature and pH on enzyme action. • To discuss the role of bile in the digestion of lipids. • Label the digestive system, discuss the roles of each organ and role of enzymes. • To draw and explain basic structures of carbohydrates, proteins and lipids. • Identify the main food groups using standard food tests. • To explain the structural difference between the different types of blood vessels including the importance of valves. • To be able to label the structure of the heart. • To explain how the blood flows around the body and the importance of a double circulatory system. • To describe the roles of artificial pacemakers and hearts. • The effect of muscle fatigue in the body and oxygen debt • Explain how gases are exchanged in the alveoli. • To describe ventilation in the lungs including pressure and volume changes. • To describe and explain the functions of each main component of blood. 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback • Exam style questions. • Appropriate use of keywords. • Extended writing to evaluate treatments for cardiovascular disease. • Observe a demonstration of a heart dissection • Required practical 4 Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue. • Required practical 5 Investigate the effect of pH on the rate of reaction of amylase enzyme • Required practical 6 Qualitative reagents to test for a range of carbohydrates, lipids, and proteins • Ch3 Moving and changing materials topic test. • Mathematical skills: Extracting and interpreting information
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<p>Pathogens and disease</p>	<ul style="list-style-type: none"> • What is good health? • Pathogens and disease. • Cancer • Diseases caused by viruses, bacteria, fungi and protists. • Human defence responses. • Plant disease and defence responses. • Vaccinations. • Antibiotics and painkillers. • Discovering and developing new drugs. • Making and the uses of monoclonal antibodies. 	<ul style="list-style-type: none"> • To list the different causes of ill health including the role of pathogens. • Explain the effect of different antibiotics on bacterial growth. • To describe the relevance the work of key scientists played in the prevention of spread of disease. • To be able to give examples of plant and animal diseases caused by viruses, bacteria, fungi and protists. • Recall and describe the specific and non-specific human immune defences. • Describe the effect of mineral deficiencies and their impact on plant growth. • Describe how plants have evolved various mechanisms to defend themselves. • Describe how vaccination induces an immune response. • Explain the importance of herd immunity. • Explain the difference between treating symptoms and treating a specific disease. • Recall how new drugs are developed and the stages involved in testing and trialling. • To explain the importance of double-blind trials and the use of a placebo. • Explain how monoclonal antibodies are produced and the uses of them. • Give examples of uses of monoclonal antibodies. • Describe the relationship between health and disease and describe what a causal mechanism is. • Explain the differences between a benign and malignant tumour and explain metastasis. • Explain smoking as a risk factor for disease in humans, including unborn babies. 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback • Exam style questions. • Appropriate use of keywords. • Extended writing to compare and contrast bacterial and viral diseases • Extended writing to evaluate the use of monoclonal antibodies. • Research opportunity on the role of scientific discoveries. • Ch4 Pathogens and disease topic test. • Mathematical skills: Sampling and scientific data
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<p>Co-ordination and control</p>	<ul style="list-style-type: none"> • Structure and function of the nervous system. • Reflex actions. • Synapses. • Structure and study of the brain. • Structure and function of the eye. • Common problems with the eye. • Endocrine system and glands. • Glucoregulation. • Diabetes and treatment. • Negative feedback and its role. • Human reproduction. • Menstrual cycle. • Artificial control of fertility. • Fertility treatments. • Plant hormones and responses. • Thermoregulation. • Removal of waste products. • The human kidney. • Dialysis. • Kidney transplants. 	<ul style="list-style-type: none"> • Describe the pathway of an impulse through the CNS. • Describe the difference between reflex and non-reflex actions. • Identify the reflex arc for different stimuli. • Label a synapse and explain its importance in response to stimuli. • Identify main sections of the brain and describe methods of investigation. • Label the eye and explain how the eye focusses on objects near and far. • Explain how common problems with the eye occur and are treated. • Identify glands and their function in mammals. • Explain the mechanisms of controlling blood glucose levels and the importance of such. • Identify the difference between type 1 and type 2 diabetes, how they occur, and treatment options. • Describe examples of negative feedback in the body, including the control of thyroxine levels. • Label human reproductive organs and link the structure to the function. • Describe the menstrual cycle and the hormones involved. • Describe methods of controlling fertility. • Explain the effects of different plant hormones in the presence of different stimuli. 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback • Exam style questions. • Appropriate use of keywords. • Evaluate the benefits and risks of procedures carried out on the brain and nervous system. • Extended writing on reflex action. • Evaluate treatments for kidney disease. • Required practical 7 Investigating reaction time • Required practical 8 The effect of light and gravity on the growth of germinating seedlings. • Ch5 Co ordination and control topic test. • Mathematical skills: The spread of scientific data

		<ul style="list-style-type: none"> • Explain the uses of plant hormones in industry. • Describe the mechanisms used to maintain optimum internal body temperature. • Explain process of removing different waste products from the body. • Describe why kidneys are important and how they work. • Create a negative feedback loop describing the control of water levels using ADH. • Describe and evaluate treatments for kidney disease. 	
<p>Genetics</p>	<ul style="list-style-type: none"> • Types of reproduction in different organisms and situations. • DNA, the genome and protein synthesis. • Gene expression and mutation. • Inheritance and inherited disorders. • Screening for inherited disorders. 	<ul style="list-style-type: none"> • Describe the different types of reproduction and explain when each are necessary. • Identify differences between meiosis and mitosis and explain why meiosis is used in the production of sex cells. • Describe advantages and disadvantages of sexual and asexual reproduction. • Describe the structure of DNA and how it is used to create proteins. • Explain the impact of mutations on the expression of genes. • Demonstrate the mechanisms of inheritance using Punnett squares, including the inheritance of dominant and recessive disorders. • Interpret information from genetic diagrams to explain the inheritance of genetic disorders. • Evaluate the screening of embryos for genetic disorders. • Explain how Mendel's work fits in with modern genetics. 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback • Exam style questions. • Appropriate use of keywords. • Data interpretation using genetic diagrams. • Ch6 Genetics topic test. • Mathematical skills Fractions ratio proportion and probability

<p>Variation</p>	<ul style="list-style-type: none"> • Variation. • Evolution by natural selection. • Selective breeding. • Genetic engineering. • Cloning. • The history of genetics. • Theories of evolution and speciation. • Evidence of evolution and extinction. • Antibiotic resistance and bacteria. • Classification systems. 	<ul style="list-style-type: none"> • Identify sources of variation. • Describe the process of evolution by natural selection. • Explain the process of selective breeding and evaluate the use. • Describe, in detail, the process of genetic engineering. • Explain the different ways of creating clones and why they are useful. • To use evidence discovered by Darwin to explain the theory of evolution. • To use Wallace’s ideas on how new species arise by speciation. • To be able to use fossil data as evidence for evolution and extinction. • Describe how mutations can lead to the development of antibiotic resistant strains of bacteria. • Use the principles of classification using the binomial naming system and evolutionary trees. 	<ul style="list-style-type: none"> • Correct use of keywords. • Exam style questions. • Data analysis comparing types of variation. • Extended writing tasks, including evaluations particularly on natural selection. • Ch7 Variation topic test • Mathematical skills using charts and graphs to display data
<p>Ecology</p>	<ul style="list-style-type: none"> • The importance of communities. • Organisms and their environment. • Distribution and abundance of species. • Competition in animals and plants. • Adaptations in animals and plants. • Feeding relationships. • Materials cycling. • The carbon Cycle. • Rates of decomposition. • The human population. • Land, water and air pollution. • Deforestation and peat destruction. • Global warming. 	<ul style="list-style-type: none"> • To describe the relationship between communities in ecosystems. • Recall the effect of biotic and abiotic factors on communities. • To be able to measure the distribution of living organisms in their natural environment. • Describe the adaptations that make plants and animals successful competitors. • To explain the ways in which plants and animals are adapted in order to survive. • Describe food chains and food webs and explain how predators and prey interact in a community. • Describe and explain the decay, carbon and 	<ul style="list-style-type: none"> • Collins Connect Quizzes with mid topic feedback. • Exam style questions. • Appropriate use of keywords. • Extended writing for evaluation questions. • Interpret predator-prey graphs. • Evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information. • Use pyramid of biomass to calculate energy use, loss and

	<ul style="list-style-type: none"> • Maintaining biodiversity. • Trophic levels and biomass transfers. • Food security and production. 	<p>water cycles, including their role in the environment.</p> <ul style="list-style-type: none"> • Explain how temperature, water and availability of oxygen affect the rate of decay. • Identify links between human population growth and land and resources available. • Describe the impact of land, water and air pollution and the living world and identify ways to reduce the impact. • Explain the effects of deforestation and peat destruction on biodiversity. • Describe some of the biological consequences of global warming and explain the greenhouse effect. • Describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity. • Identify trophic levels within a community and demonstrate them in a pyramid of biomass. • Describe some of the biological factors affecting levels of food security. • Explain ways to optimise and sustain food production. 	<p>transfer in living things.</p> <ul style="list-style-type: none"> • Required practical 9 Measure the population size of a common species in a habitat • Required practical 10 Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change • Ch8 Ecology topic test • Mathematical skills Using graphs to show relationships
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