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| **Year 11 - Science** | | | | | | |
| **Curriculum intent** | During year 10 learners will consolidate the knowledge they have learnt so far in KS3 science, to further develop their scientific knowledge and conceptual understanding through the study of biology, chemistry and physics. Learners will deepen there understanding of the nature, processes and methods of science through different types of scientific enquiries that help them to answer scientific questions about the world around them. Through these learners will be given the opportunities to apply their scientific knowledge to understand the uses and implications of science, today and for the future. | | | | | |
| **Term** | **Autumn 1** | **Autumn 2** | **Spring 1** | **Spring 2** | **Summer 1** | **Summer 2** |
| **Knowledge** | **Feedback and Control –** we will learn about organ systems and how they are carefully controlled to allow the body to work correctly. Feedback is given to the body be sensing various stimuli and then organs can cause change to make sure systems stay in balance. This unit is about Homeostasis. We will use our practical skills by investigating human reaction time and evaluating the method.  **Carbon Chemistry –**  In this unit we will learn about what crude oil is and how it can be separated into different, useful products. We will learn about different groups of hydrocarbons that can be obtained by fractional distillation of crude oil and the properties of these compounds and the different reactions they are involved in. We will also look at how some of these products can be made into useful polymers. We will also develop our skills in this unit by practicing drawing models of covalent bonding in molecules. We will also visit distillation as a method of separating a mixture based on the boiling points of the substances in it.  *Separate science will also look at other groups of compounds, including alkenes, alcohols and carboxylic acids and reactions involving these compounds.*  **Movement –**  The first lessons of this unit will be partly a review of resultant forces, as this is a key knowledge point (and calculation skill for the rest of the unit) as well as the introduction of resolving vectors into their components and determining the resultant of two perpendicular vectors Following this, students will review their knowledge of velocity and graphs of motion, as well as Newton’s first law, while going into more detail about terminal velocity.  This then feeds into Newton’s Second Law. Students have already carried out the required practical activity so they should be familiar with measuring and calculating acceleration. They will combine their knowledge of acceleration with resultant forces to cover Newton’s Second Law, followed by the required practical activity and an analysis.  Students will then go on to look at an example of acceleration in real life, with stopping distances. They will apply the v2 – u2 = 2as equation, and use this to calculate stopping distances for different scenarios. From here they will look at the two parts that make up stopping distance: thinking distance and braking distance and the factors that affect each of these.  The unit then moves onto another vector quantity: momentum. From Newton’s Second Law, students have learned how the force needed to stop an object depends on its mass and how quickly it needs to stop. Students will now look at inertial momentum and what this means as a property of objects. They will look at conservation of momentum, in both collisions, and explosions. Students studying physics will take this further by combining momentum and Newton’s Second Law to relate force to the rate of change of momentum.  The last section of the unit moves on to look more at the relationships between forces and energy transfers, starting with work done when a force moves an object through a distance. Students will then look at compression and stretching effects of forces. They will then combine their understanding of work done with their understanding of elasticity and potential energy.  Finally, students studying physics will go on to look at the turning effects of forces and how gears and levers use moments. | **Controlling Reproduction –**  In this unit we look at the differences between sexual and asexual reproduction, as well as mitosis and meiosis. We will then review how meiosis and genetics are linked to the determination of the sex of offspring. We will then learn more about the hormones that are involved in the reproductive system, including in puberty and in the menstrual cycle. We will then look at contraception and evaluating the different methods of contraception before we look at fertility and fertility treatments. In this unit we will be developing our skills in calculating probability, as well as outlining ethical arguments for medical treatments.  **Controlling Reactions -**  students look at rate of reaction graphs, using their knowledge of collision theory and the factors that affect rate of reaction to draw conclusions from graphs. Higher tier students will also learn how to draw and calculate the gradient of a tangent to a curve to determine the instantaneous rate of reaction. After rate of reaction graphs, students will go on to understand how they can actually measure rate of reaction themselves, from quantities of reactants used or products made in a given time, preparing them for the two methods used in the required practical. The required practical focuses on concentration and how the rate of reaction can be determined, allowing students an opportunity to revisit uncertainty and explain why there may be uncertainty from measurements in each method. The unit then moves on to reversible reactions and dynamic equilibrium, linking back to knowledge of yield from C4.3. Higher tier students will then look at dynamic equilibrium and Le Chatelier's principle and the effects of changing conditions. Separate science students will then use their knowledge of reaction conditions and the effect of changing these on yield to look at the example of the Haber process. Finally they will look at how the Haber process is linked to fertilisers, making links to biology and the role of fertilisers on plant growth. | **Electromagnetic Spectrum –**  Students will then use their knowledge of the relationship between wavelength and frequency when looking at the electromagnetic spectrum. They will look at the different properties of EM waves, different uses for them and some of the hazards involved. Students will then look in more detail at infrared radiation and the required practical activity investigating the effectiveness of different surfaces as emitters of infrared radiation. Separate science students will then build on this knowledge by looking at infrared radiation from different bodies, including the perfect black body and the relationship between the temperature of an object and its rate of emission and absorption of radiation. Separate science students will continue this learning looking at radiation and the Earth and the greenhouse effect, as well as the effect of human activities on the enhanced greenhouse effect. Separate science students will then also look at radiation emitted from stars and the idea of red-shift providing evidence for the Big Bang theory.  **Controlling Nature –** That gene mutations occur continuously; these mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.  **Chemistry and the Atmosphere** -  Learners will look at the current composition of the atmosphere before learning about the Earth's early atmosphere and how it has changed over time, and the importance of photosynthesis and evolution in this process. From here students will look at the greenhouse effect and the effect of human activities on the atmosphere, as well as linking to the biological consequences of global warming from prior units. Students will go on to look at the idea of carbon footprint, revisiting how products are evaluated for their environmental impact using life cycle assessments. Finally students will revisit the process of combustion of hydrocarbon fuels and how this is linked to atmospheric pollutants, and the impact of these pollutants. The unit concludes with a lesson where students will look at how humans can reduce their impact, by reducing pollution and increasing theuse of renewable energy resources | **Force Fields –** Learners will look at the differences between permanent and induced magnetism, leading into Earth's magnetic field. The inclusion of Earth's magnetic field is intended to help students understand the importance of non-contact forces on Earth and space. The unit then moves on to electromagnets and electromagnetism,including some revisiting KS3 content, before moving into applications of electromagnetism, starting with the motor effect and Fleming's left hand rule.  **Evolution** – All students will use their understanding of variation and adaptations to learn about the process of natural selection and how it results in evolution over time. Students will look at evidence for evolution, including revisiting antibiotic resistance and fossils, before looking at fossils and their formation in more detail. This is closely linked with extinction, linking back to students' prior knowledge of the biological consequences of global warming and the effect of humans on biodiversity. Combined science students will finish with classification, looking at how understanding of species and their formation has changed over time. Separate science students will go onto look at the theory of evolution and its original controversy, looking at the contributions of different scientists including Russell and Lamarck. They will finish with an application of evolution: speciation, where they consolidate their understanding of species, making links to the levels of organisation within an ecosystem.  **Chemical Analysis -** Students will then move on to pure substances and formulations as useful mixtures, linking back to how useful materials can be created in chemistry for different purposes. From looking at specific mixtures,students will then go on to look at methods of separation in more detail, specifically distillation and chromatography. When looking at distillation, students will review the process of fractional distillation from carbon chemistry, and the importance of different boiling points of substance, which links with the difference between pure and impure substances. Students will carry out the chromatography required practical, focusing on the analysis elements, which is the basisof this unit on chemical analysis. After students have looked at chromatography as a method of analysis, they will move on to chemical analysis tests, with testing for gases, of which testing for carbon dioxide and hydrogen should be a review. Separate science students will then move on to look at testing for different ions, starting with the different methods for identifying cations through flame tests and reactions with sodium hydroxide solution. They will then look at tests for anions, before finishing with asummary of chemical analysis and the use of instrumental methods of analysis. | **Ecology –**  Students then move onto the levels of organisation in an ecosystem before looking at the different biotic and abiotic factors that can affect a community. From there they will look at adaptations and how different organisms are suited to deal with the biotic and abiotic factors in their environment. Building on understanding of adaptations leads into food chains and food webs, where students look at the interactions between plants and animals in more detail, leading into predator-prey relationships, where students will look at how these relationships run in cycles and the adaptations that different predators and prey have. From here, students will carry out the sampling required practical, with a dedicated lesson afterwards that focuses on the maths skill of estimating a population size. Biology only students will then look at how sampling can be used to measure the impact of environmental change. Finally biology only students will review some content that can now be applied to their deeper understanding of relationships within an ecosystem. |  |
| **Skills** | **The following skills will be developed throughout the whole of year 11 and will enable learners to build a deep understanding of science:**  **Scientific attitudes:**   pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility   understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review   evaluate risks.  **Experimental skills and investigations:**   ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience   make predictions using scientific knowledge and understanding   select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate   use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety   make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements   apply sampling techniques.  **Analysis and evaluation:**   apply mathematical concepts and calculate results   present observations and data using appropriate methods, including tables and graphs   interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions   present reasoned explanations, including explaining data in relation to predictions and hypotheses   evaluate data, showing awareness of potential sources of random and systematic error   identify further questions arising from their results.  **Measurement:**   understand and use SI units and IUPAC (International Union of Pure and Applied  Chemistry) chemical nomenclature   use and derive simple equations and carry out appropriate calculations   undertake basic data analysis including simple statistical techniques. | | | | | |
| **Assessments** | End of half term tests | End of half term tests | End of half term tests | End of half term tests | End of half term tests | End of half term tests |
| **Enrichment** | Science in the Spotlight activities, STEM activities, British Science Week | | | | | |