| KAA Curriculum Overview | Biology | A level - year 13 | EOY Exam | Sequencing and Progression | |
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| **Rationale**<br>Following on from year 12, year 13 students begin learning about energy transfers within and between organisms. They then study the nervous system and how organisms respond to stimuli. Pupils study DNA and inheritance before they move on to gene expression and DNA technology.<br><br>Pupils are provided with opportunities to apply their knowledge of biological molecules and processes learnt in Y12 to various contexts in Y13. It is essential pupils have an understanding of how the sun's energy sustains life on earth so pupils begin the year with a focus on bioenergetics. As the year progresses, pupils gain an in depth look at genetics before ending the year focussing on fundamental disciplinary knowledge within the study of genetics and how it can be applied in real life contexts such as genetic fingerprinting.<br><br>As with Y12, required practicals are taught in conjunction with the theory within lessons. Pupils will develop independent thinking and problem solving skills using practical experience gained in Y12. Pupils will ultimately be assessed by teachers against Common Practical Assessment Criteria (CPAC) in order to obtain a practical endorsement by AQA. | | | All three assessment points across the year assess AO1, AO2 and AO3 skills. The end of year A level papers are mock papers 1 to 3, covering all AS and A level content. Roughly 10% of marks will be attributed to mathematical skills and 15% to practical skills.<br><br>The 2022 mocks can be found here: https://drive.google.com/drive/folders/1AGWkikN0KJU3ntChpgLE_9Im1nwU1fHB | The content studied in year 12 forms the basis for understanding units 5 to 8 in year 13. Direct links are made between AS and A2 topics - for example, between biological molecules and bioenergetics. | Studying A level biology develops resilience, and builds students' practical, analytical and evaluative skills. These competencies will well equip them for anything they decide to undertake after year 13. |

| Term | Autumn 1 | Autumn 2 | Spring 1 | Spring 2 | Sum 1 | Sum 2 |
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| **Link to MTP Overview** | | | | | | |
| **Topic studied & Fertile Question** | **Teacher 1 - photosynthesis recap, respiration & energy in ecosystems (unit 5)**<br><br>**Teacher 2 - inherited change (unit 7)** | **Teacher 1 - response to stimuli (unit 6)**<br><br>**Teacher 2 - populations, evolution and ecosystems (unit 7)** | **Teacher 1 - nervous coordination and muscles (unit 6)**<br><br>**Teacher 2 - gene expression (unit 8)** | **Teacher 1 - homeostasis (unit 6)**<br><br>**Teacher 2 - DNA technology (unit 8)** | **Revision** | **Revision** |
| **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**<br>Photosynthesis<br>- State the word and symbol equation for photosynthesis.<br>- Explain the importance of photosynthesis.<br>- Describe what happens in the light dependent reaction.<br>- Describe what happens in the light independent reaction.<br>- Describe and explain the effect of environmental factors on the rate of photosynthesis.<br>- Describe some agricultural process used | **Knowledge**<br>Response to stimuli<br>- Define taxis and explain some examples in organisms.<br>- Define kinesis and explain some examples in organisms.<br>- Define tropism and explain some examples in plants.<br>- State the role of IAA on regulating growth in plants and describe how it works.<br>- Describe the structure of the nervous system.<br>- Describe the reflex arc and explain the importance of reflexes. | **Knowledge**<br>Nervous coordination and muscles<br>- Describe structure of a myelinated motor neurone.<br>- Describe how the resting potential is established.<br>- Describe how action potentials are generated.<br>- Compare the passage of an action potential along unmyelinated and myelinated axons.<br>- Describe the refractory period and explain its importance.<br>- Describe and explain the factors affecting the speed of conductance: | **Knowledge**<br>Homeostasis<br>- Define homeostasis.<br>- Explain the importance of maintaining body temperature, blood pH, blood glucose and blood water potential.<br>- Define negative feedback and give examples.<br>- State the role of the liver in glycogenesis, glycogenolysis and gluconeogenesis.<br>- Describe the actions of insulin, glucagon and adrenaline in maintaining blood glucose levels.<br>- Describe the second messenger model of | | |

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| | to overcome these limiting factors.<br>Respiration<br>- State the word and symbol equations for aerobic and anaerobic respiration.<br>- Explain the importance of respiration.<br>- Describe what happens in glycolysis, the Link reaction, the Krebs cycle and oxidative phosphorylation.<br>- Describe the process of anaerobic respiration in detail and the products formed, and compare this to the process of aerobic respiration.<br>Energy in ecosystems<br>- Define biomass and describe how to calculate the chemical energy stored in dry biomass.<br>- Define GPP and NPP.<br>- Describe how energy is lost through trophic levels of a food chain.<br>- Appreciate the ways in which production is affected by farming practices designed to increase the efficiency of energy transfer.<br>- Students must be able to describe the stages of the nitrogen and phosphorus cycles.<br>- Describe the phosphorus cycle.<br>- Describe the nitrogen cycle.<br>- Describe the role of microorganisms in the nitrogen and phosphorus cycle.<br>- Explain why farmers use fertilisers.<br>- Explain the environmental issues arising from the use of fertilisers, such as leaching and eutrophication.<br>Inherited change | - Describe the basic structure of a Pacinian corpuscle and label the parts on diagrams.<br>- Describe how deformation of stretch-mediated sodium ion channels in a Pacinian corpuscle leads to the establishment of a generator potential.<br>- Describe the distribution of rods and cones in the retina.<br>- Identify the pigments in rod and cone cells.<br>- Explain how rod cells' visual acuity, sensitivity to light and sensitivity to colour are accounted for by the presence of rhodopsin and connections to the optic nerve.<br>- Explain how cone cells' visual acuity, sensitivity to light and sensitivity to colour are accounted for by the presence of different forms of iodopsin and connections to the optic nerve.<br>- Explain the importance of constriction and dilation of the pupil in response to changes in light.<br>- Describe the role of the radial and circular muscles in accommodation.<br>- Describe the location of, and the role played by, chemoreceptors and pressure receptors involved in detecting changes which lead to changes in heart rate.<br>- Explain what is meant by the sympathetic and parasympathetic nervous system and explain their role in controlling heart rate. Describe the role of the medulla oblongata. | myelination and saltatory conduction; axon diameter; temperature.<br>- Describe the detailed structure of a synapse and of a neuromuscular<br>- junction.<br>- Describe transmission across a cholinergic synapse.<br>- Compare transmission across a cholinergic synapse and across a neuromuscular junction.<br>- Predict and explain the effects of specific drugs on a synapse.<br>- Describe the structure of skeletal muscle and a myofibril.<br>- Describe the roles of actin, myosin, calcium ions, tropomyosin, troponin and ATP in myofibril contraction.<br>- Compare slow and fast twitch skeletal muscle fibres.<br>Gene expression<br>- Define mutation and explain each type.<br>- Describe and explain the effects of mutations on proteins.<br>- Define a mutagen and give an example.<br>- Compare totipotent, pluripotent and unipotent stem cells, including what they can do, and when and where they are produced.<br>- Describe how induced pluripotent stem cells are produced.<br>- Describe and explain the role of transcription factors in gene expression.<br>- Describe the role of the steroid hormone, oestrogen, in initiating transcription.<br>- Define epigenetics.<br>- Explain the effect of increased methylation of the DND and decreased | adrenaline and glucagon action, involving adenylate cyclase, cyclic AMP (cAMP) and protein kinase.<br>- State the causes of types I and II diabetes and their control by insulin and/or manipulation of the diet.<br>DNA technology<br>- State what recombinant DNA is.<br>- Describe the three different ways DNA fragments can be produced.<br>- Describe the ways that DNA fragments can be amplified - in vivo and in vitro (PCR).<br>- Describe how DNA is inserted into a vector.<br>- Describe the transformation of DNA into a host.<br>- Describe how to identify successful hosts.<br>- Describe how to grow/clone host cells.<br>- Describe how labelled DNA probes and DNA hybridisation can be used to locate specific alleles of genes.<br>- Describe how labelled DNA probes can be used to screen patients for heritable conditions, drug responses or health risks.<br>- Define VNTR.<br>- Explain the biological principles that underpin genetic fingerprinting techniques.<br>- Describe the use of genetic fingerprinting in the fields of forensic science, medical diagnosis, animal and plant breeding.<br><br>**Skills**<br>Homeostasis<br>- Interpret information relating to examples of | | |

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| | - Explain the meaning of the key terms: gene; allele; genotype; phenotype; homozygous; and heterozygous.<br>- Draw labelled genetic diagrams for monohybrid crosses.<br>- Explain dihybrid inheritance.<br>- Draw labelled genetic diagrams for dihybrid crosses.<br>- Explain how codominance affects the inheritance of characteristics.<br>- Explain how multiple alleles affect inheritance.<br>- Explain how blood groups in humans are inherited.<br>- Explain how sex is determined genetically.<br>- State what is meant by sex-linkage.<br>- Explain how sex-linked diseases such as haemophilia are inherited.<br>- Describe autosomal linkage.<br>- Explain how autosomal linkage affects the combinations of alleles in gametes.<br>- Explain what is meant by epistasis and explain the effects of epistasis.<br><br>**Skills**<br>Photosynthesis<br>- Evaluate data relating to common agricultural practices used to overcome the effect limiting factors of photosynthesis.<br>- Required practical 7 - Use of chromatography to investigate the pigments isolated from leaves of different plants, eg, leaves from shade-tolerant and shade-intolerant plants | - Understand the roles of the sinoatrial node (SAN), atrioventricular node (AVN) and Purkyne tissue in the bundle of His in the control of heart rate.<br>Populations, evolution and ecosystems<br>- Define species, population, gene pool and allelic frequency.<br>- Explain why individuals within a population of a species may show a wide range of variation in phenotype.<br>- Describe, in detail, the process of natural selection and evolution.<br>- Describe the effects of stabilising, directional and disruptive selection.<br>- Describe the process of speciation and how this arises.<br>- Define allopatric and sympatric speciation.<br>- Describe genetic drift and its importance in causing changes in allele frequency in small populations.<br>- Explain how evolutionary change over a long period of time has resulted in a great diversity of species.<br>- Define community, ecosystem and niche.<br>- Define biotic and abiotic factors and give examples.<br>- Define interspecific and intraspecific competition and predation.<br>- Describe the use of quadrats and the mark-release-recapture method to estimate the size of a population.<br>- Describe the process of succession.<br>- Show understanding of the need to manage the conflict between human needs and conservation | acetylation of associated histones on transcription.<br>- Explain the relevance of epigenetics on the development and treatment of disease, especially cancer.<br>- Describe how translation of the mRNA produced from target genes can be inhibited by RNA interference (RNAi).<br>- Compare malignant and benign tumours.<br>- Describe the role of tumour suppressor genes and oncogenes.<br>- Explain how abnormal methylation and increased oestrogen concentrations can cause tumour development.<br><br>**Skills**<br>Nervous coordination and muscles<br>- Use appropriate units when calculating the maximum frequency of impulse conduction given the refractory period of a neurone.<br><br>Gene expression<br>- Evaluate the use of stem cells in treating human disorders.<br>- Interpret data provided from investigations into gene expression.<br>- Evaluate appropriate data for the relative influences of genetic and environmental factors on phenotype.<br>- Evaluate evidence showing correlations between genetic and environmental factors and various forms of cancer. | negative and positive feedback.<br>- Required practical 11 - Production of a dilution series of a glucose solution and use of colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown 'urine' sample.<br>- Evaluate the positions of health advisers and the food industry in relation to the increased incidence of type II diabetes.<br>- Describe the roles of the hypothalamus, posterior pituitary and antidiuretic hormone (ADH) in osmoregulation.<br>- Describe the structure of the nephron.<br>- Describe the role of the nephron in urine formation.<br>DNA technology<br>- Interpret information relating to the use of recombinant DNA technology.<br>- Evaluate the ethical, financial and social issues associated with the use and ownership of recombinant DNA technology in agriculture, in industry and in medicine.<br>- Balance the humanitarian aspects of recombinant DNA technology with the opposition from environmentalists and anti-globalisation activists.<br>- Evaluate information relating to screening individuals for genetically determined conditions and drug responses.<br>- Interpret data showing the results of gel | | |

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| | or leaves of different colours.<br>- Required practical 8 - Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts.<br>Respiration<br>- Required practical 9 - Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms.<br>Energy in ecosystems<br>- Calculate the NPP of producers given values for GPP and respiratory losses. Derive the appropriate units.<br>- Calculate the NPP of consumers given values for energy stored in food, energy lost in urine and faeces and respiratory losses.<br>- Calculate the efficiency of energy transfers within ecosystems.<br>- Calculate percentage yields.<br>Inherited change<br>- Explain why results of genetic crosses often differ from predicted results.<br>- Use information to represent phenotypic ratios in monohybrid and dihybrid crosses.<br>- Explain what the chi-squared test is.<br>- Calculate values for chi-squared and use it to compare the goodness of fit of observed phenotypic ratios with expected ratios.<br>- Demonstrate how the chi-squared test is used in genetics.<br>- Calculate the frequency of alleles, genotypes and phenotypes in a population using appropriate data and the | in order to maintain the sustainability of natural resources.<br><br>**Skills**<br>Response to stimuli<br>- Required practical 10: Investigation into the effect of an environmental variable on the movement of an animal using either a choice chamber or a maze.<br>- Use values of heart rate (R) and stroke volume (V) to calculate cardiac output (CO), using the formula CO = R × V<br><br>Populations, evolution and ecosystems<br>- Evaluate evidence and data concerning issues relating to the conservation of species and habitats and consider conflicting evidence.<br>- Use given data to calculate the size of a population estimated using the mark-release-recapture method.<br>- Required practical 12 - Investigation into the effect of a named environmental factor on the distribution of a given species.<br>- Investigate the distribution of organisms in a named habitat using randomly placed frame quadrats, or a belt transect.<br>- Use both percentage cover and frequency as measures of abundance of a sessile species. | | electrophoresis to separate DNA fragments. | | |

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| | Hardy Weinberg equation. | | | | | |
| **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.<br>15 minute mini tests per fortnight.<br>CPACs assessed during required practicals 7-12.<br>Mock exams at the end of SPR2. | | | | | |