



Subject: Science

Curriculum vision

The purpose of the Science curriculum at Avonbourne Academies is to develop our students' scientific understanding so they can be scientifically informed citizens and, if they wish, pursue careers in science, or in careers that require some scientific understanding. Taking the National Curriculum as the starting point, we provide a sequenced learning journey, building a solid foundation in years 7 to 9 across the three scientific disciplines (Chemistry/Physics and Biology), which prepares students for their GCSE and A level courses. Students then have the key transferrable skills to progress to higher education and to be successful in their chosen career.

Our students experience a consistent, research led approach to teaching and learning. We ensure that powerful foundational knowledge, skills, and concepts are mastered before moving on to other ideas. Pupils revisit prior learning regularly and apply their understanding in new contexts. This approach is based upon extensive practice delivered through teacher modelling of worked examples and independent practice. Our science curriculum helps students understand the historical, ethical, and contemporary issues linked to science and its development. Wherever possible, we relate our topics to the local area and its scientific history.

Curriculum Overview

Biology Chemistry Physics

Term 1 – Key Stage 3	Autumn 1	Why this? Why now?	Autumn 2	Why this? Why now?
Year 7	Particles	Students learn about the particle model, diffusion, changes of state, gas pressure and separation techniques.	Energy	Students deepen their understanding of energy transfers through heating, as well as from one store to another. They begin to calculate power, electricity costs, and evaluate the pros and cons of energy resources.
	Cells, Tissues, and Organs	Students apply their knowledge of particles to explain how substances move in and out of cells. They learn about plant and animal cell structure through microscopy, and how cells work together to form more complex tissues and organ systems.		
Year 8	Light and Space	Students will consolidate their understanding of how light travels, and how the eye works to allow us to see images and color. The intensity of light is linked to seasons and the Earth's place in the solar system. The force of gravity is introduced.	Digestion and Nutrition	Students consolidate their knowledge of organ systems and diffusion. It deepens their understanding of the components of food in a balanced diet and the use of each within the body. The role of enzymes is introduced as part of this.
	Periodic Table	Students will learn about elements and their properties and relate this to the atomic model. They will learn how elements form compounds through chemical reactions.		



Year 9	Forces in action	Students deepen their knowledge of forces and their effects and apply this to simple machines. They investigate how objects change shape when forces are applied to them.	Reactivity	Students consolidate their knowledge of atomic structure with reactivity, and then investigate the reactions of acids with metal compounds. They deepen their understanding of how metals are extracted from their raw materials.
	Matter	Students deepen their understanding of particle model, and apply this to density calculations, and investigating pressure.		

Term 1 – Key Stage 4	Autumn 1	Why this? Why now?	Autumn 2	Why this? Why now?
Year 10	C2 Bonding, structure, and properties	Students consolidate their knowledge of compounds with the types of bonding within them and how this links to their structures and properties. Triple science students will also learn about nanoparticles.	P1 Energy	Students deepen their understanding of energy transfers, calculations involving energy, reducing wasted energy, and the pros and cons of energy resources. Triple science students will also cover thermal insulators.
	B1 Cell Biology	Students deepen their understanding of cell structures, specialized cells and how substances move in and out of cells. They learn about cell division and stem cells. Triple science students learn about culturing micro-organisms.	P2 Electricity	Students deepen their understanding of circuits, resistance, electricity in the home, The National Grid, and energy used in electrical appliances. Triple science students also cover static electricity and electric fields.
	B2 Organisation	Students deepen their understanding of nutrients in foods, how to test for them and the role of enzymes in digestion. They deepen their understanding of the respiratory and circulatory systems, and non-communicable diseases. Plant organs and systems are also covered.		
Year 11	C6 The rate and extent of chemical change	Students will deepen their understanding of the factors that affect the rate of a reaction, how they can be changed and how to measure the rate. They will also learn about gas pressures, and reversible reactions. Triple science students learn about how the conditions in reversible reactions can be altered to improve their effectiveness.	C7 Organic Chemistry	Students will learn about crude oil as a source of organic chemical building blocks, and the uses for its products. Triple science students will also learn about alkene reactions, alcohols, carboxylic acids, and polymers.
	B6 Inheritance, variation, and evolution	Students cover sexual and asexual reproduction, inheritance of genes and characteristics, evolution, selective breeding, genetic engineering, and classification. Triple science students will cover protein synthesis, the work of Mendel, Darwin and Wallace, speciation, and cloning.	C8 Chemical Analysis	Students will consolidate their knowledge of pure substances, chromatography, and testing for various gasses. Triple science students will also cover analysis of ions and spectroscopy.
	P5 Forces and motion	Students will deepen their understanding of forces and their effects on the speed or shape of objects. They will apply ideas about forces, speed and acceleration to safe stopping and braking distances in cars. Triple science students will cover moments, gears, pressure, and car safety.		



Term 1 – Key Stage 5	Autumn 1	Why this? Why now?	Autumn 2	Why this? Why now?
Year 12 Biology	Foundations in Biology	Students deepen their understanding of cell structure, microscopy, biological molecules, enzyme structure, membrane structure, transport in and out of cells, cell division and uses of stem cells.	Foundations in Biology	Continued from Autumn 1.
			Exchange and transport	Students study the structure and function of gas exchange and transport systems in a range of animals and in terrestrial plants. The significance of surface area to volume ratio in determining the need for ventilation, gas exchange and transport systems in multicellular organisms is emphasised.
Year 12 Chemistry	Elements of life	Students deepen their understanding of atomic structure, isotopes, the periodic table, reactions of masses, qualitative analysis, reacting masses as well as bonding and structure. New content introduced at this stage includes energy and matter calculations which are further explored in the Ozone topic.	Developing fuels	Developing fuels builds on to knowledge from GCSE including catalysts, alkanes and alkenes as well as bond enthalpy. The topic also introduces new content which includes ideal gas laws, enthalpy changes, Hess's law, isomers and shapes of organic molecules as well as alternative sources of fuels and the environment.
Year 13 Biology	Communication, homeostasis, and energy	Students deepen their understanding of hormonal and neuronal communication, homeostasis, the biochemical pathways of photosynthesis and respiration with an emphasis on the formation and use of ATP as the source of energy for biochemical processes and synthesis of biological molecules.	Communication, homeostasis, and energy	Continued from Autumn 1.
Year 13 Chemistry	The ozone story	Students will study composition by volume of gases, the electromagnetic spectrum and the interaction of radiation with matter, rates of reaction, radical reactions, intermolecular bonding, haloalkanes, nucleophilic substitution reactions, and the sustainability of the ozone layer.	Polymers and life	Students will study condensation polymers, organic functional groups, amines and amides, acid–base equilibria, amino acid and protein chemistry, optical isomerism, enzyme catalysis and molecular recognition, the structure and function of DNA and RNA, and structural analysis.
	What's in a medicine?	Students will study the chemistry of the –OH group, phenols and alcohols, carboxylic acids and esters, mass spectrometry and IR spectroscopy, organic synthesis, preparative techniques and thin layer chromatography, and green chemistry.	The chemical industry	Students will study aspects of nitrogen chemistry, kinetics, equilibrium and equilibrium constant calculations, effects of factors on the rate and equilibrium yields of reactions; consideration of the best conditions for an industrial process, and analysis of costs, benefits and risks of industrial processes.



Term 2 – Key Stage 3	Spring 1	Why this? Why now?	Spring 2	Why this? Why now?
Year 7	Reproduction and variation	Students deepen their understanding of sexual reproduction, foetal development, birth, growth, puberty, variation, and reproduction in plants.	Chemical Reactions	Students deepen their understanding of chemical changes, oxidation reactions, and reactions between acids and alkalis.
Year 8	Electricity and Magnetism	Students deepen their knowledge of series and parallel circuits, potential difference, resistance, insulators, static electricity, magnetic fields, and electromagnets.	Materials and the Earth	Students deepen their understanding of the Earth's structure, rock and fossil formation, fossil fuels, the greenhouse effect and global warming, and the recycling of resources.
Year 9	Energetics and Rates	Students consolidate their knowledge on measuring the rate of a reaction and which factors can affect this. They deepen their knowledge of energy changes during a reaction and investigate examples of these.	Biological systems and processes	Students deepen their knowledge of the skeletal, muscular, and respiratory systems. They then look at the effects of smoking, alcohol and drugs on health. They finish by consolidating their knowledge of DNA and inheritance.
	Sound waves	Students deepen their knowledge of sound waves and how they propagate, how we hear, how microphones and speakers work to capture and produce waves, and the uses of ultrasound.		



Term 2 – Key Stage 4	Spring 1	Why this? Why now?	Spring 2	Why this? Why now?
Year 10	P3 Particle Model of Matter	Students deepen their understanding of the particle model of matter but considering the energy and arrangement of the particles. They investigate how to measure the density of regular and irregularly shaped objects, and liquids. They will explain changes of state in terms of latent heat.	C3 Quantitative Chemistry	Students consolidate their knowledge of elements and the periodic table to calculate atomic, formula mass and moles, balance equations, and calculate the concentration of solutions. Triple students will calculate atom economy, carry out titrations, and calculate the number of moles in a gas.
	B3 Infection and response	Students learn how infectious diseases are spread by pathogens and examples of these, how our body's immune system responds, how vaccines work, and how new medicines are developed. Triple science students will also learn about monoclonal antibodies and plant diseases.	C4 Chemical Changes	In this topic students investigate redox reactions and the reactions of acids with metals, metal oxides, and metal carbonates. They learn about the reactivity series of metals, how to make salts, neutralization reactions, and the difference between strong and weak acids. They link the reactivity of metals with how they can be extracted from compounds using techniques such as electrolysis. This also links to their previous understanding of ions and electricity. Triple students will also look at titrations as part of this topic area.
Year 11	B7 Ecology	Students consolidate their knowledge of communities, adaptations of organisms, how to estimate population size, nutrient cycles, and the human impact on biodiversity and global warming.	P7 Magnetism and Electromagnetism	In this topic students learn that Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and that when current flows around a magnet it can produce movement. Triple students will develop their knowledge of our solar system, and the lifecycle of stars. They will also explore the Big Bang Theory, as well as an understanding of 'Red Shift'.
	P6 Waves	Students will learn about how waves transfer energy, how to describe wave properties, and the difference between electromagnetic and mechanical waves. They will investigate how to measure wave speed, and will discover the uses and dangers of the waves in the electromagnetic spectrum.		
	C9 Chemistry of the atmosphere	Students consolidate their knowledge about how the Earth's atmosphere started and how human activity has changed it.	P8 Space Physics	
	C10 Using resources	Students deepen their understanding of how we obtain drinking water and metals. Triple science students also learn about fertilizers, alloys, ceramics, polymers, and composite materials		



Term 2 – Key Stage 5	Spring 1	Why this? Why now?	Spring 2	Why this? Why now?
Year 12 Biology	Exchange and transport	Continued from Autumn 2.		
	Biodiversity, evolution, and disease	Students develop and understanding of the biodiversity of organisms; how they are classified and the ways in which biodiversity can be measured. The learners also gain an understanding of the variety of organisms that are pathogenic and the way in which plants and animals have evolved defences to deal with disease. The impact of the evolution of pathogens on the treatment of disease is also considered. The relationships between organisms are studied, considering variation, evolution, and phylogeny.		
Year 12 Chemistry	Elements from the Sea	Students deepen their understanding of halogen chemistry, redox chemistry and electrolysis, equilibrium, and atom economy.	What's in a medicine?	Students will study the chemistry of the –OH group, phenols and alcohols, carboxylic acids and esters, mass spectrometry and IR spectroscopy, organic synthesis, preparative techniques and thin layer chromatography, and green chemistry.
	The Ozone Story	Students will study composition by volume of gases, the electromagnetic spectrum and the interaction of radiation with matter, rates of reaction, radical reactions, intermolecular bonding, haloalkanes, nucleophilic substitution reactions, and the sustainability of the ozone layer.		
Year 13 Biology	Genetics, evolution, and ecosystems	Students will deepen their understanding of the role of genes in regulating and controlling cell function and development, heredity and the mechanisms of evolution and speciation, practical techniques used to manipulate DNA such as sequencing and amplification, the use of microorganisms in biotechnology, the role of microorganisms in recycling materials within the environment and maintaining balance within ecosystems, The need to conserve environmental resources in a sustainable fashion whilst appreciating the potential conflict arising from the needs of an increasing human population. Students also consider the impacts of human activities on the natural environment and biodiversity.		
Year 13 Chemistry	Oceans	Students deepen their understanding of dissolving and associated enthalpy changes, the greenhouse effect, acid–base equilibria and pH, solubility products, and entropy.	Developing metals	Students deepen their understanding of redox titrations, cells and electrode potentials, d-block chemistry, and colorimetry.



Term 3 – Key Stage 3	Summer 1	Why this? Why now?	Summer 2	Why this? Why now?
Year 7	Forces and Motion	Students will deepen their knowledge of balanced and unbalanced forces, gravity, calculate weight, pressure, speed, friction, and interpret distance-time graphs.	Ecological Relationships and Classification	Students will deepen their knowledge of food webs, decay, population estimation, classification, adaptations, evolution by natural selection, extinction, and biodiversity.
Year 8	Plants and Photosynthesis	Students consolidate their knowledge of plant organs, photosynthesis, transport in plants, and how plants affect the gasses in the atmosphere.	Matter	Students deepen their understanding of particle model, and apply this to density calculations, and investigating pressure.
Year 9	Biological Processes	Students deepen their knowledge of the skeletal, muscular, and respiratory systems. They then look at the effects of smoking, alcohol and drugs on health. They finish by consolidating their knowledge of DNA and inheritance.	Atomic Structure	Students will deepen their knowledge of elements and compounds, separation techniques, atomic structure and how models of the atom were developed, isotopes, and electron configuration. They will compare the properties and reactivity of groups 1 and 7.
			Cell Biology	Students deepen their understanding of cell structures, specialized cells and how substances move in and out of cells. They learn about cell division and stem cells. Triple science students learn about culturing micro-organisms.

Term 3 – Key Stage 4	Summer 1	Why this? Why now?	Summer 2	Why this? Why now?
Year 10	P4 Atomic Structure	Students will deepen their understanding of atoms and isotopes, the development of atomic models through experimentation, radiation and its uses, and half-life.	B5 Homeostasis and response	Students will deepen their understanding of the nervous system, reflexes, hormonal responses, homeostasis, the menstrual cycle, methods of contraception, and fertility treatments. Triple science students will also study the brain, the eye and vision, temperature regulation, water regulation and the kidneys, and plant hormones.
	B4 Bioenergetics	Students will consolidate their knowledge of photosynthesis and its limiting factors, respiration, exercise, and metabolism.	C6 The rate and extent of chemical change	Students will deepen their understanding of the factors that affect the rate of a reaction, how they can be changed and how to measure the rate. They will also learn about gas pressures, and reversible reactions. Triple science students learn about how the conditions in reversible reactions can be altered to improve their effectiveness.
	C5 Energy Changes	Students will deepen their understanding of exothermic and endothermic reactions and apply this to different contexts.		
Year 11	Revision	Preparation for GCSE exams through targeted revision programme		



Term 3 – Key Stage 5	Summer 1	Why this? Why now?	Summer 2	Why this? Why now?
Year 12 Biology	Biodiversity, evolution and disease	Continue from Spring 2.	Biodiversity, evolution and disease	Continue from Summer 1.
Year 12 Chemistry	What's in a medicine?	Continue from Spring 2	Chemistry Polymers and life	Students will deepen their understanding of condensation polymers, organic functional groups, amines and amides, acid–base equilibria, amino acid and protein chemistry, optical isomerism, enzyme catalysis and molecular recognition, the structure and function of DNA and RNA and structural analysis.
Year 13 Biology	Genetics, evolution and ecosystems	Continue from Spring 2	Bespoke revision programme	
Year 13 Chemistry	Chemistry Colour by design	Students will deepen their understanding of the chemical origins of colour in organic compounds, aromatic compounds and their reactions, dyes and dyeing, diazonium compounds, fats and oils, gas–liquid chromatography, carbonyl compounds and their reactions, organic synthesis and polyfunctional compounds.	Bespoke revision programme	

Links to Specifications at Key Stage 4 and 5	
Combined Double Award Science AQA GCSE Combined Science: Trilogy (8464) Triple Science AQA GCSE Biology (8461) AQA GCSE Chemistry (8462) AQA GCSE Physics (8463)	A Level Biology OCR Biology A (H020, H420)
	A Level Chemistry OCR Chemistry B (Salters) (H033, H433)



Wider reading

Extracurricular Opportunities (competitions, associations, and clubs)

CREST club on Thursday for Years 7 and 8 allowing students the opportunity to explore their own interests and conduct their own experiments. Students research independently and expand their practical skills – a chance to do practical's that cannot/ are not done in the classroom. Nationally recognised CREST Bronze accreditation can be achieved at the end of the year.

Academic Reading

Websites

If you are interested in knowing more, have a look at these...

[New Scientist](#)

[Space.com](#)

[Science Focus](#)

[Natural History Museum](#)

[Chemical Science journal \(rsc.org\)](#)

[Institute of Physics - For physics • For physicists • For all :](#)

[Institute of Physics \(iop.org\)](#)

[Royal Society of Biology \(rsb.org.uk\)](#)

Science in our local area:

Bournemouth Natural History Society found here: [Bournemouth](#)

[Natural Science Society: Home Page \(bnss.org.uk\)](#)

Dorset Wildlife Trust:

[Brownsea Island | Dorset Wildlife Trust](#)

Books

If you are interested in knowing more, have a read through these...

[*The Disappearing Spoon by Sam Kean*](#)

A life on our planet by David Attenborough

Hello, is this planet Earth?: My View from the International Space Station by Tim Peake

Revision Guides/ Support for study

Oak National Academy – [Years 7, 8 and 9](#) and [GCSE](#)

BBC Bitesize - [Years 7, 8 and 9](#) and [GCSE](#)

GCSE: CGP Revision guides – [Higher Tier](#) and [Foundation Tier](#) and Separate Sciences