KAA Curriculum Overview	Biology	A level - year 12	EOY Exam	Sequencing and Progression	
Rationale Studying A level biology provides students with an appreciation of the complexities of life. Biology encompasses anatomy and physiology, behaviour, origin, and distribution, all of which form part of the A level course. In year 12, pupils begin learning about key biological molecules, as well as key structures that make up cells. Pupils then go on to apply this knowledge into how molecules are transported across cell membranes and across exchange surfaces. Pupils develop this knowledge in a different context, within animals and plants. They complete the AS course looking at the synthesis of proteins and how organisms are adapted to survive. This sets pupils up for Y13 where they will develop their knowledge and understanding of other processes that ensure an organism's survival such as glucoregulation and osmoregulation. Pupils will complete required practicals 1-6 in Y12. These will be carried out alongside the teaching of the theory within lessons. Practicals in biology are an essential part of the curriculum, supporting and consolidating scientific concepts, allowing for the development of investigative skills and providing an opportunity for pupils to build and master practical skills. Required practicals 1, 2 and 3 build upon the required practicals within the GCSE combined science course whereby pupils investigated enzyme controlled reactions, the use of microscopes and the rate of osmosis. This allows pupils to grow in confidence when using specialist equipment to take measurements and recognising hazards before completing more unfamiliar experiments such as required practicals 5 and 6 towards the end of the year.			All three assessment points across the year assess AO1, AO2 and AO3 skills. Roughly 10% of marks will be attributed to mathematical skills and 15% to practical skills. The end of year AP3 will mimic examinations for the AS qualification (paper 1 and paper 2). The 2022 AP3 papers can be found here: https://drive.google.com/drive/folders/1FJGUYDhAXGohFGTH9j7N7I2UfKj-G1CN	At KS3 and KS4, students have studied a very simplified version of some of the topics in unit 1 to 4 - for example, cell structure and transport. Students' existing understanding of these topics and key terms will aid their transition to A level.	A secure grasp of units 1 to 4 is imperative before moving on to year 13. The biggest benefit will be a deeper understanding of cell structure and adaptation, and transport across membranes. As this will equip pupils with a strong foundation in core biological processes that are applied to different contexts in Y13.

Term	Autumn 1	Autumn 2	Spring 1	Spring 2	Sum 1	Sum 2
Link to MTP Overview						
Topic studied & Fertile Question	**Teacher 1 - biological molecules (unit 1)** **Teacher 2 - cell structure (unit 2)**	**Teacher 1 - nucleic acids (unit 1) & DNA and protein synthesis (unit 4)** **Teacher 2 - transport in cells (unit 2)**	**Teacher 1 - genetic diversity (unit 4)** **Teacher 2 - cell recognition and immunity (unit 2)**	**Teacher 1 - biodiversity (unit 4)** **Teacher 2 - gas exchange and digestion (unit 3)**	**Teacher 1 - photosynthesis (unit 5)** **Teacher 2 - mass transport (unit 3)**	**Revision and end of year exams**
Adjustments following last assessments / evaluation.	None	None	None	None	None	None
Key knowledge and skills students need to have gained by the end of the unit	**Knowledge** Biological molecules - Describe the structure of glucose, maltose, sucrose, lactose, glycogen, starch, cellulose, lipids and proteins. - Describe the formation and breakdown of maltose, sucrose, lactose, glycogen, starch, cellulose, lipids and proteins. - Describe the functions of glucose, glycogen, starch, cellulose, lipids and proteins in cells. - Describe the food tests for reducing sugars, non-reducing sugars, lipids and proteins.	**Knowledge** Nucleic acids - Describe and draw the structure of a nucleotide. - Describe and compare the structure of DNA and RNA. - Describe the process of semi-conservative DNA replication. - Describe and draw the structure of ATP. - Describe the function of ATP in cells. - Describe the formation and breakdown of ATP. - Describe the structure of water molecules. - Describe the properties of water and how these are related to its function.	**Knowledge** Genetic diversity - Describe the types of mutation and explain their impact. - Describe the process of meiosis. - Describe how genetic diversity can arise during meiosis. - Describe how mutations can arise during meiosis. - Explain how random fertilisation of haploid gametes further increases genetic variation within a species. - Explain the different outcomes of mitosis and meiosis.	**Knowledge** Biodiversity - Define species. - Explain the importance of courtship behaviour and give some examples. - Describe the structure of the phylogenetic classification system. - Name the different taxonomic ranks. - State the rules of the binomial naming system. - Define biodiversity, species richness and index of diversity. - Describe how farming techniques reduce biodiversity. - Evaluate the balance between conservation and farming.	**Knowledge** Photosynthesis - State the word and symbol equation for photosynthesis. - Explain the importance of photosynthesis. - Describe what happens in the light dependent reaction. - Describe what happens in the light independent reaction. - Describe and explain the effect of environmental factors on the rate of photosynthesis. - Describe some agricultural process used to overcome these limiting factors. Mass transport	**Revision and end of year exams**

	- Describe, in detail, the structure of proteins and how this relates to their function. - Describe enzyme action and explain how different factors affect the rate of enzyme action. Cell structure - Name, identify and describe the function of cell organelles. - explain adaptations of specialised eukaryotic cells. - Describe the structure of prokaryotes and compare these with eukaryotes. - Describe the structure of a virus. - Compare light, scanning electron and transmission electron microscopes. - Describe cell fractionation and centrifugation. - Explain in detail what happens in each stage of the cell cycle. - Describe the behaviour of chromosomes in mitosis. - Explain how cancer arises. - Describe the process of binary fission in bacteria. **Skills** Biological molecules - Use, and interpret the results of, qualitative tests for reducing sugars, non-reducing sugars, lipids and proteins. - Required practical 1 - investigate the effect of a named variable on the rate of an enzyme-controlled reaction. - Identify the variables that must be controlled in their investigation into rate of reaction.	- Recognise the role of ions in the following topics: hydrogen ions and pH; iron ions as a component of haemoglobin; sodium ions in the cotransport of glucose and amino acids; and phosphate ions as components of DNA and of ATP DNA and protein synthesis - Describe the structure of DNA in eukaryotes, prokaryotes, chloroplasts and mitochondria. - Describe the three features of the genetic code. - Define introns and exons. - Define genome and proteome. - Describe the structure of mRNA and tRNA. - Describe the process of transcription. - Describe the process of translation. Transport in cells - Describe the fluid mosaic model of the structure of the phospholipid bilayer. - Describe the process of simple diffusion, facilitated diffusion, osmosis, active transport and cotransport. - Explain the adaptations of specialised cells in relation to the rate of transport across their internal and external membranes - Explain how surface area, number of channel or carrier proteins and differences in gradients of concentration or water potential affect the rate of movement across cell membranes. **Skills** Nucleic acids: - Use incomplete information about the frequency of bases on	- Define genetic diversity and allelic frequency. - Describe the process of natural selection in detail. - Describe directional and stabilising selection and give examples of each. - Describe examples of anatomical, physiological or behavioural adaptations. Cell recognition and immunity - Describe the structure of an antibody. - Describe the process of phagocytosis in detail. - Describe the response of T lymphocytes to infection (cellular response). - Describe the response of B lymphocytes to infection (humoral response). - Explain how vaccines work and describe herd immunity. - Describe the difference between passive and active immunity. - Describe the structure of HIV and its replication in helper T cells. - Describe the formation of monoclonal antibodies, their uses, and some of the ethical issues related to their uses. - Describe the role of antibodies in ELISA. **Skills** Genetic diversity - Complete diagrams showing the chromosome content of cells after the first and second meiotic division, when given the chromosome content of the parent cell. - Recognise where meiosis occurs when given information about an unfamiliar life cycle.	- Understand that genetic diversity within and between species can be investigated by comparing the frequency of measurable or observable characteristics, the base sequence of DNA, the base sequence of mRNA, the amino acid sequence of the proteins encoded by DNA and mRNA. Gas exchange and digestion - Describe the relationship between the size of an organism or structure and its surface area to volume ratio. Appreciate how this relates to metabolic rate. - Describe the adaptations of gas exchange surfaces in single celled organisms, insects, fish and dicotyledonous plants. - Describe the structural and functional compromises between the opposing needs for efficient gas exchange and the limitation of water loss shown by terrestrial insects and xerophytic plants. - Describe the gross structure of the human gas exchange system, and the essential features of the alveolar epithelium as a surface over which gas exchange takes place. - Describe ventilation and the exchange of gases in the lungs. - Describe the mechanism of breathing. - Describe the role of enzymes in the digestion of carbohydrates, lipids and proteins. - Describe the mechanisms for absorption in the ileum.	- Describe the structure and role of haemoglobin. - Describe what is shown on the oxyhaemoglobin dissociation curve. - Explain the effect of carbon dioxide on this dissociation curve (Bohr effect). - Explain how some animals are adapted to their environment by possessing different types of haemoglobin with different oxygen transport properties. - Describe the structure of the circulatory system. - Describe the gross structure of the human heart. - Describe the structure of arteries, arterioles and veins in relation to their function. - Describe the structure of capillaries and explain the importance of capillary beds as exchange surfaces. - Describe the formation of tissue fluid and its return to the circulatory system. - Describe the structure of the xylem and the phloem. - Describe the cohesion-tension theory of water transport in the xylem. - Describe the mass flow hypothesis for the mechanism of translocation in plants. **Skills** Photosynthesis - Evaluate data relating to common agricultural practices used to overcome the effect limiting factors of photosynthesis. - Required practical 7 - Use of chromatography to investigate the pigments	

	- Calculate the uncertainty of their measurements of the rate of reaction. - Select an appropriate format for the graphical presentation of the results of their investigation into the rate of enzyme controlled reactions. - Use a tangent to find the initial rate of an enzyme-controlled reaction. Cell structure - Convert between cm, um and nm. - Calculate magnification, real image and actual image from cell diagrams. - Draw cell diagrams from microscope viewings. - Recognise the stages of mitosis from cell diagrams. - Required practical 2 - Prepare stained squashes of cells from plant root tips; set-up and use an optical microscope to identify the stages of mitosis in these stained squashes and calculate a mitotic index.	DNA strands to find the frequency of other bases. - Evaluate the work of scientists in validating the Watson–Crick model of DNA replication DNA and protein synthesis - Relate the base sequence of nucleic acids to the amino acid sequence of polypeptides, when provided with suitable data about the genetic code. - Interpret data from experimental work investigating the role of nucleic acids. Transport in cells: - Required practical 3 - Produce a dilution series of a solute to produce a calibration curve with which to identify the water potential of plant tissue. - Required practical 4 - Investigate the effect of a named variable on the permeability of cell-surface membranes. - Determine the water potential of plant tissues using the intercept of a graph of, eg, water potential of solution against gain/loss of mass.	- Use the expression 2^n to calculate the possible number of different combinations of chromosomes following meiosis, without crossing over. - Derive a formula from this to calculate the possible number of different combinations of chromosomes following random fertilisation of two gametes, where *n* is the number of homologous chromosomes pairs. - Interpret data relating to the effect of selection in producing change within populations. - Required practical 6 - Use of aseptic techniques to investigate the effect of antimicrobial substances on microbial growth. Cell recognition and immunity - Evaluate methodology, evidence and data relating to the use of vaccines and monoclonal antibodies.	**Skills** Biodiversity - Calculate an index of diversity and interpret the significance of the calculated value of the index. - Interpret data relating to similarities and differences in the base sequences of DNA and in the amino acid sequences of proteins to suggest relationships between different organisms within a species and between species. - Carry out random sampling within a single population. - Design appropriate methods to ensure random sampling. - Collect data from random samples, calculate a mean value of the collected data and the standard deviation of that mean, and interpret mean values and their standard deviations. Gas exchange and digestion - Calculate the surface area to volume ratios given the dimensions of cells with different shapes. - Interpret information relating to the effects of lung disease on gas exchange and/or ventilation. - Interpret data relating to the effects of pollution and smoking on the incidence of lung disease. - Analyse and interpret data associated with specific risk factors and the incidence of lung disease. - Evaluate the way in which experimental data led to statutory	isolated from leaves of different plants, eg, leaves from shade-tolerant and shade-intolerant plants or leaves of different colours. - Required practical 8 - Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts. Mass transport - Analyse and interpret data relating to pressure and volume changes during the cardiac cycle. - Analyse and interpret data associated with specific risk factors and the incidence of cardiovascular disease. - Evaluate conflicting evidence associated with risk factors affecting cardiovascular disease. - Recognise correlations and causal relationships. - Required practical 5 - Dissect an animal or plant gas exchange system or mass transport system or organ within such a system. - Recognise correlations and causal relationships - Interpret evidence from tracer and ringing experiments and to evaluate the evidence for and against the mass flow hypothesis. - Set up and use a potometer to investigate the effect of a named environmental variable on the rate of transpiration.	

				restrictions on the sources of risk factors. - Recognise correlations Calculate pulmonary ventilation rate (PVR) using the equation: PV R = tidal volume × breathing rate.		
How is understanding assessed at the end of the unit?	45 minute topic test at the end of each unit (2 per half term), covering AO1, AO1, AO3. 15 minute mini tests per fortnight. CPACs assessed during required practicals 1-6.					