SCIENCE

Year 11

What are the aims and intentions of this curriculum?

The aim of our Key Stage 4 Curriculum is to ensure that the topics taught at KS3 are covered in progressively greater depth over the course of this key stage. GCSE study in Separate and Combined Sciences provide the foundations for understanding the material world. Scientific understanding is changing our lives and is vital to the world's future prosperity, that all students should be taught essential aspects of the knowledge, methods, processes and uses of science. They should be helped to appreciate how the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas relating to the sciences which are both inter-linked, and are of universal application.

Students will be able to

- Develop skills, independent learning, curiosity, taking risks and learning new things.
- Explore the link between science and the relevance to everyday life.

Content covered by Separate Science Only is bolded

Highlighted in green are links to PSHE in the curriculum

Highlighted in blue are links to Careers in the curriculum

Term	Topics	Knowledge and key terms	Skills developed	Assessment
Autumn 1	**Chemistry** Rates, Equilibrium and Organic Chemistry • Rates and equilibrium • Crude oil and fuels • Organic reactions • Polymers	**Students will learn:** Activation energy, catalyst, collision theory, displacement, endothermic reaction, enzyme, exothermic reaction, rate of reaction, reaction profile **Additional polymerisation**, alcohol, alkane, alkene, **amino acids**, carboxylic acids, cracking, combustion, crude oil, **condensation polymerisation, DNA**, esters, fermentation, fractional distillation, homologous series, hydrocarbons, **nucleotides, polyester**, polymer, polypeptide, **repeat unit** **Key links to other units**: Revisit the Units on Elements, Periodic Table, Types of Reaction and Chemical Energy in Year 9. Revisit Atoms, Bonding, Chemical Reactions and Energy Changes in Year 10	**Students are able to:** • Describe the effect of changes in temperature, concentration, pressure, and surface area on rate of reaction. • Describe the characteristics of catalysts and their effect on rates of reaction. • Predict the effect of changing reaction on equilibrium position and suggest appropriate conditions to produce a particular product. • Recognise functional groups and identify members of the same homologous series • Name and draw the structural formulae, using fully displayed formulae, of the first four members of the straight chain alkanes, alkenes, alcohols and carboxylic acids. • Predict the formulae and structures of products of reactions of the first four and other given members of these homologous series.	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

			• Recall the basic principles of addition polymerisation. • **Explain the basic principles of condensation polymerisation.** **Working scientifically** • Required practical: Investigate how changes in concentration affect the rates of reaction. **Enrichment opportunities** • Career link https://edu.rsc.org/future-in-chemistry/not-a-student/teachers-and-careers-advisers/linking-curriculum-to-careers	
Autumn 2	**Physics** Waves, Electromagnetism and Space • Wave properties • Electromagnetic waves • Light • Electromagnetism • **Space**	**Students will learn:** Amplitude, angle of incidence, angle of reflection, colour filters, convex lens, diffused reflection, **echo sounding**, focal length, frequency, Hertz, infrared radiation, ionizing radiation, longitudinal waves, magnification, microwaves, normal**, P-waves, perfect black body**, period, radio waves, **reflection, S-waves, seismic waves**, specular reflection, transverse waves, **ultrasound waves**, ultraviolet, visual light, wave speed, wavelength Alternator, attraction, dynamo, electric motor, electromagnet, Fleming's left hand rule, generator effect, induced magnet, magnetic field, magnetic poles, motor effect, permanent magnet, repulsion, solenoid, **step-down transformer, step-up transformer**, Telsa **Artificial satellite, big bang theory, circular orbits, main sequence, milky way galaxy, natural satellite, nebula, protostar, red giant star, red-shift, star life cycle, sun supernova, white dwarf** **Key links to other units:** Revisit the Units on Wave Effects and Wave Properties in Year 9.	**Students are able to:** • Describe wave motion in terms of amplitude, wavelength, frequency and period. • Describe the difference between transverse and longitudinal waves. • Describe the effects of reflection, transmission, and absorption of waves at material interfaces. • Recall that light is an electromagnetic wave. • **Use ray diagrams to illustrate reflection, refraction and the similarities and differences between convex and concave lenses.** • **Explain how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted**. • Describe the attraction and repulsion between unlike and like poles for permanent magnets and describe the difference between permanent and induced magnets. • Recall that the strength of the field depends on the current and the distance from the conductor, and explain how	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

		Revisit Energy and Electricity in Year 10	solenoid arrangements can enhance the magnetic effect. • **Explain how the effect of an alternating current in one circuit in inducing a current in another is used in transformers.** • **Recall the main features of our solar system, including the similarities and distinctions between the planets, their moons, and artificial satellites.** • **Recall that our sun was formed from dust and gas drawn together by gravity.** • **Explain the red shift of light from galaxies, the 'big bang' and universal expansion.** **Working scientifically** • Required practical: Measure the frequency, wavelength and speed of waves in a solid and a ripple tank. • Investigating fields around a current carrying wire. • Investigating the strength of an electromagnet. **Enrichment opportunities** • Black History Month- *Celebrate persons in STEM* • Royal Observatory • Career link https://careerpilot.org.uk/job-sectors/subject/physics#link-1	
Spring 1	**Chemistry** Analysis and the Earth's Resources • Chemical Analysis • The Earth's atmosphere • The Earth's resources • **Using our resources**	**Students will learn:** Chromatography**, flame emission spectroscopy, flame test**, formulation, impure substance, instrumental methods, litmus paper, mobile phase, precipitation, pure substance, Rf value, stationary phase, Acid rain, carbon footprint, environmental implication, fossil fuels, global climate change, global dimming, greenhouse effect, greenhouse gases, particulates, photosynthesis, pollutant	**Students are able to:** • Explain what is meant by the purity of a substance. • Interpret chromatograms, including measuring Rf values. • Describe tests to identify aqueous cations and aqueous anions. • Interpret evidence for how it is thought the atmosphere was originally formed.	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities

		Alloy, bioleaching, **borosilicate glass**, **composite, corrosion**, desalination, electrolysis, **electroplating**, finite resources, **galvanising**, ground water, life cycle assessment, **NPK fertilisers**, ore, phytomining, potable water, raw materials, renewable resources, **sacrificial protection, soda-lime glass**, sterilisation, sustainable development, the Haber process, thermosetting, thermosoftening **Key links to other units**: Revisit the Units on Types of Reaction, Chemical Energy, Global Warming and Earth Resources in Year 9. Revisit Atoms, Bonding, Chemical Reactions and Energy Changes in Year 10	• Describe the greenhouse effect in terms of the interaction of radiation with matter. • Describe the major sources of carbon monoxide, sulfur dioxide, oxides of nitrogen and particulates in the atmosphere. • Describe the principal methods for increasing the availability of potable water in terms of the separation techniques used, including ease of treatment of waste, ground and salt water. • Describe the basic principles in carrying out a life-cycle assessment of a material or product. • **Explain the importance of the Haber process in agricultural production.** **Working scientifically** • Required practical: Investigate how paper chromatography can be used to separate and identify a mixture. • Required practical: Use chemicals to identify the ions in unknown ionic compounds. • Required practical: Analyse and purify a sample of water, and make it safe to drink. **Enrichment opportunities** • National Apprenticeship Week • International Day of Women and Girls in Science- *Celebrate persons in STEM* • Thames Water-Presentation on water treatment. • Career Mentoring with a STEM Ambassador • Career link https://edu.rsc.org/future-in-chemistry/not-a-student/teachers-and-	**Summative:** • SMART TEST • Required Practical to be written up after each investigation

			careers-advisers/linking-curriculum-to-careers	
Spring 2	**Biology** Genetics and Reproduction • Variation and evolution • Genetics and evolution Ecology • Adaptations, Interdependence and competition • Organising an ecosystem • Biodiversity and ecosystems	**Students will learn:** **Adult cell cloning**, allele, amino acid, archaea, binominal naming system, Charles Darwin, chromosome, classification, **embryo transplant**, evolution, evolutionary tree, extinction, family tree, fertilization, fossil, gametes, genetic engineering, GM crops, inbreeding, Linnaean system, MRSA, mutation, natural selection, selective breeding, **speciation**, Three-domain system, **tissue culture**, variation, vector Abiotic factors, adaptation, **anaerobic decay, apex predator,** biodiversity, biogas, biotic factors, carbon cycle, community, competition, **compost, decomposers, decomposition**, deforestation, **distribution**, ecosystem, efficiency of biomass transfer, extremophiles, food chain, **food security**, global warming, interdependence, mean, median, mode, **mycoprotein**, peatland, pollution, population, predators, prey **primary consumers**, producers, **pyramid of biomass**, quadrat, **secondary consumers, sustainable**, tertiary consumers, transect, **trophic level**, water cycle **Key links to other units**: Revisit the Units on Evolution and Inheritance in Year 9.	**Students are able to**: • State that there is usually extensive genetic variation within a population of a species. • Describe evolution as a change in the inherited characteristics of a population over time through a process of natural selection, which may result in the formation of new species. • Describe the evidence for evolution, including fossils and antibiotic resistance in bacteria. **(PSHE- Health and prevention)** • Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection. • Explain the impact of the selective breeding of food plants and domesticated animals. **(PSHE- Healthy eating)** • Describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem. • Recall that many different materials cycle through the abiotic and biotic components of an ecosystem. • **Evaluate the evidence for the impact of environmental changes on the distribution of organisms, with reference to water and atmospheric gases**. • **Describe pyramids of biomass and explain, with examples, how biomass is lost between the different trophic levels** • Describe how to carry out a field investigation into the distribution and abundance of organisms in an ecosystem	**Formative:** • Practical activities • Debates • Presentations • Self/ peer assessments • Problem solving activities **Summative:** • SMART TEST • Required Practical to be written up after each investigation

			and explain how to determine their numbers in a given area. • **Describe some of the biological factors affecting levels of food security. (PSHE- Healthy eating)** **Working scientifically** • Required practical 7: Investigate the population size of a common species in a habitat • Required practical 8: Investigate the effect of a factor on the rate of decay **Enrichment opportunities** • Career Mentoring with a STEM Ambassador • National Careers Week- *celebrate persons in STEM* • British Science Week • Earth Day • LEAF Education- Workshop on sustainable farming and food security • Career link https://careerpilot.org.uk/job-sectors/subject/biology	
Summer 1	**Revision:** Separate Sciences Combined Sciences			GCSE practice papers
Summer 2	**GCSE Examination**			