Combined Science – Key Stage 4

Curriculum

The study of science stimulates an interest and sense of wonder in the world, as well as helping students to understand the world around them. At Cambourne we aim for science to be highly engaging, and for students to become capable and confident scientists. We offer a broad and balanced curriculum, aligned with the National Curriculum. Our curriculum is carefully sequenced, so that students can make excellent progress in their understanding of science and the scientific method.

Biology Curriculum

	What pupils will learn	How it builds on learning
Year 10	**Cell Biology (Paper 1)** Eukaryotes and prokaryotes, animal and plant cells, cell differentiation, microscopy, chromosomes, mitosis, stem cells, transport in cells	Cells have been taught throughout KS3; this is taught as the first unit due to the fundamental nature of the concepts covered which feed into the rest of the GCSE content.
	Organisation (Paper 1) Principles of organisation, human digestive system, heart and blood vessels, blood, coronary heart disease, health issues, effects of lifestyle on disease, cancer, plant tissues, plant organ systems	A unit which follows on from a number of the KS3 biology units, in particular Core Biology, Breathing and Respiration, Food and Digestion and Understanding Health.
	Infection and response (Paper 1) Communicable diseases (including viral, bacterial, fungal and protist diseases), human defence systems, vaccination, antibiotics and painkillers, discovery and development of drugs	Aspects of this topic were covered in much less detail in the Understanding Health topic. This unit goes into the greater detail needed for the GCSE level.
	Bioenergetics (Paper 1) Photosynthesis (reaction, rates and uses of glucose), aerobic and anaerobic respiration, responses to exercise, metabolism and the rate of photosynthesis *Foundation tier:* *Students are not required to know how factors affecting photosynthesis interact. They are also not required to understand photosynthesis and the inverse square law.* *Students are not required to know how lactic acid is converted back to glucose.*	Building on both the Photosynthesis and Breathing and Respiration units, this unit focuses on energy use and transfer in biological systems: a key concept that reappears throughout the course.
	Ecology (Paper 2) Introduction to ecology and variation	Follows on from the Year 7 Living World unit and parts of several other units.
	What pupils will learn	**How it builds on learning**
Year 11	**Ecology (Paper 2)** Communities, abiotic factors, biotic factors, adaptations, levels of organisation of an ecosystem, cycling of materials, biodiversity, waste management, land use, deforestation, global warming, maintaining biodiversity	Follows on from the Year 7 Living World unit and parts of several other units. Taught in the early autumn term due to the outdoor nature of one of the required practicals.

	Inheritance, variation, and evolution (Paper 2) Sexual and asexual reproduction, meiosis, DNA and the genome, genetic inheritance, inherited disorders, sex determination, variation, evolution, selective breeding, genetic engineering, evidence for evolution, fossils, extinction, resistant bacteria, classification *Foundation tier* *Students do not need to understand the main steps in genetic engineering.*	Builds on several KS3 units but in much greater detail. Taught in Year 11 when students have a stronger grounding in biological concepts after their Year 10 studies.
	Homeostasis (Paper 2) Homeostasis, human nervous system, endocrine system, control of blood glucose, hormones in reproduction, contraception, hormone treatments for infertility, negative feedback, *Foundation tier:* *Students are not required to understand how glucagon is involved in the regulation of blood sugar.* *Students are not required to understand the interaction of hormones in the menstrual cycle.* *Students are not required to student hormone treatments for infertility or negative feedback.*	The unit follows on from the Core Biology and Reproduction units as well as other lessons within different units they have covered at KS3. The understanding of many elements of the Year 10 GCSE course are important to enable students to fully understand this unit.

Chemistry Curriculum

	What pupils will learn	How it builds on learning
Year 10	**Bonding, structure and the properties of matter** Chemical bonds, ionic bonding, ionic compounds, covalent bonding, metallic bonding, states of matter, properties of ionic compounds, properties of small molecules, polymers, covalent structures, properties of metals and alloys, structure and bonding of carbon Foundation tier Students do not study the limitations of the particle mode.	Foundational content is covered in this unit, which needs to be covered with Atomic Structure unit before other units are introduced. Separating mixtures not covered here as this is covered in chemical analysis. Builds on material covered in a variety of units at KS3.
	Atomic Structure and the periodic table Atoms, elements and compounds; mixtures; development of the model of the atom; charges of subatomic particles; size and mass of atoms; relative atomic mass; electronic structure; development of periodic table;	Foundational content is covered in this unit, which needs to be covered with Bonding unit before other units are introduced. Builds on material covered in a variety of units at KS3.

	metals and non-metal; properties of group 0, 1 and 7	
	Chemical analysis Pure substances, formulations, chromatography, tests of common gases Foundation tier Students do not study strong and weak acids	Builds on ideas covered in year 8 - separating mixtures. These ideas include separating mixtures, chromatography and gas tests.
	Quantitative Chemistry Conservation of mass and balancing equations, relative formula mass, chemical measurements, moles and balancing equations, limiting reactants, concentration of solutions, calculations based on chemical equations *Foundation tier* *Students do not study moles or the amounts of substances in equations* *Students do not study using moles to balance equations or limiting reactants*	Introduced in year 10 as there are opportunities in year 11 to revisit the ideas covered here. Concepts within this unit are challenging, and students tend to grasp the ideas better when exposed to them twice.
	Using resources Using the Earth's resources and sustainable development, potable water, waste water treatment, alternative methods for extracting metals, life cycle assessment, reducing resource use *Foundation tier* *Students do not study alternative methods of extracting metals*	Builds on ideas covered in year 9 in materials unit and also allows revisiting of concepts from year 10 Bonding and Atomic Structure units – these include potable water, types of material, life cycle assessments.
	Chemistry of the Atmosphere Atmospheric composition, Earth's early atmosphere, greenhouse gases and the influence of human activity, climate change, common atmospheric pollutants and their sources	Builds on ideas covered in environmental chemistry in year 9, also allows revisiting of ideas related to combustion/chemical reactions/chemical formulae which are covered in Energy Changes unit in year 9 and Periodic Table unit.
	What pupils will learn	**How it builds on learning**
Year 11	**Energy Changes** Exothermic and endothermic reactions, reaction profiles, energy changes in reactions *Foundation tier* *Students do not do bond energy calculations*	Allows revisiting of ideas in bonding and builds on year 9 unit introducing ideas of energy changes in chemical reactions.
	Chemical changes Reactivity of metals, extraction of metals, oxidation and reduction in terms of electrons, reactions of acids, production of salts, pH scale and neutralisation, strong and weak acids, electrolysis of molten ionic compounds and aqueous solutions, half equations, use of electrolysis for metal extraction. *Foundation tier*	Allows revisiting of ideas covered in quantitative chemistry in year 10 and also formation of ions in Atomic Structure unit. Builds on Reactions of Acids unit in year 8.

	Students do not study oxidation and reduction in terms of electrons *Students do not study strong and weak acids* *Students do not study half equations*	
	Rate and extent of Chemical Change Calculating rates of reaction, factors which affect rates, collision theory and activation energy, catalysts, equilibria and reversible reactions, *Foundation tier* *Students do not study the effect of changing conditions on equilibrium or the effect of changing concentration, temperature or pressure*	Allows revisiting of ideas covered in year 10, including bonding. It also introduces the challenging concept of equilibrium at a stage where students are most likely to be prepared for it. In addition, it revisits the concept of the Haber process studied in year 10.
	Organic Chemistry Crude oil, hydrocarbons and alkanes, fractional distillation, properties of hydrocarbons, cracking and alkenes,	This unit comes after Bonding and Atomic Structure units as it allows concepts in these units to be revisited.

Physics Curriculum

	What pupils will learn	How it builds on learning
Year 10	**Electricity 1** Standard circuit symbols, electrical charge and current, current, resistance, potential difference, series and parallel circuits,	Topic needs to be taught before electromagnetism so that students can draw on concepts from electricity topic. Students build on their understanding of electricity from the Year 9 Electricity and Magnetism topic. This topic also allows the more mathematical nature of GCSE science to be introduced.
	Atomic Structure Atoms and isotopes, structure of atom, mass number and atomic number, development of atomic model, radioactive decay, nuclear equations, half lives and the nature of radioactive decay, contamination and irradiation, *Foundation tier* *Students do not study net decline*	Students study this unit early in year 10 as the concepts are relatively simple, and in order to not overwhelm students with the amount of maths in GCSE physics. Students able to draw on knowledge from Year 8 Matter topic.
	Energy 1 Energy stores and systems, kinetic energy, elastic potential energy, gravitational potential energy, power, efficiency, conservation of energy *Foundation tier* *Students do not study how to improve the efficiency of energy transfers*	Topic is taught before forces, as a number of concepts in forces draw on the Energy unit. Students build on their knowledge from the Year 9 Energy unit, as well as energy content embedded within KS3.

	Particle model of matter Density, changes of state, internal energy, specific latent heat, particle motion in gases, pressure in gases	Topic is taught in year 10 as the concept are easier than later topics. Students draw on knowledge from Year 7 Core Chemistry unit, Year 8 Matter topic and Year 9 Pressure unit.
	Energy 2 Thermal conductivity, insulation and rates of cooling, specific heat capacity, national and global energy resources	Topic is taught before forces, as a number of concepts in forces draw on the Energy unit. Students build on their knowledge from the Year 9 Energy unit, as well as energy content embedded within KS3. Topic is taught separately to Energy 1 as all content relates to heat energy.
	Electricity 2 Resistance of a wire; IV characteristics; LDRs, thermistors and sensing circuits; direct and alternating potential difference; mains electricity; the national grid	Topic is taught after Electricity 1 as Electricity 1 contains foundation knowledge for this unit, which primarily looks at applications of electricity.
	What pupils will learn	**How it builds on learning**
Year 11	**Forces 1** Scalar and vector quantities, contact and non-contact forces, gravity and weight, speed, acceleration, distance time graphs, velocity time graphs, Newton's laws of motion, terminal velocity and weight, resultant forces and resolving forces *Foundation tier* *Students do not study resolution of forces* *Students do not study velocity in the context of circular motion* Students do not learn to determine acceleration as the tangent to a velocity time graph Students do not learn that the area under a distance time graph is the distance	Forces is taught after Energy as knowledge of energy is required. Students draw on knowledge, which is acquired in a number of units KS3, including Year7 Core Physics, Yr8 Forces and Year 9 Pressure and moments. Topic is also taught late because cognitive demand is high.
	Waves Transverse and longitudinal waves, properties of waves, wave equation, relationship between period and frequency, electromagnetic spectrum, properties and uses of electromagnetic waves, refraction *Foundation tier* *Students do not study refraction* *Students study electromagnetic waves in less detail*	Students able to draw on knowledge from Year 7 Light, Year 8 Waves topics and Year 9 Introduction to Physics Unit.
	Forces 2 Forces and elasticity, Hooke's law, stopping distances, reaction times, factors affecting braking distances, centre of mass, momentum and conservation of momentum, centre of mass	Forces is taught after Energy as knowledge of energy is required. Students draw on knowledge, which is acquired in a number of units KS3, including Year7 Core Physics, Yr8 Forces and Year 9 Pressure and moments. Topic is also taught late because cognitive

	Foundation tier *Students do not study momentum*	demand is high. Forces is taught in two parts due to the amount of content in the unit.
	Electromagnetism Magnetic poles, magnetic fields, the motor effect, Fleming's left-hand rule, electric motors *Foundation tier* *Students do not study Fleming's left-hand rule or electric motors*	Topic taught after Electricity topics in year 10 as knowledge from this unit is required. Students are able to draw on understanding developed in year 10 and year 11.

Assessment

Students undertake formative assessments at the end of each topic. The aim of these is for students to be able to improve their understanding of the topic that they have just completed and to consolidate their learning. Students also undertake summative tests. In year 10 students have an exam after the Christmas holidays which focuses on Electricity and Radioactivity. Students have another exam at the end of year 10 which covers all content covered in year 10 (content studied in year 10 is primarily Paper 1 content). In year 11 students take a mock exam in December, which covers paper 1 material, giving students an opportunity to revise and consolidate. Students then undertake a second mock in March which covers all the content covered in year 11.

Supporting your child

What you can do at home:

Parents can support students in a number of ways, including:

- Supporting students with revision for tests – revision resources for these are provided via SatchelOne and Teams, along with instructions. It can be really helpful if parents guide students through using these resources.
- Reading about science – resources for could include texts provided by the school library or BBC Science Focus magazine.

Equipment:

In addition to standard school equipment, students should bring a green pen and a calculator to lessons.

Extended learning

Homework policy:

Homework set is meaningfully related to classwork and includes: planning and writing up experiments, reading, note-taking and answering questions to aid understanding, and extending understanding of a topic through research and revision for the end of unit tests and end of year examinations. Homework will usually be set every two weeks for each subject, but the exact frequency of this is at the discretion of the teacher

Clubs/ Enrichment opportunities:

Enrichment opportunities are provided throughout year 10 and 11. All students are given the opportunity to undertake the British Physics Olympiad.

Extended study suggestions and reading lists:

The library has a range of texts and study guides to support learning. The BBC Bitesize for GCSE Science website contains up-to-date subject content that can be used for revision.

Possible trips and visits:

A number of STEM based trips are typically offered over the course of the year.