

KS4 Curriculum Map – Biology:

Topic	Substantive Knowledge This is the specific, factual content for the topic, which should be connected into a careful sequence of learning.	Disciplinary Knowledge (Skills) 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?
Cell structure and transport	<ul style="list-style-type: none"> • Microscopy. • Animal and plant cells. • Eukaryotic and Prokaryotic cells. • Specialisation in animal and plant cells. • Movement across membranes. • Exchanging materials. 	<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. • Describe diffusion and osmosis and explain factors that affect them. • 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. 	<ul style="list-style-type: none"> • Appropriate use of keywords. • Required practical number 1. • Required practical number 3. • B1 topic test. • Mathematical skills.
Cell division	<ul style="list-style-type: none"> • Cell cycle and mitosis. • Growth and differentiation. • Stem cells and ethics. 	<ul style="list-style-type: none"> • Describe the 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. 	<ul style="list-style-type: none"> • Appropriate use of keywords. • Extended writing for evaluation questions.

<p>Organisation and the digestive system</p>	<ul style="list-style-type: none"> • The digestive system and how it works. • The chemistry of food. • Enzymes as catalysts and factors affecting enzyme action. • Making digestion efficient. 	<ul style="list-style-type: none"> • To label the digestive system and 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 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. 	<ul style="list-style-type: none"> • Appropriate use of keywords. • Required Practical number 4. • B3 topic test. • Mathematical skills. • Drawing graphs. • Required Practical number 5.
<p>Organising Animals and Plants</p>	<ul style="list-style-type: none"> • Composition of the blood. • Blood vessels. • The structure and function of the heart. • Helping the heart. • Breathing and gas exchange. • Tissues, organs and transport systems in plants. • Evaporation and Transpiration. 	<ul style="list-style-type: none"> • To describe and explain the functions of each main component of blood. • 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. • To explain how gases are exchanged in the alveoli. • To describe ventilation in the lungs including pressure and volume changes. • 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"> • Appropriate use of keywords. • Practical to investigate stomata. • Mathematical skills. • Graphs skills. • B4 topic test.

<p>Communicable diseases</p>	<ul style="list-style-type: none"> • What is good health? • Pathogens and disease. • Growing bacteria in the lab. • Preventing bacterial growth and infections. • Diseases caused by viruses, bacteria, fungi and protists. • Human defence responses. • Plant disease and defence responses. 	<ul style="list-style-type: none"> • To list the different causes of ill health including the role of pathogens. • To calculate how bacteria grow by binary fission. • Use aseptic techniques to grow bacteria safely in the laboratory. • 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. 	<ul style="list-style-type: none"> • Appropriate use of keywords. • Required practical number 2. • Research opportunity on the role of scientific discoveries. • Extended writing task on various diseases. • Mathematical skills.
<p>Preventing and treating diseases</p>	<ul style="list-style-type: none"> • Vaccinations. • Antibiotics and painkillers. • Discovering and developing new drugs. • Making and the uses of monoclonal antibodies. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Appropriate use of keywords. • Mathematical skills. • Graphs skills. • Extended writing task. • B5 and B6 topic test.

<p>Non-Communicable diseases</p>	<ul style="list-style-type: none"> • Cancer. • Smoking. • Diet, exercise, alcohol and other carcinogens. 	<ul style="list-style-type: none"> • 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. • Explain the effect of diet and exercise on the development of obesity and its link to cardiovascular disease. • Identify the impact of alcohol and other carcinogens on the body. 	<ul style="list-style-type: none"> • Correct use of keywords. • Data analysis on causal mechanisms. • Extended writing task.
<p>Photosynthesis</p>	<ul style="list-style-type: none"> • Photosynthesis equation. • Limiting factors of photosynthesis. • Uses of glucose in plants. 	<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. • Calculation of inverse law. • Explain how photosynthesis can be optimised for industry. 	<ul style="list-style-type: none"> • Correct use of keywords. • Required practical 6. • Safely test a leaf for starch and create a risk assessment. • Apply knowledge to design own greenhouse or analyse data to relate limiting factors to cost-effectiveness.
<p>Respiration</p>	<ul style="list-style-type: none"> • Aerobic and anaerobic respiration equation • The response of the body to exercise • Metabolism and the liver 	<ul style="list-style-type: none"> • Describe respiration as an exothermic reaction and explain the need for it • Describe the effect of muscle fatigue in the body and oxygen debt • Explain the role of the liver during metabolism 	<ul style="list-style-type: none"> • Correct use of keywords • Investigate the body's response to exercise • Extended writing task related to changes in the body during exercise
<p>The human nervous system</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. 	<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. 	<ul style="list-style-type: none"> • Correct use of keywords. • Required practical 7. • Extended writing relating to the eye.

		<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Evaluate the benefits and risks of procedures carried out on the brain and nervous system.
<p>Hormonal coordination</p>	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. • Explain the uses of plant hormones in industry. 	<ul style="list-style-type: none"> • Correct use of keywords. • Extended writing tasks. • Research tasks relating to hormonal control. • Evaluate advantages and disadvantages of different fertility treatments. • Required practical 8. • Exam questions.
<p>Homeostasis in action</p>	<ul style="list-style-type: none"> • Thermoregulation. • Removal of waste products. • The human kidney. • Dialysis. • Kidney transplants. 	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • Correct use of keywords. • Extended writing tasks. • Exam question practice.

<p>Reproduction</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. 	<ul style="list-style-type: none"> • Correct use of keywords. • Extended writing tasks. • Data interpretation using genetic diagrams. • Exam style questions.
<p>Variation and evolution</p>	<ul style="list-style-type: none"> • Variation. • Evolution by natural selection. • Selective breeding. • Genetic engineering. • Cloning. 	<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. • Evaluate the uses of genetic technologies. 	<ul style="list-style-type: none"> • Correct use of keywords. • Data analysis comparing types of variation. • Extended writing tasks, including evaluations. • Exam style questions.
<p>Genetics and evolution</p>	<ul style="list-style-type: none"> • 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"> • Explain how Mendel's work fits in with modern genetics. • 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. 	<ul style="list-style-type: none"> • Correct use of key words. • Extended writing. • Mathematical skills. • Research on key scientists. • Exam style questions.

		<ul style="list-style-type: none"> 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. 	
Adaptations, Interdependence and competition	<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. 	<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. 	<ul style="list-style-type: none"> Correct use of key words. Required Practical number 9. Mathematical skills. Extended writing. Exam style questions.
Organising an ecosystem	<ul style="list-style-type: none"> Feeding relationships. Materials cycling. The carbon Cycle. Rates of decomposition. 	<ul style="list-style-type: none"> Describe food chains and food webs and explain how predators and prey interact in a community. Describe and explain the decay, carbon and water cycles, including their role in the environment. Explain how temperature, water and availability of oxygen affect the rate of decay. 	<ul style="list-style-type: none"> Interpret predator-prey graphs. Required practical number 10. Extended writing. Exam style questions.
Biodiversity and ecosystems	<ul style="list-style-type: none"> The human population. Land, water and air pollution. Deforestation and peat destruction. Global warming. Maintaining biodiversity. Trophic levels and biomass transfers. Food security and production. 	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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 transfer in living things. Extended writing. Exam questions.

		<ul style="list-style-type: none">• 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.	
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