Curriculum Vision

Faculty	Science	Subject	Biology, Chemistry & Physics

Our Vision

Faculty Vision

We aim to provide a high-quality science curriculum which is ambitious for all students.

We want them to develop a sense of excitement and curiosity about natural phenomena.

We want to foster their ability to think critically and creatively so that they can analyse the world they live in.

Students will do this by

- Acquiring a sound base of knowledge of facts and understanding of scientific principles.
- Developing an understanding of the evidence for the science.
- Developing scientific method - carrying out practical work to investigate ideas, gathering evidence for evaluation and analysis to support scientific ideas and draw reasoned conclusions.
- Using scientific and mathematical models to develop understanding.

Curriculum Intent

Rationale for Science Curriculum Intent

Our aim is to develop a love of science, to develop future scientists and teach them about the vast application and wonders of science in their everyday lives. Therefore, the science curriculum has been designed around 3 key principles:

1. Develop understanding of science by teaching substantive concepts within the big ideas in appropriately sequenced, component steps.
2. Emphasis on diagnostic questioning to reveal preconceptions and common misunderstandings.
3. Development of scientific skills through scientific enquiry, integrated into each unit enabling students to make predictions and observations and then explain and analyse their findings so that they can form conclusions.

The substantive and disciplinary knowledge and key vocabulary has been carefully sequenced to ensure that new content builds upon prior learning, enabling students to develop understanding and skills which are essential at GCSE and beyond. This is based on the research carried out by Best Evidence Science Teaching.

We use lesson preparation to ensure that the lessons meet the needs of all pupils. Staff spend time using planned resources to prepare for their lessons. This involves identifying the key knowledge and skills that the students need to be able to know, show and remember by the end of the lesson. There is a focus on prior learning and key vocabulary. An exemplar answer is produced. This is then used in lessons to intentional monitor the learning and adapt teaching appropriately.

Teaching involves clear teacher explanations and worked examples that make knowledge explicit to pupils. This might include analogies and models that help pupils to make the links between concrete and abstract concepts. There is a strong emphasis on reading, writing, and talking in science lessons enabling students to focus on key subject vocabulary and recap and orally rehearse and structure their thoughts using scientific language.

Reflecting the The Arthur Terry Learning Partnership Curriculum Aims

The ATLP curriculum aims to provide children with a broad and academic programme that closely follows the National Curriculum.

Our provision is a coherent and carefully sequenced (knowledge engaged) curriculum based on the principles of cognitive science. There is a focus on the development of literacy and the application of acquired knowledge to ensure children access the curriculum at a depth to ensure a deep and enduring understanding in discrete subject areas.

The content and experiences within our curriculum are designed to accumulate and address the gaps in cultural capital of all our students in particularly the disadvantaged. Our extra-curricular offer supports our provision, with a focus within each subject thus helping to form stronger schemata for long term retention.

Reflecting the Purpose and Aims of Science from the NC Programme of Study
A high-quality science education provides the foundation for understanding the world through the specific disciplines of biology, chemistry, and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes, and uses of science. Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about national phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

- Develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics.
- Develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them.
- Are equipped with the scientific knowledge required to understand the uses and implications for science, today and for the future.

Aspect of intent	Why is this important?	What will it look like in lessons?
Develop and apply scientific knowledge	Scientific literacy is needed to understand our society and world and allow us to make informed decisions about health, environment, and the wider world.	Subject specific content is delivered by experts. A knowledge rich curriculum that is split into key components of learning within the individual disciplines. Concepts are built from concrete, easier concepts to more abstract and challenging concepts. This is based on evidence from BEST. Taking account of the common misunderstandings and misconceptions.
Foster curiosity and critical thinking	By asking questions we develop deeper understanding and knowledge as well as stimulating the thinking in others. The ability to ask questions about the information in front of us allows us to make better informed decisions that affect our lives.	Questioning that allows thinking time about key concepts and how they might apply in alternative scenarios. Opportunities to engage in practical investigations based on previously taught substantive knowledge.

		Discussions in class with many participants actively listening and contributing. Evaluation tasks that stimulate higher level thinking skills.
Scientific method	Practical experiments help pupils to understand both substantive and disciplinary knowledge. Developing knowledge of scientific approaches by testing methods, formulating and testing a hypothesis and collecting and analysing data, before drawing conclusions will enable students to make evidence-based decision later in life.	The purpose of the scientific approach will be signposted. There is a scaffolded approach to aspects of the scientific method building towards the full process in Post 16. Skills taught, reinforced, and revisited throughout the 5-year curriculum in different units of work.

Overview of the curriculum content:

The content is viewed as a coherent 5-year spiral curriculum, with opportunities for spaced retrieval, covering the National curriculum at KS3 and 4 and the GCSE specification for AQA combined and separate sciences. Adaptive teaching is used to ensure that the teaching meets the needs of all our pupils. It builds on from and incorporates the planning completed by the ATLP Science group, in terms of resources and sequencing in Years 7 and 8, but is then adapted as we move through into Year 9 to provide additional pace and challenge for our students.

Recovery Curriculum adaptations

We have identified the content in biology, chemistry and physics that is most important for enabling pupils to build up their knowledge of key scientific concepts. We also identified the most important procedures and concepts underpinning the scientific method that may not be as secure following remote teaching. We are incorporating opportunities to retrieve knowledge and address gaps that appear, as well as increasing the scaffolding and support for scientific skills, including graphs, tables and the scientific method.

Our curriculum is mapped progressively in terms of substantive and disciplinary knowledge including mathematics. For each scientific discipline there are five big ideas containing component concepts that build into composite knowledge.

In **Biology** the big ideas are:- The Cellular Basis for life / Heredity and Life Cycles / Organisms and their Environment / Variation Adaptation and Evolution / Health and Disease.					
	YEAR 7	**YEAR 8**	**YEAR 9**	**YEAR 10**	**YEAR 11**
The cellular basis of life	<u>Autumn</br>Cells & Organisation</br>▪ Cells as the fundamental unit of living organisms</br>▪ Functions of the cell structures -animal/plant</br>▪ Observing, interpreting and recording cell structures using a light microscope</br>▪ Similarities and differences between plant and animal cells</br>▪ The role of diffusion in the movement of substances in and out of cells</br>▪ Adaptations of unicellular organisms from cells to organ systems</br>▪ The structure and function of the human skeleton</br>▪ Interaction between skeleton and muscles</br>▪ Antagonistic muscles	<u>Autumn</br>Bioenergetics</br>▪ Reactants and products of photosynthesis with a word summary</br>▪ Photosynthesis uses sunlight to build organic molecules</br>▪ Adaptations of leaves for photosynthesis – leaf tissues</br>▪ Aerobic respiration with a word summary</br>▪ Anaerobic respiration in humans with a word summary</br>▪ Anaerobic respiration in microorganisms including fermentation</br>▪ Differences between aerobic and anaerobic respiration</br>▪ Structure and functions of the gas exchange system in humans, including adaptations to function</br>▪ The mechanism of breathing to move air in and out of the lungs, using a pressure model	<u>Autumn</br>▪ Cells</br>▪ Animal, plant and to now include bacterial cells (prokaryotes/eukaryotes)</br>▪ Microscopy and progressing to calculating magnification and conversion of units</br>▪ Cell differentiation and specialisation</br>▪ Diffusion retrieval</br>▪ Osmosis</br>▪ Active Transport</br></br><u>Autumn 2</br>▪ Organisation</br>▪ Hierarchical organisation of multicellular organisms</br>▪ Supplying cells – the circulatory system</br>▪ The heart</br>▪ Blood vessels</br>▪ The blood	<u>Autumn 1</br>▪ Cells</br>▪ Exchanging substances/exchange surfaces:</br>▪ Lungs – respiratory system (year 8)</br>▪ Villi – Digestive system (year 9)</br>▪ Leaves – plant organisation (year 8)</br>▪ Specialised cells retrieval</br>▪ Stem Cells</br>▪ Chromosomes and cell division – mitosis</br>▪ Binary Fission (separates)</br>▪ Cancer</br>▪ Monoclonal antibodies – linked to cancer treatment</br></br><u>Autumn 2</br>▪ Organisation</br>▪ More on enzymes and digestion</br>▪ Investigating enzymatic reactions</br>▪ The circulatory system – the heart</br>▪ The circulatory system – blood vessels	▪ Inheritance</br>▪ DNA</br>▪ The structure of DNA and Protein synthesis</br>▪ Mutations</br>▪ Reproduction</br>▪ Meiosis</br>▪ X & Y chromosomes</br>▪ Genetic diagrams</br>▪ Inherited disorders</br>▪ Variation</br>▪ Evolution</br>▪ Antibiotics and antibiotic resistance</br>▪ Speciation</br>▪ Fossils</br>▪ Selective breeding</br>▪ Genetic engineering</br>▪ Cloning</br>▪ Classification

		▪ The impact of exercise, asthma and smoking on the human gas exchange system ▪ The role of leaf stomata in gas exchange in plants		▪ The circulatory system blood ▪ Cardiovascular system ▪ CV disease and treatments ▪ More on plant cell organisation ▪ Transpiration and translocation ▪ Transpiration and the rate of transpiration <u>Spring 1</u> ▪ Bioenergetics ▪ Photosynthesis retrieval ▪ Word and symbol equations for photosynthesis ▪ The rate of photosynthesis - limiting factors ▪ Measuring the rate of photosynthesis ▪ Ideal conditions for photosynthesis - greenhouse (separates) ▪ Plant diseases (separates) ▪ Respiration ▪ Metabolism ▪ Aerobic and anaerobic respiration ▪ Exercise	
Heredity and life cycles	<u>Spring</u> <u>Reproduction</u>			<u>Summer</u> <u>Homeostasis</u> ▪ Homeostasis ▪ The nervous system	

	▪ Structure and function of the male and female reproductive system ▪ Menstrual cycle without details of hormones ▪ Gametes ▪ Fertilisation ▪ Gestation and birth ▪ Maternal lifestyle on the foetus through the placenta ▪ Contraception ▪ Reproduction in flowering plants ▪ Flower structure ▪ Wind & insect pollination ▪ Fertilisation ▪ Seed and fruit formation and dispersal			▪ Reflexes ▪ Investigating reaction time ▪ The brain (separates) ▪ The eye (separates) ▪ Controlling body temperature (separates) ▪ The endocrine system ▪ Controlling blood glucose ▪ Diabetes ▪ The kidneys (separates) ▪ Puberty and the menstrual cycle ▪ Controlling fertility ▪ Adrenaline and Thyroxine ▪ Plant hormones (separates) ▪ Investigating plant growth (separates	
Organisms and their environment	<u>Summer</u> <u>Interdependence</u> ▪ Food chains and food webs ▪ Interdependence within ecosystems ▪ Biodiversity		<u>Summer</u> <u>Ecology</u> ▪ Competition ▪ Abiotic & biotic factors ▪ Adaptations ▪ interdependence, food chains, predator prey ▪ Quadrats and transects ▪ Deforestation, lane use, waste management	<u>Spring 2</u> <u>Ecology</u> ▪ Carbon and water cycle ▪ Decay and investigating decay ▪ Global warming ▪ Biogas ▪ Trophic levels ▪ Pyramids of biomass / transfer ▪ Food security and farming ▪ Biotechnology	
Variation, adaptation and evolution		<u>Summer</u> <u>Genetics</u> ▪ Genetic information -DNA, genes and chromosomes			

		▪ Differences between species ▪ Variation between individuals within a species being continuous or discontinuous ▪ Natural selection & evolution ▪ Adaptation and extinction			
Health and disease		<u>Spring</u> <u>Nutrition & Health</u> ▪ Content of a healthy balanced diet ▪ Plants making carbohydrates in their leaves by photosynthesis ▪ Energy requirements ▪ Malnutrition ▪ Organs of the digestive system ▪ Functions of the organs of the digestive system ▪ Medicinal vs Recreational drugs ▪ Alcohol ▪ Smoking	<u>Spring</u> <u>Infection & Health</u> ▪ What is health - physical/mental ▪ Communicable diseases – pathogens and how they spread ▪ Communicable diseases – symptoms, signs, transmission, treatment ▪ Culturing bacteria ▪ First line of defence ▪ Second line of defence – WBC ▪ Vaccinations ▪ Non communicable diseases CHD ▪ Non communicable diseases cancer ▪ Genetic diseases		

In **Chemistry** the big ideas are:- Substances and properties / Particles and structure / Chemical reactions / Earth chemistry / Dynamic Earth				
YEAR 7	**YEAR 8**	**YEAR 9**	**YEAR 10**	**YEAR 11**
<u>Autumn 1</u> ▪ HSW practical on dissolving ▪ Spring ▪ Separation techniques ▪ Pure and impure substances ▪ Solubility ▪ Solubility Practical ▪ Rock Salt ▪ Separating Mixtures ▪ Chromatography ▪ Distillation	<u>Autumn</u> ▪ Periodic table ▪ Atoms ▪ Elements ▪ Electron configuration ▪ Development of the periodic table ▪ Physical and chemical properties ▪ Metals and non-metals ▪ Group 1 ▪ Group 7 ▪ Group 0	<u>Autumn 1</u> ▪ Atoms, elements, compounds and mixtures ▪ Chemical Formula and conservation of mass ▪ Atomic structure ▪ The development of the model of the atom ▪ Electronic Configuration and the periodic table ▪ Isotopes ▪ Group 1 including chemical equations and reasons for trend in reactivity ▪ Group 7 including chemical equations and reasons for trend in reactivity ▪ Displacement reactions and ionic equations ▪ Transition metals (chemistry only) <u>Autumn 2</u> ▪ Organic chemistry ▪ Crude oil and alkanes ▪ Fractional Distillation ▪ Cracking ▪ Uses of hydrocarbons ▪ Reactions of alkenes	<u>Autumn</u> ▪ Quantitative ▪ Conservation of mass ▪ Balancing equations ▪ Relative formula mass ▪ Calculating Moles ▪ Amount of substance in an equation ▪ Using moles to balance equations ▪ Concentration of solution ▪ Percentage Yield (Chemistry Only) ▪ Atom economy (Chemistry Only) ▪ Using concentration of solutions in Mol/dm3 (Chemistry Only) ▪ Use of the amount of substance in relation to volumes of gases (Chemistry Only)	▪ Organic chemistry ▪ Alcohols (chemistry only) ▪ Properties and combustion of alcohols ▪ (chemistry only) ▪ Carboxylic acids (chemistry only) ▪ Natural and addition polymers ▪ Condensation polymers (chemistry only) ▪ Pure and Impure substances ▪ Chromatography ▪ Interpreting Chromatograms ▪ Testing gases ▪ Tests for Positive Ions ▪ Tests for negative ions ▪ Instrumental methods ▪ Flame emission spectroscopy ▪ Reversible reactions and dynamic equilibrium ▪ Energy changes and reversible reactions
<u>Spring</u> ▪ Solids, liquids and gases ▪ Changes of state	<u>Spring</u> ▪ Acids and alkalis ▪ pH scale	<u>Spring</u> ▪ Chemical bonds ▪ Ionic bonding	<u>Spring</u> ▪ The rate and extent of chemical change	

▪ Evaporation and condensation ▪ Diffusion ▪ Brownian motion ▪ Gas pressure	▪ Neutralisation ▪ Metals and acids ▪ Metals and water ▪ Oxidation ▪ Displacement ▪ Metal Ores	▪ Ionic compounds ▪ Covalent bonding ▪ Properties of simple covalent molecules ▪ Giant covalent structures ▪ Metallic bonding ▪ Properties of metals and alloys ▪ Rusting and corrosion ▪ Polymers ▪ Properties of Polymers ▪ Glass and ceramics ▪ Nanoparticles	▪ Collision theory ▪ Factors that affect the rate of chemical reactions ▪ The effect of changing Surface area on rate of reaction ▪ Catalysts	▪ The effect of changing conditions on equilibrium (HT only) ▪ The effect of changing concentration (HT only) ▪ The effect of temperature and pressure changes on equilibrium (HT only) ▪ Haber Process ▪ Economics of the Haber process ▪ Making fertilizer in the lab v in industry
<u>Summer</u> ▪ Chemical reactions ▪ Indicators of chemical reactions ▪ Elements ▪ Compounds ▪ Atoms and the periodic table ▪ Making compounds ▪ Balancing equations ▪ Conservation of mass ▪ Exothermic and endothermic reactions	<u>Summer</u> ▪ Chemistry in the atmosphere ▪ Combustion ▪ Carbon cycle ▪ Greenhouse effect ▪ Earth structure ▪ Igneous rock ▪ Sedimentary rock ▪ Metamorphic rock ▪ Rock cycle ▪ Ceramics	<u>Summer</u> ▪ Exothermic and endothermic reactions ▪ Energy transferred during endothermic and exothermic reactions ▪ Reaction Profiles ▪ Bond energies ▪ Cells and Batteries (chemistry only) ▪ Fuel cells (chemistry only)	<u>Summer</u> ▪ Redox reactions ▪ Reactivity of metals ▪ The reactivity series ▪ Extraction of metals by reduction ▪ Phyto mining and bioleaching ▪ Neutralisation of acids and salt production ▪ Soluble salts ▪ Titrations (Chem) ▪ Strong and weak acids (chem) ▪ Electrolysis ▪ Electrolysis of molten ionic compounds ▪ Using electrolysis to extract metals ▪ Electrolysis of aqueous materials ▪ Half equations	▪ Redox reactions ▪ Reactivity of metals ▪ The reactivity series ▪ Extraction of metals by reduction ▪ Phyto mining and bioleaching ▪ Neutralisation of acids and salt production ▪ Soluble salts ▪ Titrations (Chem) ▪ Strong and weak acids (chem) ▪ Electrolysis ▪ Electrolysis of molten ionic compounds ▪ Using electrolysis to extract metals ▪ Electrolysis of aqueous materials ▪ Half equations

In **Physics** the big ideas are:- Matter / Force and Motion / Sound Light and Waves / Electricity and Magnetism / Space

	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11
Matter	Spring P2: Energy I ▪ Using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes ▪ Comparing the starting with the final conditions of a system and describing increases and decreases in the amount of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in in chemical compositions. ▪ Other processes that involve energy transfer: change motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.	Autumn P4: Energy II ▪ Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged ▪ Heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter to the colder one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators ▪ Differences in resistance between conducting and insulating components (quantitative) ▪ Comparing energy values of different foods (from labels) (kJ) ▪ Comparing power ratings of appliances in watts (W, kW).	Summer: Particles ▪ All substances are made of particles. ▪ The kinetic energy of a particle is linked to its temperature. ▪ The energy of particles causes a change in the bond energy and therefore the state. ▪ Solids, liquids and gases have different properties. ▪ Different substances require different amounts of energy to heat them or to change their states. ▪ The above can be investigated and a heating/ cooling curve applied. ▪ Pressure is linked to volume and temperature. ▪ Different substances have different densities based on their mass and their volume.	Autumn Energy ▪ Energy stores and systems (Links to year 8) ▪ Explore Conduction, Convection to explain energy transfer. (Progression year 8) ▪ Conservation of energy ▪ Energy changes in systems ▪ Efficiency ▪ Reducing unwanted energy ▪ Insulating materials ▪ Kinetic energy ▪ Gravitational energy ▪ Changes in energy (Progression year 7) ▪ Elastic potential energy (Calculations from forces Year 9) ▪ Specific heat Capacity (Heating and cooling curves)(Taken from the particles topic) ▪ Power ▪ Renewable resources (Link Year 8) ▪ Non-Renewable resources (link year 8)	Electricity ▪ Review of current, potential difference and resistance. ▪ Resistance in a wire ▪ Resistors ▪ Filament bulbs ▪ Diodes, LDRs, Thermistors ▪ Domestic electricity ▪ Power and energy transfer in everyday appliances (Review from energy year 10) ▪ National grid (Review from energy year 10) Separates ▪ Static electricity (Progression year 8) ▪ Electrical; fields ▪ IV characteristics Magnets ▪ Magnetism (Progression year 8) ▪ Magnetic fields (Progression Year 8) ▪ Electromagnets (Progression year 8) ▪ Motors

		▪ Comparing amounts of energy transferred (J, kJ, kW hour) ▪ Domestic fuels bills, fuel use and costs ▪ Fuels and energy resources.	▪ Atmospheric pressure, decreases with increase of height as weight of air above decreases with height.	▪ National grid (Year 8) ▪ National grid and energy resources (Year 8) <u>Summer</u> <u>Atomic Structure:</u> ▪ Atoms and their structures (Progression from year 9 chemistry) ▪ Isotopes (Progression year 10 chemistry) ▪ Development of the atomic model (Review chemistry Year 10) ▪ Radioactive decay ▪ Half life ▪ Types of radiation ▪ Radioactive contamination ▪ Uses of radiation <u>Separates</u> ▪ Background radiation ▪ Nuclear fission and Fusion (Progression Year 8 energy).	▪ F = B x I x i <u>Separates</u> ▪ Motor effect, left hand rule ▪ Electrical motors ▪ Induced potential (Link year 11 electricity. ▪ Transformers (Link year 11 electricity) <u>Spring</u> <u>Separates Only</u> <u>Space and the universe</u> ▪ Space and beyond (progression year 7) ▪ Life cycle of a star ▪ Stars and elements ▪ Doppler effect ▪ How the universe began ▪ Evidence for the big bang (CMB) ▪ Orbital motion.
Force and Motion	Autumn <u>Forces and their effects</u> ▪ Forces as pushes and pulls, arising from the interaction between two objects ▪ Using force arrows in diagrams, adding forces in one dimension,		Autumn <u>Forces</u> ▪ Forces and their effects: Forces are a push or a pull that acts on an object due to the interactions with another object: Al forces that act on objects are either Contact Forces	<u>Forces - Application</u> ▪ Describe interactions between pairs of objects that produce a force on each other. ▪ Terminal Velocity (link balanced forces) ▪ Acceleration (Progression year 9)	

	balanced and unbalanced forces ▪ Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity ▪ Speed and the quantitative relationship between average speed, distance and time ▪ The representation of a journey on a distance-time graph ▪ Relative motion: trains and cars passing one another ▪ Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) ▪ Change depending on direction of force and its size		where objects are touching (Progression year 7) ▪ non-contact forces, where the forces act at a distance. (Progression year 7) ▪ Vectors and Scalars and examples of each. ▪ Balanced and unbalanced forces: Relating to sinking and floating, motion of objects. (Progression year 7) ▪ Links to calculating resultant forces. (Progression year 7) ▪ Forces: associated with deforming objects; stretching and squashing – springs; (Progression year 7) ▪ Forces measured in newtons, measurements of stretch or compression as force is changed (Progression year 7) ▪ Force-extension linear relation; Hooke's Law as a special case, energy changes on deformation (Progression year 7) ▪ Work done If work is done, a force has been	▪ Uniform acceleration (Progression Year 9) ▪ Stopping distances ▪ Momentum ▪ Car safety ▪ Change in momentum ▪ Newtons third Law of motion <u>Separates:</u> ▪ Vector diagrams ▪ Atmospheric pressure (Progression Year 9) ▪ Pressure in liquids (Progression Year 9) ▪ Moments and gears (Progression Year 9) ▪ Centre of mass	

			applied to move an object ▪ Moment as the turning effect of a force Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged <u>Pressure</u> ▪ Atmospheric pressure, decreases with increase of height as weight of air above decreases with height ▪ Pressure in liquids, increasing with depth; up thrust effects, floating and sinking ▪ Pressure measured by ratio of force over area – acting normal to any surface. <u>Forces and motion</u> ▪ forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only) (Progression year 7) ▪ Change of speed depends on direction of force and its size		

			(Distance time graphs, Velocity time graphs) (Progression year 7)		
Sound Light and Waves		Spring P5: Light ▪ The similarities and differences between light waves and the waves in matter ▪ Light waves travelling through a vacuum; speed of light ▪ The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface ▪ Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye ▪ Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras ▪ Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection	Waves ▪ Use of ray model to explain reflection and refraction of light and action of convex lens in focusing (qualitative); the human eye. ▪ The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface ▪ Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras ▪ Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection ▪ Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone	WAVES: Application ▪ Ripple tank (Links to wave structure and calculating wave speed). ▪ EMS ▪ EMS uses and dangers ▪ Radio sound waves ▪ Visible spectrum ▪ Infrared radiation ▪ Leslie cans (RP) Separates: ▪ Sound waves (Progression Year 9)Hearing (Link to the ear Year 9) ▪ Seismic waves ▪ Ultrasound (Progression year 9) ▪ Lenses Convex/concave ▪ Image and ray diagrams Concave lenses and magnification (Link to reflection and refraction Year 9) ▪ Waves for detection and exploration. ▪ Colour/ wavelength (Links to year 9 colour and filters) ▪ Black body radiation	

		<u>Summer</u> <u>P6: Sound</u> ▪ frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound ▪ Sound needs a medium to travel, the speed of sound in air, in water, in solids ▪ Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal ▪ Auditory range of humans and animals ▪ Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone.			
Electricity and Magnetism	<u>Summer</u> <u>P3: Electricity & Magnetism</u> ▪ Electric Current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and as flow of charge			<u>Electricity</u> ▪ Electrical circuits (Progression year 7) ▪ Charge and current (Progression year 7) ▪ Potential difference (Progression year 7) ▪ Electrical resistance (Progression year 7)	

	▪ Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current. ▪ Magnetic poles, attraction and repulsion ▪ Magnetic fields by plotting with compass, representation by field lines ▪ Earth's magnetism, compass and navigation ▪ The magnetic effect of a current, electromagnets,			▪ Series circuits and Parallel circuits (Progression year 7)	
Space	<u>Space:</u> ▪ Planets and the solar system ▪ Gravity in Space ▪ The night sky, stars and galaxies ▪ Days and night				

Building on Prior Key Stage Learning

KS1			
Year 1		**Year 2**	
Seasonal Change		Forces	
Everyday Materials		Everyday Materials	
Plants and Animals (including humans)		Plants, Living things and their habitats	
KS2			
Year 3	**Year 4**	**Year 5**	**Year 6**
Light Forces and Magnets	Sound and Electricity	Earth and Space Forces	Light Electricity
Rocks	States of Matter	Properties and changes of materials	Properties and changes of materials

Plants Animals (including humans)	Living things and their habitats Animals (including humans)	Living things and their habitats Animals (including humans)	Living things and their habitats Animals (including humans)

Post 16

Biology

At Key Stage 5 we follow the OCR syllabus. In year 12, the course starts with the foundations in biology module. This involves looking at the ultrastructure of cells, the structure and function of biological molecules and how they relate to their functions. The structure and function of enzymes and biological membranes and cellular organisation is also explored. Following on from this, student explore the exchange and transport systems in plants and animals, immunity, biodiversity, classification, and evolution. Over the course of the year, students explore a wide range of practical activities linked to the specification including the opportunity to participate in fieldwork. Practical skills such as planning experiments, making qualitative and quantitative observations, processing and presenting data and using it to draw conclusions are revisited throughout the course.

In year 13, the academic rigour increases as students start with an in-depth study of the biochemistry of respiration and photosynthesis. This builds upon their knowledge of biological molecules and processes from Year 12. They look at how organisms respond to and survive in their environment through the study of the nervous system and endocrine systems. Students then look at more detailed genetics including the more recent understanding of epigenetics and how man has harnessed the knowledge of genetics to manipulate organisms using genetic engineering. Students have the opportunity to visit a university laboratory and experiment with PCR testing. The year finishes with the study of ecosystems and population. By the end of the course students can make links between the different hierarchical levels of biology and use this to explain their observations.

Chemistry

The A-level course is taught principally in two streams; physical and theoretical; inorganic and organic. In the first year, physical chemistry starts with refining atomic model of the students with particular attention to the electronic structure -some aspects of quantum chemistry are introduced which will be necessary for later topics in both streams. Other topics within the physical stream develop from those with which the students are already more familiar, e.g., bonding, rates, equilibrium and redox. Concepts such as electrostatic force in intra- and intermolecular forces, energy changes and the particulate nature of matter are used and developed to help students conceptualise the processes. In inorganic chemistry aspects of groups are further studied but incorporating explanations involving the forces at play in the reactions. Organic chemistry introduces homologous series and reaction mechanisms, again aspects of interparticle forces are involved together with some of the quantum chemistry in the formation and shape of molecular orbitals. Practical skills are developed through normal lab work and assessed practical work for the CPAC qualification.

For the second year, physical chemistry starts with thermodynamics introducing the concept of entropy (by building on energy and the random motion built into particulate theory). Rates, equilibria, and electrode potentials follow developing on GCSE and Year 12 topics with the final topic being acids, bases and buffer solutions. The second year of the A-level course develops a number of higher-level mathematical skills (e.g. logarithms for pH) which are taught as necessary. In the inorganic/organic stream the quantum chemistry taught in Year 12 is utilised to explain shapes and colours of transitions metals and the energetics topic to explain complex ion stability. In the organic stream topics include: oxidation products of alcohols, aromatic compounds and their chemical reactions, acid-base nature organics, biological molecules (e.g. proteins and DNA), nmr. In all of these links to the topics studied in the physical stream are emphasised. Towards the end of the course synoptic questions are emphasised to show the interconnectedness of the different streams and parts of the course.

Physics

At Key Stage 5 we follow the OCR syllabus. Students continue to study the central concepts but in greater detail. We aim to produce independent learners with enhanced skills who are ready for the world of university or employment in science related courses and careers.

In year 12, the course starts with the foundations in physics module. This involves looking at the foundations of physics and begins by introducing students to mathematical conventions, that student will use going through the topics. Pupils are then exposed to modules that focus on motion and forces and their affects. Pupils learn about acceleration and can apply these concepts to everyday situations such as gravity. Pupils then begin to apply

knowledge to explain moments, torque, drag and terminal velocity. This is expanded more, and pupils learn about Hooke's law, and explain plastic and elastic deformation, and applies this to stress and strains, where pupils will complete practical's, analyse data, and write valid conclusions.

Over the course of the year, students explore a wide range of practical skills are developed through normal lab work and assessed practical work for the CPAC qualification linked to the specification. Practical skills such as planning experiments, making qualitative and quantitative observations, processing and presenting data and using it to draw conclusions are revisited throughout the course.