Year 11 Combined

Overall Curriculum Intent

By the end of their 5-year journey students will know the fundamental principles from biology, chemistry and physics that will provide a foundation for understanding and navigating the world. Student knowledge is structured around the Big Ideas in science which range from the particulate nature of matter to the cellular basis of living organisms, to the structure of the universe.
Students will understand the process of scientific enquiry that leads to the creation and development of concepts and theories. Students will understand how science can be used to explain observation and make predictions about natural phenomena.

	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Knowledge Introduced	**Homeostasis and Response (Biology)** Homeostasis Human Nervous System [RP6] Endocrine System Control of blood glucose levels Hormones in contraception Contraception Treatment of Infertility Feedback Systems **Forces (Physics) Part 2** Distance and displacement. Speed and velocity. Distance-time relationship. Acceleration including using apparatus and techniques to investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force [RP 19] Newton's laws of motion (1st, 2nd, and 3rd) Stopping distances Reaction times Factors affecting braking distance. Momentum. **Rates of Reaction and Energy Changes** Energy transfer during exothermic and endothermic reactions. Energy profiles Use apparatus and techniques to investigate the variables that affect temperature changes in reacting solutions such as, e.g. acid plus metals, acid plus carbonates. [RP10] Energy changes during reactions. Calculating rate of reaction Factors affecting rate of reactions. Use apparatus and techniques to investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity [RP11] Collision theory and activation energy. Catalysts Reversible reactions. Energy changes in reversible reactions. Equilibrium. Effects of changing condition, temperature, concentration, and pressure on equilibrium.	**Waves (Physics)** Transverse and Longitudinal Waves Properties of waves including wave speed, wavelength, and frequency. Make observations to identify the suitability of apparatus to measure the frequency, wavelength, and speed of waves in a ripple tank and waves in a solid and take appropriate measurements. [RP20] Types of electromagnetic waves Properties of electromagnetic waves Use apparatus and techniques to investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. [RP21] Uses and applications of electromagnetic waves. **Inheritance (Biology)** Reproduction Meiosis DNA and the Genome Genetic Inheritance Inheritance disorders Sex determination Variation Evolution Selective Breeding Genetic Engineering Evidence for Evolution Fossils Extinction Resistant Bacteria Classifying Organisms. **Chemistry of the Atmosphere (Chemistry)** Gases in the atmosphere Early atmosphere How oxygen increased in the atmosphere How carbon dioxide decreased in the atmosphere Greenhouse gases Human impact on greenhouse gases Global climate change Carbon footprint and its reduction Atmospheric pollutants from fuels Properties and effects of atmospheric pollutants.	**Ecology (Biology)** Communities Biotic and Abiotic Factors Adaptations Levels of Organisation Use apparatus and techniques measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species. [RP7] How materials are cycled. Biodiversity Waste Management Land Use Deforestation Global Warming Maintaining biodiversity **Organic Chemistry (Chemistry)** Crude oil, hydrocarbons and alkanes Fractional distillation and petrochemicals Properties of hydrocarbons Cracking and Alkenes	**Magnetism (Physics)** Poles of a magnet Magnetic fields Electromagnetism Fleming's left-hand rule Electric motors **Using Resources (Chemistry)** Earth's resources and sustainable development Potable water Use of apparatus and techniques to analyse and purify water samples from different sources, including pH, dissolved solids and distillation. [RP13] Waste water treatment Alternative methods of extracting metals. Life cycle assessments Ways of reducing use of resources.	**Revision and Examination Preparation**	**Revision and Examination Preparation**
Key vocabulary/ concepts/ideas students must master	**HOMEOSTASIS AND RESPONSE (BIOLOGY)** **Key Concepts** Understand and explain the role of homeostasis in maintaining optimum internal conditions. Explain the functions and adaptations of the human nervous system. Plan and carry out an investigation into the effect of a factor on human reaction time. [RP6] Describe how the human endocrine system controls and co-ordinates hormone release.	**WAVES (PHYSICS)** **Key Concepts** Describe the features of transverse and longitudinal waves. Describe the properties of waves, including calculating frequency and wave speed. Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in	**ECOLOGY (BIOLOGY)** **Key Concepts** Apply knowledge of organisms and interdependence to explain how communities are maintained. Explain how a range of biotic and abiotic factors impact communities. Explain how and why organisms are adapted to environments. Describe how ecosystems are organised.	**MAGNETISM (PHYSICS)** **Key Concepts** Describe and draw the magnetic field around a range of magnets, including the Earth's magnetic field. Apply knowledge of electromagnets to a range of uses, explaining how to increase/decrease the strength of the magnet. Compare permanent magnets and electromagnets.	**Revision and Examination Preparation**	**Revision and Examination Preparation**

	Explain the role of insulin in controlling blood sugar levels in the body. Compare type 1 and type 2 diabetes, including treatment methods. Describe the role of hormones in human reproduction. Explain the interaction of hormones to control the menstrual cycle. Evaluate hormonal and non-hormonal methods of contraception. Explain and evaluate the use of hormones in fertility treatment. Explain the roles of adrenaline and thyroxine in the body, including the control of thyroxine by negative feedback. **Mathematical Skills** Construct and interpret frequency tables and diagrams, bar charts and histograms 2c Translate information between graphical and numeric form 4a **Working Scientifically Skills** Evaluate information around the relationship between obesity and diabetes and make recommendations taking into account social and ethical issues. 1.3 Show why issues around contraception cannot be answered by science alone 1.3 Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments 1.4 Developments of microscopy techniques have enabled IVF treatments to develop. 1.1 Understand social and ethical issues associated with IVF treatments. 1.3 Evaluate from the perspective of patients and doctors the methods of treating infertility. 1.4 Use appropriate apparatus to record time. AT1 [RP6] select appropriate apparatus and techniques to measure the process of reaction time. AT3 [RP6] Safe and ethical use of humans to measure physiological function of reaction time and responses to a chosen factor. AT4 [RP6] **RATES OF REACTION (CHEMISTRY)** **Key Concepts** Use and apply a wide range of mathematical skills, alongside knowledge of chemical reactions, to calculate the rate of a reaction using formulae and graphs. Explain how and why a range of factors affect the rate of a reaction. Investigate how changes in concentration affect the rates of reactions by a method involving measuring the volume of a gas produced and a method involving a change in colour or turbidity. [RP11] Apply knowledge of collision theory to explain the effect of changing factors on the rate of a chemical reaction. Explain how catalysts affect the rate of a reaction. Recognise and interpret reversible and irreversible reactions. Explain chemical equilibrium and the impact of changing conditions on equilibrium. **Mathematical Skills** Recognise and use expressions in decimal form 1a	a solid and take appropriate measurements. [RP20] Describe the properties, uses and applications of electromagnetic waves. Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. [RP21] **Mathematical Skills** Use the equations Frequency = 1/T and wave speed = wavelength x frequency, substituting values and changing the subject as appropriate. 3b, c Recognise and use expressions in standard and decimal form 1a, c Construct and interpret frequency tables and diagrams, bar charts and histograms 2c **Working Scientifically Skills** Make observations of waves in fluids and solids to identify the suitability of apparatus to measure speed, frequency and wavelength. AT4 [RP20] Use appropriate apparatus to make and record temperature accurately. AT1 [RP21] make observations of the effects of the interaction of electromagnetic waves with matter AT4 [RP21] **INHERITANCE (BIOLOGY)** **Key Concepts** Compare sexual and asexual reproduction in plants and animals, including the process of meiosis and mitosis. Describe the structure of DNA and the genome, demonstrating an appreciation of the importance of understanding the human genome. Explain how genetic characteristics and disorders are inherited from parents. Explain how the sex of an infant is determined. Apply knowledge to explain how and why genetic and environmental variation in species occurs. Explain how evolution occurs through natural selection. Explain the impact of selective breeding of food plants and domesticated animals. Evaluate the process of genetic engineering. Describe and evaluate the evidence for evolution. Use information to demonstrate an understanding of the Linnaean system of classification. **Mathematical Skills** Understand the concept of probability in predicting the results of a single gene cross 2e Use direct proportion and simple ratios to express the outcome of a genetic cross. 1c, 3a Complete a Punnett square diagram and extract and interpret information from genetic crosses and family trees. 2c, 4a Use punnet squares to make predictions using the theory of probability. 2e Extract and interpret information from charts, graphs and tables 2c, 4a **Working Scientifically Skills** Appreciate that embryo screening and gene therapy may alleviate suffering but consider the ethical issues which arise. 1.3 Use the theory of evolution by natural selection in an explanation and appreciate that there is evidence now available to support this theory. 1.2, 1.3	Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species [RP7] Explain how materials are cycled within an ecosystem. Explain the importance of biodiversity in ecosystems and the impact human interactions have on biodiversity. **Mathematical Skills** Extract and interpret information from charts, graphs and tables relating to the interaction of organisms within a community. 2c, 4a Extract and interpret information from charts, graphs and tables relating to the effect of abiotic factors on organisms within a community. 2c, 4a In relation to abundance of organisms students should be able to: 2b,2f,4a,4c [RP7] • understand the terms mean, mode and median • calculate arithmetic means • plot and draw appropriate graphs selecting appropriate scales for the axes. Interpret graphs used to model predator-prey cycles.4a **Working Scientifically Skills** Recording first-hand observations of organisms. 2.6 [RP7] Interpret graphs used to model predator-prey cycles. 1.2 Interpret and explain the processes in diagrams of the carbon cycle, the water cycle. 1.2 Explain how waste, deforestation and global warming have an impact on biodiversity. 1.4 Understand the conflict between the need for cheap available compost to increase food production and the need to conserve peat bogs and peatlands as habitats for biodiversity and to reduce carbon dioxide emissions. 1.4, 1.5 Evaluate the environmental implications of deforestation. 1.4 Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications 1.6 Explain why evidence is uncertain or incomplete in a complex context. 1.3 Evaluate given information about methods that can be used to tackle problems caused by human impacts on the environment. Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information. 1.4, 1.5 Use appropriate apparatus to record length and area. AT1 [RP7] Use transect lines and quadrats to measure distribution of a species. AT3 [RP7] Safe and ethical use of organisms and response to a factor in the environment. AT4 [RP7] Application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field. AT6 [RP7] **ORGANIC CHEMISTRY (CHEMISTRY)** **Key Concepts**	Apply Fleming's Left Hand Rule to current carrying conductors. Apply knowledge of forces and magnets to describe how an electric motor works. **Mathematical Skills** Use the equation Force = BIL, substituting values and changing the subject as appropriate. 3b, c Recognise and use expressions in standard and decimal form 1a, c Construct and interpret frequency tables and diagrams, bar charts and histograms 2c **Working Scientifically Skills** Describe a practical procedure to determine the magnetic field around a magnet or current-carrying conductor. 2.2 From given information, identify the variables in an investigation 2.2 **USING RESOURCES (CHEMISTRY)** **Key Concepts** Explain how humans use Earth's resources for survival. Understand how and why potable water is produced. Carry out analysis and purification of water samples from different sources, including pH, dissolved solids and distillation. [RP13] Compare methods of waste water treatment. Evaluate alternative methods of metal extraction, using information provided. Apply knowledge of the stages of life cycle assessments to a range of products. Evaluate ways to reduce the use of limited resources using information provided. **Mathematical Skills** Extract and interpret information about resources from charts, graphs and tables 2c, 4a (WS3.2) use orders of magnitude to evaluate the significance of data. 2h In relation to LCAs: (1a, c, d, 2a, 4a) Recognise and use expressions in decimal form. Use ratios, fractions and percentages. Make estimates of the results of simple calculations. Use an appropriate number of significant figures. Translate information between graphical and numeric form. **Working Scientifically** LCAs should be done as a comparison of the impact on the environment of the stages in the life of a product and only quantified where data is readily available for energy, water, resources and wastes. Interpret LCAs of materials or products given appropriate information. 1.3, 4, 5 Safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater. AT2 [RP13] use of appropriate apparatus and techniques for the measurement of pH in different situations. AT3 [RP13] Safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, distillation. AT4 [RP13]		

	Use ratios, fractions and percentages when calculating rates of reaction. 1c Make estimates of the results of simple calculations 1d Translate information between graphical and numeric form using data for a reaction. 4a Understand that y = mx + c represents a linear relationship 4b Plot the mass/volume of product formed or reactant used from experimental or other data 4c Determine the slope and intercept of a linear graph 4d Draw and use the slope of a tangent to a curve as a measure of rate of change 4e Calculate areas of triangles and rectangles, surface areas and volumes of cubes, in relation to rates of reaction 5c **Working Scientifically Skills** Use of appropriate apparatus to make and record a range of measurements accurately, including mass, temperature, and volume of liquids and gases. AT1 [RP11] Use of appropriate apparatus and techniques for conducting and monitoring chemical reactions.AT3 [RP11] making and recording of appropriate observations during chemical reactions including the measurement of rates of reaction by a variety of methods such as production of gas and colour change. AT5 [RP11] Safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes. AT6 [RP11] Use scientific theories and explanations to develop a hypothesis about what happens to rate of reaction when factors are changed. (2.1) [RP11] Plan experiments to test a hypothesis developed about what happens to rate of reaction when factors are changed. (2.2) [RP11] Apply a knowledge of a range of techniques, instruments, apparatus and materials to select those appropriate to the experiment planned. (2.3) [RP11] Carry out rates experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. (2.4) [RP11] Make and record measurements of time and mass/volume using a range of apparatus and methods. (2.6) [RP11]	Explain the benefits and risks of selective breeding given appropriate information and consider related ethical issues. 1.3, 1.4 Interpret information about genetic engineering techniques and to make informed judgements about issues concerning cloning and genetic engineering, including GM crops. 1.4 Interpret evolutionary trees 1.2 **CHEMISTRY OF THE ATMOSPHERE** **Key Concepts** Describe and explain how the composition of the atmosphere has changed over time. Describe and explain the greenhouse effect and how this is impacted by human activity. Evaluate evidence for the green house effect and global climate change. Describe and explain the properties and effects of atmospheric pollutants. **Mathematical Skills** To use ratios, fractions and percentages in relation to the composition of the Earth's atmosphere. 1c **Working Scientifically Skills** Understand how the theories about the Earth's atmosphere have changed over time 1.1 Make predictions about the greenhouse effect and global climate change using given models/data. 1.2 Explain why data is needed to answer scientific questions about climate change and the Earth's atmosphere, and why it may be uncertain, incomplete or not available 1.3 Describe and evaluate, with the help of data, methods that can be used to tackle problems caused by human impacts on the environment.1.4 Suggest reasons why the perception of risk is often very different from the measured risk 1.5 Explain that the process of peer review helps to detect false claims and to establish a consensus about which claims should be regarded as valid. Explain that reports of scientific developments in the popular media are not subject to peer review and may be oversimplified, inaccurate or biased. 1.6 Recognise or describe patterns and trends in data presented in a variety of tabular, graphical and other forms. Draw conclusions from given observations 3.5 Present reasoned explanations including relating data to hypotheses. 3.6	Describe the general structure of alkanes and alkenes and use this to determine chemical formulae from diagrams. Explain how fractional distillation works and describe the uses of key fractions. Describe the properties o hydrocarbons and link these to their uses as fuels. Explain the process of cracking and give examples to illustrate its usefulness. **Mathematical Skills** **N/A** **Working Scientifically Skills** Recognise/draw/interpret diagrams. 1.2			
Knowledge revisited	**Homeostasis and Response (Biology)** In KS3, students have learned the basics of the human reproductive system, along with information about puberty and contraception. Students have also studied the major organs of the body and diabetes as a condition that can be affected by diet. Students will retrieve this knowledge, alongside their KS4 biological knowledge, to understand the human nervous system and other body control systems. Contraception and infertility and studied in more depth than before, providing not only an important understanding of Biology, but also key information that students will need for their future lives. **Rates of Reaction and Energy Changes**	**Waves (Physics)** Students have developed knowledge of simple waves in KS3 and will retrieve this knowledge, along with their knowledge of energy transfers and particles to develop a deeper understanding of waves and electromagnetic waves. In addition to developing students' knowledge of Physics, this unit provides knowledge needed for future life through the study of applications of electromagnetic waves. **Inheritance (Biology)** Students have developed an understanding of the reproduction and inheritance and evolution at KS3 alongside their knowledge of cellular biology (KS4). Here, students retrieve and build upon this knowledge to develop their understanding of genetics, evolution, and	**Ecology (Biology)** Students will retrieve their knowledge of ecology and interdependence from KS3, alongside knowledge of chemistry of the atmosphere (KS4) to further develop their knowledge of ecological sampling, ecosystems and the factors affecting ecosystems. Interdependence is a key biological concept so knowledge gained here will support students to develop a broad understanding of Biology. **Organic Chemistry (Chemistry)** Students will retrieve prior knowledge of atoms, elements, compounds and mixtures, along with knowledge of distillation to developing an understanding of alkanes and alkenes and how the different components of crude oil are	**Magnetism (Physics)** Students have previously learnt about magnetism in KS3 and electricity at both KS3 and earlier in KS4. They will retrieve and build upon this prior knowledge to deepen their understanding of magnets and electromagnets, including everyday uses of electromagnets, contributing to their knowledge base in Physics and providing information for their future beyond school. **Using Resources (Chemistry)** Students have previously learnt about the Earth's resources and the human impact on the Earth in KS3 Science and Geography. Students will retrieve this knowledge and further develop	**Revision and Examination Preparation**	**Revision and Examination Preparation**

	Students will draw on many aspects of their prior learning including knowledge of the particle model, chemical reactions (KS3), energy transfers and chemical energy (KS3), to support them to develop their understanding of rates of reaction in Chemistry. Rates of reaction is a key principle of Chemistry, and the knowledge gained here will support students to have a broad understanding of Chemistry.	variation. The knowledge developed here will support the development of a broad biological knowledge B but will also support their personal development for the future. **<u>Chemistry of the Atmosphere (Chemistry)</u>** Students have previously learnt about the Earth's atmosphere and the human impact on global warming in KS3 Science and Geography. Students will retrieve this knowledge and further develop their understanding of the Earth's atmosphere and how this has changed and developed over time. The knowledge gained here will also support students to take their place in the world, where climate change and human impact are key global issues.	separated. Students will understand the uses of alkanes and alkenes and the advantages and disadvantages of fractional distillation. This will to the development of a broad understanding of Chemistry.	their understanding of the Earth's resources, the issues with resource use and sustainability and how this could be reduced. The knowledge gained here will also support students to take their place in the world, where climate change and human impact are key global issues.		
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