Key Stage 4 Curriculum Overview – Science

Curriculum Intent

Science is diverse and exciting. It helps students to explore the world around them and understand many things that have such relevance to their daily lives, thus enabling them to 'Live life in all its fullness'. Our science curriculum aims to inspire and excite children about science, stimulate curiosity, awareness, and challenge through scientific enquiry, and provide opportunities for collaboration and independent work to develop substantive and disciplinary knowledge. The core principals of science teaching at Holywell are to develop students' knowledge and understanding of science; and equip students with the skills to be able to work scientifically.

Our school values are the driving force behind our attitudes, behaviours, and actions. A key aspiration in science is for students to be curious and have the confidence to explore their ideas. We want students to live and learn as scientists. This links explicitly with values such as patience, responsibility, courage, kindness, respect, honesty, humility, perseverance, and empathy. In lessons we promote our values and try to engender a spirit of collaboration.

We want students to have high aspirations and be the best versions of themselves. We encourage them to question, seek answers and have a love of learning. We have high expectations for all students to aim high and work hard. We courage students to set goals and think about how to achieve them. We promote the importance of taking care of yourself physically and mentally by eating well, exercising regularly, getting enough sleep, and managing stress. Our classrooms are positive, supportive, and encouraging.

With such a key focus on practical experimentation, we generate lots of communities – in terms of community spirit in lessons, paired and group work, discussion at small group and whole class level, and practical collaboration. Students are encouraged to develop their skills together, share knowledge, share findings, and seek and give feedback to/from peers.

It is our intention for all students to make progress from their respective starting point and to achieve personal success. To reach this goal requires versatile and imaginative teachers, effective teaching and learning strategies, and high expectations. We believe students should be able to recognise, describe, use, and apply key scientific ideas to explain abstract phenomena. Scientific enquiry links direct practical experience with key scientific ideas and is therefore integrated into lessons rather than taught separately. We encourage students to reflect on the evidence that supports scientific interpretations. Above all, Science is to be enjoyed.

Name of course: GCSE Combined Science: Trilogy (Double Science – 2 GCSE's) Examination Board: AQA Specification Code: 8464	***Triple Science (Separate Sciences – 3 GCSE's)**		
	***Name of course: GCSE Biology** Examination Board: AQA Specification Code: 8461	***Name of course: GCSE Chemistry** Examination Board: AQA Specification Code: 8462	***Name of course: GCSE Physics** Examination Board: AQA Specification Code: 8463

GCSE Method of Assessment

There are six papers: two biology, two chemistry and two physics. Each of the papers will assess knowledge and understanding from distinct topic areas.

Combined Science	**Triple Science**
6 x Written Exams: 1 hour 15 mins each Questions: Multiple choice, structured, closed short answer, and open response. Foundation and Higher Tier 70 marks / 16.7% of GCSE per exam paper	6 x Written Exams: 1 hour 45 mins each Questions: Multiple choice, structured, closed short answer, and open response. 100 marks / 50% of GCSE per exam paper

Biology Paper 1	Biology Paper 2	Chemistry Paper 1	Chemistry Paper 2	Physics Paper 1	Physics Paper 2
What's assessed Biology topics 1–4: Cell Biology; Organisation; Infection and response; and Bioenergetics.	What's assessed Biology topics 5–7: Homeostasis and response; Inheritance, variation and evolution; and Ecology.	What's assessed Chemistry topics 8–12: Atomic structure and the periodic table; Bonding, structure, and the properties of matter; Quantitative chemistry; Chemical changes; and Energy changes.	What's assessed Chemistry topics 13–17: The rate and extent of chemical change; Organic chemistry; Chemical analysis; Chemistry of the atmosphere; and Using resources. Questions in Paper 2 may draw on fundamental concepts and principles from Sections 5.1 to 5.3.	What's assessed Physics topics 18–21: Energy; Electricity; Particle model of matter; and Atomic structure.	What's assessed Physics topics 22–24: Forces; Waves; and Magnetism and electromagnetism

Unit	Year 10	Unit	Year 11
Autumn 1 **B1 – Cell biology (4.1)** **10 Hours**	**Title of unit: Cell Biology** **Main foci:** Cells are the basic unit of all forms of life. In this unit we explore how structural differences between types of cells enables them to perform specific functions within the organism. **Cell structure:** Eukaryotes and prokaryotes; Animal and plant cells; Cell specialisation; Cell differentiation; Microscopy **Cell division:** Chromosomes; Mitosis and the cell cycle; Stem cells **Transport in cells:** Diffusion; Osmosis; Active transport ***Triple Science*** **Microscopy:** More detail on microscope resolution and magnification calculations; use of an electron microscope to explain sub-cellular structures **Cell Division:** The cell cycle covered in more depth, including the stages of mitosis. **Stem cells:** Greater depth on embryonic and adult stem cells; Therapeutic cloning; Stem cell use in plants (meristems) and ethical issues	**Autumn 1** **P5 – Forces (6.5)** **12 Hours**	**Title of unit: Forces** **Main foci:** In this unit we will explore how engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. **Forces and their interactions:** Scalar and vector quantities; Contact and non-contact forces; Gravity; Resultant forces **Work done and energy transfer:** Work done; Energy transfer **Forces and elasticity:** Hooke's law **Forces and motion:** Describing motion along a line; Distance and displacement; Speed; Velocity; The distance-time relationship; Acceleration **Forces, accelerations and Newton's Laws of motion:** Newton's First Law; Newton's Second Law; Newton's Third Law **Forces and braking:** Stopping distance; Reaction time; Factors affecting braking distance **Momentum:** Momentum is a property of moving objects (HT only); Conservation of momentum (HT only) ***Triple Science*** **Forces:** Moments, levers and gears; Pressure in a fluid and atmospheric pressure; Upthrust and factors affecting floating/sinking; Terminal velocity and drag forces; More detailed motion graphs including area under graphs for distance; Stopping distance calculations and factors affecting stopping distances
Autumn 1 **C1 – Atomic structure and the periodic table (5.1)** **10 Hours**	**Title of unit: Atomic structure and the periodic table** **Main foci:** The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. In this unit we explore the historical development of the periodic table and how the arrangement of elements can be explained in terms of atomic structure. **A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes:** Atoms, elements and compounds; Mixtures; The development of the model of the atom; Relative electrical charges of subatomic particles; Size and mass of atoms; Relative atomic mass; Electronic structure **The periodic table:** The periodic table; Development of the periodic table; Metals and non-metals; Group 0; Group 1; Group 7	**Autumn 1** **C6 – The rate and extent of chemical change (5.6)** **8 Hours**	**Title of unit: The rate and extent of chemical change** **Main foci:** In this unit we will explore the reactivity of chemicals as a factor in how fast chemical reactions proceed. We will also learn about the variables that can be manipulated in order to speed up or slow down reactions. **Rate of reaction:** Calculating rates of reactions; Factors which affect the rate of chemical reactions; Collision theory and activation energy; Catalysts **Reversible reactions and dynamic equilibrium:** Reversible reactions; Energy changes and reversible reactions; Equilibrium; The effect of changing conditions of equilibrium (HT only); The effect of changing concentration (HT only); The effect of temperature changes on equilibrium (HT only); The effect of pressure changes on equilibrium (HT only)

	Triple Science **Atomic Structure and the Periodic Table:** Relative atomic mass (Ar) calculations; Development of the model of the atom in more detail (e.g. Rutherford, Bohr); Electronic structure using full electronic configurations		***Triple Science*** **The Rate and Extent of Chemical Change:** Reversible reactions and dynamic equilibrium in more depth; Le Chatelier's Principle: effects of temperature, pressure and concentration
Evidence of learning	Students will know more and be able to do more than they could before completing the unit.	Students will know more and be able to do more than they could before completing the unit.	
Links to prior learning	KS3 - Cells Year 7 KS3 - Atoms, elements and compounds Year 7 KS3 - The periodic table Year 8	KS3 – Forces Year 7 KS3 – Reactions Year 7	
Links to future learning	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	
Autumn 2 **P1 – Energy (6.1)** **9 Hours**	**Title of unit: Energy** **Main foci:** The concept of energy emerged in the 19th century. In this unit we explore energy as a key tool for understanding change in a system, and the ways energy is stored before and after such changes. **Energy:** Energy stores and systems; Changes in energy; Energy changes in systems; Power; Conservation and dissipation of energy; Energy transfers in a system; Efficiency; National and global energy resources ***Triple Science*** **Energy:** Efficiency calculations using energy and power; More detail on thermal conductivity and thermal insulation; Energy resources: environmental impact in greater depth	**Autumn 2** **B5 – Homeostasis and response (4.5)** **9 Hours**	**Title of unit: Homeostasis and response** **Main foci:** Cells in the body can only survive within narrow physical and chemical limits. In this unit we explore the control systems that monitor and adjust the body, comparing and contrasting the structure and function of the nervous and hormonal systems. **Homeostasis:** Homeostasis **The human nervous system:** Nervous system **Hormonal coordination in humans:** Human endocrine system; Control of blood glucose concentration; Hormones in human reproduction; Contraception; The use of hormones to treat infertility (HT only); Feedback systems (HT only) ***Triple Science*** **The brain:** Structure and function of different regions of the brain; Methods for studying the brain (e.g. MRI) **The eye:** Structure and function of eye parts; How defects like myopia and hyperopia are corrected **Control of body temperature:** (not in Trilogy) Thermoregulatory centre; Vasodilation and vasoconstriction **Hormonal coordination:** Detailed role of hormones in reproduction; Menstrual cycle hormones (FSH, LH, oestrogen, progesterone); Use of contraceptive methods and fertility treatments (e.g. IVF)

Autumn 2 **B2 – Organisation (4.2)** **9 Hours**	**Title of unit: Organisation** **Main foci:** In this unit we will explore the principles of organisation focussing on the human digestive system, respiratory system and circulatory system. We will also learn about organisation in plants, paying particular attention to their transport system. **Principles of organisation:** Animal tissues, organs and organ systems; The human digestive system; Enzymes; The heart and blood vessels; Blood; Coronary heart disease: a non-communicable disease; Health issues; The effect of lifestyle on some non-communicable diseases; Cancer **Plant tissues, organs and systems:** Plant tissues; Plant organ system ***Triple Science*** **The heart and circulatory system:** More detail on the structure and function of the heart; Explanation of blood pressure and heart valves **Plant tissues and organ systems:** Additional emphasis on the structure of plant tissues; Detailed structure and function of xylem and phloem; Factors affecting transpiration and translocation	**Autumn 2** **C7 – Organic chemistry (5.7)** **10 Hours**	**Title of unit: Organic chemistry** **Main foci:** In this unit we will explore the great variety of carbon compounds and their importance in our world. We will also learn about modifying organic molecules to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents. **Carbon compounds as fuels and feedstock:** Crude oil, hydrocarbons and alkanes; Fractional distillation and petrochemicals; Properties of hydrocarbons; Cracking and alkenes ***Triple Science*** **Organic Chemistry:** Structure and reactions of alkenes, alcohols, carboxylic acids; Addition and condensation polymerisation; Naturally occurring polymers: DNA, proteins, starch, cellulose
Autumn 2 **C2 – Bonding, structure, and the properties of matter (5.2)** **12 hours**	**Title of unit: Bonding, structure and the properties of matter** **Main foci:** In this unit we will explore the theories of structure and bonding to explain the physical and chemical properties of materials. We will also learn about how chemists use this knowledge of structure and bonding to engineer new materials with desirable properties. **Chemical bonds, ionic, covalent and metallic:** Chemical bonds; Ionic bonding; Ionic compounds; Covalent bonding; Metallic bonding **How bonding and structure are related to the properties of substances:** The three states of matter; State symbols; Properties of ionic compounds; Properties of small molecules; Polymers; Giant	**Autumn 2** **P6 – Waves (6.6)** **10 Hours**	**Title of unit: Waves** **Main foci:** Waves carry energy from one place to another and can also carry information. In this unit we explore mechanical waves and take a look at modern technologies such as imaging and communication systems to shoe how we can make the most of electromagnetic waves. **Waves in air, fluids and solids:** Transverse and longitudinal waves; Properties of waves **Electromagnetic waves:** Types of electromagnetic waves; Properties of electromagnetic waves 1; Properties of electromagnetic waves 2; Uses and applications of electromagnetic waves ***Triple Science*** **Waves:** Seismic waves and structure of the Earth; More detailed wave behaviour: refraction, absorption and transmission; Required practical on ripple tanks and waves on a string

	covalent structures; Properties of metals and alloys; Metals as conductors **Structure and bonding of carbon:** Diamond; Graphite; Graphene and fullerenes ***Triple Science*** **Bonding, Structure, and the Properties of Matter:** More advanced ionic and covalent bonding diagrams; Metallic bonding and structure in greater detail; Nanoscience: uses and properties of nanoparticles	**Autumn 2** **C8 – Chemical analysis (5.8)** **8 Hours**	**Title of unit: Chemical analysis** **Main foci:** In this unit we will explore the methods scientists use to analyse chemicals. We will also learn about the tests for several different gases. **Purity, formulations and chromatography:** Pure substances; Formulations; Chromatography **Identification of common gases:** Test for hydrogen; Test for oxygen; Test for carbon dioxide; Test for chlorine ***Triple Science*** **Chemical Analysis:** Flame tests and tests for metal ions, halides, sulphates, and carbonates; Instrumental analysis: flame emission spectroscopy (theory only)
Evidence of learning	Students will know more and be able to do more than they could before completing the unit.	Students will know more and be able to do more than they could before completing the unit.	
Links to prior learning	KS3 – Health and lifestyle Year 8 KS3 – Energy Year 8 KS3 – Particles and their behaviour Year 7 KS3 – Structure and function of body systems Year 7	KS3 – Structure and function of body systems Year 7 KS3 – Energy Year 8 KS3 – Waves Year 7 KS3 – Separation techniques Year 8	
Links to future learning	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	
Spring 1 **P2 – Electricity (6.2)** **10 Hours**	**Title of unit: Electricity** **Main foci:** Electric charge is a fundamental property of matter everywhere. In this unit we will explore circuits and their components. We will also learn about charge, current, resistance and potential difference. **Current, potential difference and resistance:** Standard circuit diagram symbols; Electrical charge and current; Current, resistance and potential difference; Resistors; Series and parallel circuits **Domestic uses and safety:** Direct and alternating potential difference; Mains electricity **Energy transfers:** Power; Energy transfers in everyday appliances; The National Grid ***Triple Science***	**Spring 1** **B6 – Inheritance, variation and evolution (4.6)** **10 Hours**	**Title of unit: Inheritance, variation and evolution** **Main foci:** In this unit we will discover how the number of chromosomes is halved during meiosis and then combined with new genes from the sexual partner to produce offspring. We will also learn about gene mutations, variation, evolution and selective breeding. **Reproduction:** Sexual and asexual reproduction; Meiosis; DNA and the genome; Genetic inheritance; Inherited disorders; Sex determination **Variation and evolution:** Variation; Evolution; Selective breeding; Genetic engineering **The development of understanding of genetics and evolution:** Evidence for evolution; Fossils; Extinction; Resistant bacteria **Classification of living organisms:** Classification ***Triple Science***

	Electricity: Domestic electricity: frequency and voltage of mains supply; National Grid: role of step-up and step-down transformers; Power calculations including current, potential difference and resistance		**Genetic diagrams:** Punnett squares, family trees, and inherited disorders (e.g. cystic fibrosis) **DNA and genome:** Structure of DNA, complementary base pairing; The Human Genome Project **Selective breeding and genetic engineering:** More detail, including recombinant DNA techniques; GM crops, cloning in animals and plants (e.g. tissue culture) **Fossils and extinction:** More focus on fossil formation; Detailed causes of extinction **Evolutionary trees:** (interpreting diagrams and data)
Spring 1 **B3 – Infection and response (4.3)** **10 Hours**	**Title of unit: Infection and response** **Main foci:** In this unit we will explore pathogens and microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. We will also learn about how we can avoid diseases by reducing contact with them, as well as how the body uses barriers, and our immune system response to the potentially hostile invaders. **Communicable diseases:** Communicable (infectious) diseases; Viral diseases; Bacterial diseases; Fungal diseases; Protist diseases; Human defence systems; Vaccination; Antibiotics and painkillers; Discovery and development of drugs ***Triple Science*** **Monoclonal antibodies:** Principles of production and use (pregnancy tests, diagnosis, cancer treatment) **Plant diseases:** Examples like TMV, rose black spot; Plant defense mechanisms, both physical and chemical **More detail on the immune system:** Phagocytosis, antitoxins, and memory cells	**Spring 1** **P7 – Magnetism and electromagnetism (6.7)** **Spring 2** **10 Hours**	**Title of unit: Magnetism and electromagnetism** **Main foci:** In this unit we will explore electromagnetic effects used in a wide variety of devices. We will also learn about how an electric current can be produced using a magnet and coil of wire. **Permanent and induced magnetism, magnetic forces and fields:** Poles of a magnet; Magnetic fields **The motor effect:** Electromagnetism; Fleming's left-hand rule (HT only); Electric motors (HT only) ***Triple Science*** **Magnetism and Electromagnetism:** Fleming's left-hand rule and applications in electric motors; Loudspeakers and microphones; Induced potential and the generator effect; Transformers and the equations linking voltage and turns
Spring 1 **C3 – Quantitative chemistry (5.3)** **10 Hours**	**Title of unit: Quantitative chemistry** **Main foci:** In this unit we will explore different types of chemical reaction to make sense of how different chemicals react together, to identify patterns and make predictions about the behaviour of other chemicals. We will also learn about purity and yield. **Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations:** Conservation of mass and balanced chemical equations; Relative formula mass;	**Spring 1** **C9 – Chemistry of the atmosphere (5.9)** **8 Hours**	**Title of unit: Chemistry of the atmosphere** **Main foci:** In this unit we will explore the Earth's dynamic atmosphere. We will consider the effects of man-made changes and natural cycles. We will also learn about weather and climate change, the problems caused by increased levels of air pollutants, and the development of solutions that help to reduce the impact of human activity. **The composition and evolution of the Earth's atmosphere:** The proportions of different gases in the atmosphere; The Earth's early atmosphere; How oxygen increased; How carbon dioxide decreased

	Mass changes when a reactant or product is a gas; Chemical measurements **Use of amount of substance in relation to masses of pure substances:** Moles (HT only); Amounts of substances in equations (HT only); Using moles to balance equations (HT only); Limiting reactants (HT only); Concentration of solutions ***Triple Science*** **Quantitative Chemistry:** Higher level detail on concentration calculations in mol/dm^3; Titration calculations and techniques (including required practical); Limiting reactants and more complex mole calculations; Atom economy and percentage yield in detail		**Carbon dioxide and methane as greenhouse gases:** Greenhouse gases; Human activities which contribute to an increase in greenhouse gases in the atmosphere; Global climate change; The carbon footprint and its reduction **Common atmospheric pollutants and their sources:** Atmospheric pollutants from fuels; Properties and effects of atmospheric pollutants ***Triple Science*** **Chemistry of the Atmosphere:** Evolution of the atmosphere in more detail; Greenhouse gases and climate change mechanisms; Carbon footprint and ways of reducing it
		Spring 1 **C10 – Using resources (5.10)** **8 Hours**	**Title of unit: Using resources** **Main foci:** In this unit we will explore the Earth's natural resources and how we used them to manufacture useful products. We will also learn about sustainability, the use of energy, waste and the environmental impact of the manufacture of these products. **Using the Earth's resources and obtaining potable water:** Using the Earth's resources and sustainable development; Potable water; Wastewater treatment; Alternative methods of extracting metals (HT only) **Life cycle assessment and recycling:** Life cycle assessment; Ways of reducing the use of resources ***Triple Science*** **Using Resources:** Life cycle assessments (LCAs) with greater depth and analysis; Potable water production: desalination and treatment of waste water; Corrosion and methods of preventing it; Alloys, ceramics, polymers, and composites in more detail; Haber process and conditions affecting yield; NPK fertilisers: industrial production and balanced equations
Evidence of learning	Students will know more and be able to do more than they could before completing the unit.	Students will know more and be able to do more than they could before completing the unit.	
Links to prior learning	KS3 Electricity and magnetism Year 8 KS3 - Health and lifestyle Year 8	KS3 – Adaptation and inheritance Year 8 KS3 – Variation Year 9 KS3 – Electricity and magnetism Year 8	
Links to future learning	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	

<table>
<tr><td></td><td>Further Education Courses, Foundation Courses in Science and Access Courses</td><td colspan="2"></td></tr>
<tr><td>Spring 2

B4 – Bioenergetics (4.4)

10 Hours</td><td>Title of unit: Bioenergetics
Main foci: In this unit we will explore how plants harness the Sun’s energy in photosynthesis in order to make food. We will also learn about the processes of aerobic and anaerobic respiration which transfers energy that the organism needs to perform its functions.

Photosynthesis: Photosynthetic reaction; Rate of photosynthesis; Uses of glucose from photosynthesis
Respiration: Aerobic and anaerobic respiration; Response to exercise; Metabolism

*Triple Science
Photosynthesis: Rate of photosynthesis experiments; Limiting factors and their interactions shown using graphs
Respiration: Detailed comparison between aerobic and anaerobic respiration; Anaerobic respiration in microorganisms (fermentation) and its use in industry</td><td>Spring 2

Space Physics*

Only in Physics 8463 – not included at all in Combined Science</td><td>*Triple Science
Space Physics: Life cycle of a star including black holes and neutron stars; Orbital motion, red-shift and the Big Bang theory</td></tr>
<tr><td>Spring 2

P3 – Particle model of matter (6.3)

9 Hours</td><td>Title of unit: Particle model of matter
Main foci: In this unit we will explore the particle model that is widely used to predict the behaviour of solids, liquids and gases. We will also learn about how engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft.

Changes of state and the particle model: Density of materials; Changes of state
Internal energy and energy transfers: Internal energy; Temperature changes in a system and specific heat capacity; Changes of state and specific latent heat
Particle model and pressure: Particle motion in gases

*Triple Science
Particle Model of Matter: Internal energy and specific latent heat; Derivation and use of pressure-volume relationship (for gases)</td><td>Spring 2</td><td>GCSE Revision
Exact content to be determined by class teacher, and will aim to cover the key ideas for both paper 1 and paper 2 including a review of the required practical tasks</td></tr>
</table>

Evidence of learning	Students will know more and be able to do more than they could before completing the unit.		
Links to prior learning	KS3 – Green plants and ecosystem processes Year 8 KS3 – Particles and their behaviour Year 7		
Links to future learning	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	
Summer 1 **C4 – Chemical changes (5.4)** **12 Hours**	**Title of unit: Chemical changes** **Main foci:** In this unit we will explore how our understanding of chemical changes enables us to predict what new substances would be formed in a reaction. **Reactivity of metals:** Metal oxides; The reactivity series; Extraction of metals and reduction; Oxidation and reduction in terms of electrons (HT only) **Reactions of acids:** Reactions of acids with metals; Neutralisation of acids and salt production; Soluble salts; The pH scale and neutralisation; Strong and weak acids (HT only) **Electrolysis:** The process of electrolysis; Electrolysis of molten ionic compounds; Using electrolysis to extract metals; Electrolysis of aqueous solutions; Representation of reactions at electrodes as half equations (HT only) ***Triple Science*** **Chemical Changes:** Strong and weak acids, pH and hydrogen ion concentration relationship; Reactivity series in more depth with more metal displacement reactions; Electrolysis: half equations and purification of copper	**Summer 1**	**GCSE Revision** Exact content to be determined by class teacher, and will aim to cover the key ideas for both paper 1 and paper 2 including a review of the required practical tasks
Summer 1 **P4 – Atomic structure (6.4)** **6 Hours**	**Title of unit: Atomic structure** **Main foci:** In this unit we will explore ionising radiation, its dangers and uses. We will also learn about the rules for radiological protection and how radioactive materials are widely used in medicine, industry, agriculture and electrical power generation. **Atoms and isotopes:** The structure of an atom; Mass number, atomic number and isotopes; The development of the model of the atom (common content with chemistry)	**Summer 1**	**GCSE Exam period begins…**

	Atoms and nuclear radiation: Radioactive decay and nuclear radiation; Nuclear equations; Half-lives and the random nature of radioactive decay; Radioactive contamination ***Triple Science*** **Atomic Structure:** Detailed model of the atom including historical models (e.g. Rutherford, Bohr); Nuclear equations and balancing nuclear decay reactions; Half-life, and applications of radioactive decay in more detail (e.g. medical uses)		
Evidence of learning	Students will know more and be able to do more than they could before completing the unit.		
Links to prior learning	KS3 – Reactions of metals Year 8 KS3 – Reactions Year 7		
Links to future learning	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	
Unit	**Year 10**	**Unit**	**Year 11**
Summer 2 **C5 – Energy changes (5.5)** **9 Hours**	**Title of unit: Energy changes** **Main foci:** Energy changes are an important part of chemical reactions. In this unit we explore exothermic and endothermic reactions and their everyday applications. **Exothermic and endothermic reactions:** Energy transfer during; exothermic and endothermic reactions; Combustion and oxidation; Thermal decomposition; Reaction profiles; The energy change of reactions (HT only) ***Triple Science*** **Energy Changes:** Bond energy calculations and energy profile diagrams in more detail; Fuel cells and hydrogen-oxygen fuel cells (uses, advantages, limitations)	**Summer 2**	**GCSE Exam period continues…**
Summer 2 **B7 – Ecology (4.7)** **8 Hours**	**Title of unit: Ecology** **Main foci:** In this unit we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.		

	Adaptations, interdependence and competition: Communities; Abiotic factors; Biotic factors; Adaptations; Organisation of an ecosystem; Levels of organisation; How materials are cycled **Biodiversity and the effect of human interaction on ecosystems:** Biodiversity; Waste management; Land use; Deforestation; Global warming; Maintaining biodiversity ***Triple Science*** **Trophic levels and biomass:** Pyramids of biomass and calculations of biomass transfer; Efficiency of biomass transfer **Food production:** Sustainable food production, e.g. fish farming, mycoprotein, biotechnology in food **Decay:** Role of microorganisms; Factors affecting rate of decay (experiment); Biogas production	
Evidence of learning	Students will know more and be able to do more than they could before completing the unit.	
Links to prior learning	KS3 – Reactions of metals Year 8 KS3 – Reactions Year 7 KS3 - The periodic table Year 8	
Links to future learning	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses	A-level Biology, Chemistry and Physics Vocational BTEC Science and Health and Social Care Further Education Courses, Foundation Courses in Science and Access Courses

Reading in the curriculum (Literacy & Vocabulary)

We implement many strategies to help develop students' reading abilities through science study.

Vocabulary Building

When reading aloud, we introduce new vocabulary words and discuss their meanings.

We encourage and support students to use new words in their writing.

We develop subject specific vocabulary verbally and in writing.

Focus on Content

We dive deeply into a specific topic to expand vocabulary and comprehension

We encourage students to summarise main ideas after reading.

Research Opportunities

We let students explore topics they enjoy through research projects. It enhances vocabulary and critical thinking.

Oral Language Practice

We provide opportunities for students to communicate and discuss content throughout lessons.

We encourage students to read aloud together or with a partner.

Use Visual Aids

We incorporate visuals like charts, diagrams, and illustrations to enhance comprehension.

Expose Students to Different Discourse Patterns:

We explore various writing styles, and sentence structures (e.g. formal practical writing, comprehension, biography).

Promote Independent Reading Time:

We allocate time for students to consolidate and read independently.

Model Reading Strategies:

We demonstrate effective reading techniques, such as predicting, questioning, and inferring.

Careers in the curriculum

Good performance in the combined science GCSE course allows access to a range of science-based A level or Level 3 BTEC qualifications in science and applied science. This in turn can potentially lead to a wide range of choices of apprenticeships or degree courses in areas such as marine biology, forensic science, pharmacology and more. Science graduates are highly sought after, in a wide range of careers, for their logical problem-solving abilities as well as their mathematical talents. Careers can include medicine, engineering, veterinary science, architecture, business and management, conservation and many other choices.

Protected Characteristics in the curriculum

We recognise the importance of exemplifying British values in our teaching and learning, and through our practice. In the science department, it is expected that this is much more likely to be effective through naturally occurring opportunities rather than specially contrived situations.

Democracy

We all have a role in influencing decisions, and everyone has a right to have their voices heard. We should be aware of our rights and responsibilities.

What does this look like in science?

Students work together practically in groups which encourages them to share views and opinions and take instructions from others.

There are opportunities to debate issues where students can share their opinions and listen to the views of others. For example, the generation of electricity, the placement of quarries, the use of drugs, genetic modification, selective breeding and climate change.

The Rule of Law

Laws protect everyone and no-one is above the law. We should understand the need for rules to make a happy, safe and secure environment and know the consequences when rules are not followed.

What does this look like in science?

Students follow laboratory rules for the safety of all.

Students learn about the need for speed limits and seat belts.

There are opportunities to discuss laws relating to science, such as the use of IVF, stem cells, genetic modification and DNA databases, maintaining biodiversity, use of energy sources, fishing and farming.

Individual Liberty

We have a freedom of choice and a right to respectfully express our views and beliefs. We can act as we choose within the law. The rights of ourselves and the others around us are protected.

What does this look like in science?

There are opportunities for students to work independently and make choices in a safe environment when carrying out investigations.

There are opportunities to debate issues where students can share their opinions and listen to the views of others. For example, the generation of electricity, the placement of quarries, the use of drugs, genetic modification, selective breeding and climate change.

Mutual Respect and Tolerance

There is equality and fairness for all, regardless of background or religious beliefs. We understand that we do not all share the same beliefs and values. We respect the values, ideas and beliefs of others and do not impose our own onto them.

What does this look like in science?

Students work together practically in groups which encourages teamwork and respect for others.
There are opportunities to learn about scientific discoveries by a diverse range of people from our culture and other cultures.
Students learn about the continual evolution of scientific ideas which occurs through the acceptance that different people have different ideas about a concept.
There are opportunities to consider conflict between religious beliefs and scientific understanding with respect and acceptance of people's values.

Safeguarding including safety in the curriculum

Although students have always been taught to work safely, there is now a more-general requirement that they are taught about health and safety and how it should be implemented. Students should understand something of the principles of health and safety, which is more than learning how to follow a set of safe working instructions. Teaching and learning science offers many opportunities for students to learn about health and safety in a 'live' practical situation which can provide them with insights into health and safety in general. Recognising hazards, assessing risk and working safely are important skills not only in the school laboratory but also at home and at work.

Students are shown how to identify hazards from hazard labels, printed instructions, or their own experience. Students are taught how to judge the nature of the actual risks to which they might be exposed. They are taught that it is impossible to eliminate all risks, and that a judgement should be made about what level of risk is acceptable.

Values across the curriculum

Living our values

Our school values are the driving force behind our attitudes, behaviours, and actions. A key aspiration in science is for students to be curious and have the confidence to explore their ideas. We want students to live and learn as scientists. This links explicitly with values such as patience, responsibility, courage, kindness, respect, honesty, humility, perseverance, and empathy. In lessons we promote our values and try to engender a spirit of collaboration.

Being the best we can be

We want students to have high aspirations and be the best versions of themselves. We encourage them to question, be curious and have a love of learning. We have high expectations for all students to aim high and work hard. We courage students to set goals and think about how to achieve them. We promote the importance of taking care of yourself physically and mentally by eating well, exercising regularly, getting enough sleep, and managing stress. Our classrooms are positive, supportive, and encouraging.

In community

With such a key focus on practical experimentation, we generate lots of communities – in terms of community spirit in lessons, paired and group work, discussion at small group and whole class level, and practical collaboration. Students are encouraged to develop their skills together, share knowledge, share findings, and seek and give feedback to/from peers.

Spirituality in the curriculum

How does the curriculum reflect the schools Theological routed Christian vision? How is spiritual development an intrinsic part of the curriculum?

Our curriculum supports the spiritual development of students by creating an environment of curiosity, exploring interconnectedness, and fostering open-mindedness. By developing these key attributes, we hope to develop a sense of connection to something bigger than ourselves, to help students 'Live life in all its fulness', living our values; being the best we can be, in community.

Through the science curriculum we aim to:

Consider the Ethics – We discuss the moral side of scientific work to instil a sense of responsibility e.g. dissection work, animal testing, pollution. Explore the moral aspects of technological advancements.

Boost Curiosity – We encourage pondering life's big questions while studying science concepts e.g. where do we come from? Are we alone in the universe? Looking for meaning and purpose in natural and physical phenomena. Wonder about what is special about life. Emotional drive to know more and to wonder about the world. Wonder at the vastness of space and the beauty of natural objects.

Pause for Mindfulness Moments – We integrate short mindfulness exercises for self-awareness and focus.

Connect Concepts – We emphasize how different scientific ideas are interconnected and explore interconnectedness.

Holywell School Curriculum Overview

Develop Open-Minded Learning – We foster an open-minded approach to scientific inquiry. Develop open mindedness to the suggestions of others. Challenging stereotypes.
Encourage Earth Respect – We relate scientific knowledge to caring for the environment.
Support Art-Science Fusion – We combine art and science for creative spiritual expression.

Develop Social Education – We encourage group practical work, team working skills and taking responsibility for their own and other people's safety. Encourage understanding that science has a major effect on the quality of our lives. Consider the benefits of scientific developments and the social responsibility involved.
Promote Cultural Education – We explore scientific discoveries as a part of our culture and the discoveries of other cultures. Highlight the scientific discoveries of a wide range of men and women in many different cultures.

How we track your progress

We use a variety of strategies to enable us to reflect on the impact of our curriculum and our teaching on student learning, outcomes and progress. Linking to our progress descriptors, all students' progress is tracked through the work they produce in lessons and their contribution to lessons. Summative and formative assessments include (but are not limited to):

Talking to students; asking questions
Providing Next step challenges
Live feedback in lesson
Periodic assessment tasks
Quizzes
Concept maps
Verbal/written outcomes
Reflection tasks
Presentations
Tests (End of topic / unit / half term / term / year)
Online assessments
Assessed pieces of work
Assessed practical investigations

Parents/Carers can support their child by:

Asking your child if you can help them: checking their knowledge, chatting to them over meals, using flashcards to quiz them.
Provide your child with a suitable study space at home.
Encourage your child to attend revision sessions and complete all their homework.

Sustainability within the subject

Integrate sustainability into our curriculum and support students with their understanding of the natural environment, climate change, renewable energy, biodiversity, and environmental chemistry
Link core science ideas like ecosystems, carbon cycles, and energy to real-world sustainability challenges
Use case studies of sustainable technologies and practices
Promote eco-friendly lab practices by reducing single-use plastics and hazardous chemicals in experiments
Reuse and recycle materials where possible
Choose experiments that demonstrate green chemistry principles
Encourage digital data recording instead of paper
Support student research or action projects focussed on local issues

Involve students in school-wide eco-initiatives like recycling and energy monitoring Showcase projects at science fairs Collaborate with geography, DT and PSHE Invite experts and use Real-World data by bringing in local scientists to speak to students Use open data sets e.g. NASA climate data and WWF biodiversity stats in lessons