Department	Science	Head of Department	Mr Franklin
5 Year Overview – Curricular Intent			

“Science and everyday life cannot and should not be separated.”

Rosalind Franklin

Science at Ellesmere Park is practical, hands-on and intends for our students to foster an inquisitive nature about how our world works. Science lessons are pitched to ensure challenge for all, so that students can develop their resilience, so that they begin to problem-solve, think, and work independently. For our students to confidently work scientifically, they need to be taught the knowledge so that they can read, write, talk, and think like a scientist. Improving scientific literacy is important, so that students can understand the scientific process, analyse evidence, and use such evidence to think critically.

At Key Stage Three, our curriculum model is researched and evidence-based in a way that is sequenced for learning to progress, where teachers ask questions to reveal common misunderstandings that students may have. In doing so, teachers can plan to challenge those misunderstandings and encourage conceptual development. Students are taught the key concepts, be it cells, particles or forces and motion, and as they progress through their learning journey, our spiralling curriculum model revisits those concepts and allows students to make more connections and develop their schema of understanding. The scope of our Key Stage Three curriculum model allows for students to broaden and deepen their scientific knowledge, with increasing demand.

By Key Stage Four, students have revisited and built up their scientific knowledge over time, to the point where, with support from their teacher, they are clear on the most important knowledge that they need to know. We help our students recognise that the components of science they have been taught previously can be applied to unfamiliar contexts.

Our teachers have high expectations of what our students are capable of; all students should feel successful in their science lessons. We are enthusiastic about what we teach, and in turn we want our students to see a value in learning about science and develop a love for the subject.

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	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 7	After completing an induction into science to learn about safety, scientific apparatus and the scientific method, students will be taught knowledge and skills from the following components on rotation: Cells, Material science, and Forces. Students should understand: <u>Cells:</u> Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope; Sub-cellular structures and their functions; The role of diffusion in the movement of materials in and between cells; Structural adaptations of unicellular organisms; Classification of organisms into groups according to similarities and differences in their features. <u>Materials science:</u> The identification of materials as composites, metals, polymers, and ceramics; Properties of composite materials, metals, non-metals, polymers, and ceramics; The evaluation of composite materials for uses. <u>Forces:</u> Forces as pushes or pulls, arising from the interaction between two objects, measured in Newtons (N); The use of force arrows in scientific diagrams; The effects of balanced and unbalanced forces; The difference between contact and non-contact forces gravity.		Students will be taught knowledge and skills from the following components on rotation: Inheritance, Organisation, Substances and mixtures, Sound and light, and Our solar system. Students should understand: <u>Inheritance:</u> Heredity as the process by which genetic information is transmitted from one generation to the next; Modelling of chromosomes, genes, and DNA; The work of Watson, Crick, Wilkins, and Franklin in the discovery of DNA. <u>Organisation:</u> The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms; How cells enlarge and divide to make new cells in growing multicellular organisms; The structures and functions of the human circulatory system, digestive system, gas exchange system (including the mechanism of breathing), skeletal system and interactions between the skeleton and muscles. <u>Substances and mixtures:</u> Arrangement, movement, and energy of particles in the three states of matter; How matter is conserved when it changes state; Properties of solids, liquids, and gases; Atoms and molecules as particles; The difference between a pure substance and a mixture; The process of dissolving to make a solution; Brownian motion in gases; Diffusion because of a concentration gradient; Separation techniques, including filtration, evaporation, distillation, and chromatography. <u>Sound and light:</u> How sound waves can echo, reflect, and be absorbed; How sound is made and travels, including how microphones and loudspeakers work; How humans hear sounds; How light waves can be absorbed, scatter and reflect; How light travels. <u>Our solar system:</u> What makes up our Solar System; How planets and moons stay in orbit; Why we have days, years, and seasons; Why the days feel longer in Summer; Why it is warmer in some countries compared to others; The lunar cycle and the causes of an eclipse.		Students will be taught knowledge and skills from the following components on rotation: Variation, Health and disease, Atoms, elements and compounds, Designing materials, Earth's resources, and Heating and cooling. Students should understand: <u>Variation:</u> What fossils are, how they form and what we can learn from fossil evidence; How organisms within the same species can differ from each other; The difference between continuous and discontinuous variation. <u>Health and disease:</u> The difference between physical and mental health; Causes and treatment of ill health; The effects of exercise, asthma and smoking on gas exchange; what recreational drugs are and the impact of substance misuse. <u>Atoms, elements and compounds:</u> The work of John Dalton on atoms; The difference between atoms, elements, and compounds; How we represent elements and compounds. <u>Designing materials:</u> How we explain the melting points, masses, and flexibility of polymer materials. <u>Earth's resources:</u> What is inside the Earth; How the structure of Earth can be modelled; The formation of igneous rock; How to investigate crystal size in igneous rock. <u>Heating and cooling:</u> Internal energy; The production of a heating and cooling curve; The transfer of heat energy; The investigation of conduction, insulation, and radiation.	

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 8	Students will be taught knowledge and skills from the following components on rotation: Diet and exercise, Solubility and chemical change, and Motion. Students should understand: <u>Diet and exercise:</u> The components of a healthy diet; Why we need nutrients; How we know how much energy is in food; Why some people require more energy than others; How we investigate energy in food; Why we should eat a balanced diet and what happens if we do not; The dangers of obesity and effects of deficiency diseases on the body; The effects of exercise on the body. <u>Solubility and chemical change:</u> What happens in a chemical reaction; The difference between a physical and chemical change; How to investigate chemical changes such as thermal decomposition, combustion, and oxidation; Why some substances are soluble; How to investigate solubility; The causes of a saturated solution. <u>Motion:</u> How to calculate the speed, distance, and time of a journey and how this can be represented on a distance/time graph; What relative motion is; How drag can affect motion; How drag can be investigated; What causes the motion of an object to change; What energy transfers are involved in changing the motion of an object.		Students will be taught knowledge and skills from the following components on rotation: Biochemistry, The Periodic Table, Air pollution, How we see and making images, and Space and beyond. Students should understand: <u>Biochemistry:</u> Photosynthesis; Adaptations of plant roots and leaves; How plants absorb water and minerals and exchange gases; The difference between aerobic and anaerobic respiration; Fermentation; How we can investigate fermentation of glucose. <u>The Periodic Table:</u> What elements are; How elements were originally arranged on the Periodic Table by Mendeleev; How the original Periodic Table changed over time; What the different patterns in the Periodic Table are, including the Alkali metals, Transition metals, Halogens and Noble gas elements; How we can investigate the properties of metals and non-metals. <u>Air pollution:</u> What the Earth's atmosphere is made up of and how its composition has changed over time; How human activities are changing the composition of the Earth's atmosphere today; The impact of human and natural activities on climate change; The importance of recycling. <u>How we see and making images:</u> How ray diagrams are used to demonstrate reflection and refraction of light; Dispersion of white light using prisms; Structure and function of parts of the eye; How we see, including how we see colours; What lenses are and how they can help to correct vision; How cameras use lenses. <u>Space and beyond:</u> Stars and Galaxies; The lifecycle of stars; Why Scientists think that Space is expanding; How Scientists make observations of Space; How telescopes work; Whether there could be life on other planets.		Students will be taught knowledge and skills from the following components on rotation: Reproduction, Interdependence of organisms, Evaporation and the water cycle, Energy and reactions, Acids and alkalis, Weathering and erosion, More about force, and Simple Electrical Circuits. Students should understand: <u>Reproduction:</u> Puberty in humans; Comparing the human male and female reproductive systems; The menstrual cycle; Fertilisation; Gestation in humans; The importance of the placenta; What happens during birth in humans; The structure of a flower; How plants reproduce; Seed dispersal in plants; The lifecycle of a butterfly. <u>Interdependence of organisms:</u> What ecosystems are; How food chains and webs represent feeding relationships; energy transfer; Interdependence in the food chain; Bees and human food security. <u>Evaporation and the water cycle:</u> Comparing boiling and evaporation; Explaining evaporation; The permeability of rocks; The water cycle and modelling the water cycle. <u>Energy and reactions:</u> How we can investigate endothermic and exothermic reactions. <u>Acids and Alkalis:</u> Comparing acid or alkalis; Using indicators to identify acids and alkalis; The pH scale; How to make a salt; How we can investigate the acidity of metal and non-metal oxides; What acid rain is, how it forms and the effects of acid rain on the environment. <u>Weathering and Erosion:</u> Different types of weathering; Investigating chemical weathering; Comparing weathering and erosion. <u>More about Force:</u> Why weight changes on other planets; Why springs stretch; What Hooke's Law is and how it can be investigated; What moments or turning forces are and how they can be calculated. <u>Simple Electrical Circuits:</u> How to represent circuit components using symbols; How to build a series circuit; How to measure current and voltage in a series circuit; How to draw accurate series circuit diagrams; How current and voltage in a series circuit can be investigated; The causes of static electricity.	

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Year 9	Students will be taught knowledge and skills from the following components on rotation: Infectious disease, Understanding chemical reactions, More electrical circuits, Waves, and Fuel uses and costs. Students should understand: <u>Infectious Disease</u> What pathogens are; How bacteria cause disease; How viruses cause disease; How fungi cause disease; How we can investigate the growth of bacteria; Whether all diseases are infectious. <u>Understanding chemical reactions:</u> How to represent chemical reactions using symbol equations; Reactions of metals with acid; Displacement reactions; Extraction of metal from ores/metal oxides using carbon; What catalysts are and how they affect the rate of a chemical reaction. <u>More electrical circuits:</u> How to build a parallel circuit; How to measure current and voltage in a parallel circuit; How to draw accurate parallel circuit diagrams; How current and voltage can be investigated in a parallel circuit; What electrical resistance is; How resistance can be investigated in electrical circuits; How we can model electrical resistance in circuits. <u>Waves:</u> What water waves are; How we can calculate wave speed; Similarities and differences between light waves and water waves; What pressure waves are; How pressure waves are used in cleaning; How pressure waves are used in physiotherapy. <u>Fuel uses and costs:</u> What makes a good fuel; Different types of fuel; How we can investigate the energy transferred by different fuels; How we can compare energy efficiency; What the cost of fuel is; Alternative energy resources; What power is and how power can be calculated.		Students will be taught knowledge and skills from the following components on rotation: Biodiversity and human impact, Adaptation and evolution, Rock changes, Floating and sinking, and Magnets and electromagnets. Students should understand: <u>Biodiversity and human impact:</u> Why there are different kinds of ecosystems; The different levels within ecosystems; The living and non-living parts of an ecosystem; How organisms can be identified inside and outside the science laboratory; How organisms are classified and named; How quadrats can be used to investigate the distribution of organisms; What biodiversity is and why it is so important; What the threats are to biodiversity; How humans can help to preserve biodiversity. <u>Adaptation and evolution:</u> How organisms are adapted to their environment; Why organisms compete; What natural selection is; How to model natural selection; How natural selection can lead to evolution; What can cause the extinction of a species. <u>Rock changes:</u> What sedimentary rocks are; How fossil fuels form; What happens in the carbon cycle; How sedimentary rocks can change to become metamorphic rocks; What the rock cycle is and how it can be modelled. <u>Floating and sinking:</u> What density is; How density can be investigated; What pressure is; How pressure can be investigated; What causes pressure in the atmosphere and under water; What convection is; What causes a convection current; How a convection current can be modelled. <u>Magnets and electromagnets:</u> How magnets behave; How we can demonstrate a magnetic field; How compasses work; How electromagnets work; How we can investigate electromagnets; Where we see magnetic effects.	Students will be taught knowledge and skills from the following components on rotation: Cell biology, Inheritance and the genome, Interdependence of organisms and classification, Atomic structure and the Periodic Table, Bonding, Energy of moving particles, and Measuring and calculating motion. Students should understand: <u>Cell biology:</u> The main components of cells; Comparing eukaryotes and prokaryotes; How we draw and label cells from the field of view; How we calculate actual sizes of cells; How microscopy techniques have developed over time; The advantages and disadvantages of electron microscopy. <u>Inheritance and the genome:</u> What chromosomes are and how they determine our sex; What DNA is; How DNA can be extracted from fruit; The importance of the Human Genome Project; Why some characteristics are inherited; What genetic disorders are. <u>Interdependence of organisms and classification:</u> The causes of interdependence within a community; How changes in abiotic and biotic factors affect a community; How belt transects can be used to investigate the distribution of a species; How materials are cycled through an ecosystem; How the three domains are used to classify organisms. <u>Atomic structure and the Periodic Table:</u> The difference between atoms, elements, and compounds; How our understanding of atoms has changed over time; What is inside the nucleus of an atom; How we know the number and configuration of electrons in an atom; What the Periodic Table can tell us about elements; How we explain the properties of elements in group 1, 7 and 0. <u>Bonding:</u> Why atoms lose or gain electrons; How metals and non-metals bond; How we can investigate the properties of ionic compounds; How non-metals bond; What metallic bonding is; How we can use models to represent chemical bonds. <u>Energy of Moving Particles:</u> How energy can be stored and transferred; What the first law of thermodynamics is; What specific heat capacity is and how it can be investigated; What specific latent heat is. <u>Measuring and Calculating Motion:</u> The difference between a vector and scalar quantities; How we calculate the acceleration of a moving object; How we represent journeys on a velocity/time graph; How we interpret velocity/time graphs; What terminal velocity is.	

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
Year 10	Students will be taught knowledge and skills from the following components on rotation: <u>Cell transport</u> • Diffusion. • Osmosis. • Active transport. <u>Human and plant systems</u> • The principles of organisation. • The human digestive system. • The heart and blood vessels. • The components of the blood. • Plant tissues. • Plant organs. <u>Coordination and control</u> • Homeostasis. • The human nervous system. • The human endocrine system. • The control of blood glucose concentration. • Feedback systems. • The human brain (Triple Science only). • The human eye (Triple Science only). • The control of body temperature (Triple Science only). • Maintaining water and nitrogen balance (Triple Science only). • Plant hormones (Triple Science only). • Required practical: germination (Triple Science only). • The uses of plant hormones (Triple Science only). <u>Quantitative chemistry</u> • Conservation of mass and balancing chemical equations. • Relative formula mass. • Mass changes when a reactant or product is a gas. • Chemical measurements. • Moles. • Amounts of substances in equations. • Using moles to balance equations. • Limiting reactants. • Concentration of solutions. • Percentage yield (Triple Science only). • Atom economy (Triple Science only). • Uses of concentrations (Triple Science only). • The amount of a substance in relation to volumes of gases (Triple Science only). <u>Crude oil</u> • Crude oil, hydrocarbons and alkanes.		Students will be taught knowledge and skills from the following components on rotation: <u>Human lifestyles and health</u> • Coronary heart disease. • Health issues. • The effect of lifestyle on some non- communicable diseases. • Cancer. <u>Growth and development</u> • Mitosis and the cell cycle. • Stem cells. • Cell specialisation. • Cell differentiation. <u>More infectious diseases</u> • Communicable diseases. • Viral diseases. • Bacterial diseases. • Fungal diseases. • Protist diseases. • Human defence systems. • Monoclonal Antibodies (Triple Science only). • Plant Disease (Triple Science only). <u>Rates of reaction and catalysts</u> • Calculating rates of reactions. • Factors which affect the rates of chemical reactions. • Collision theory and activation energy. • Catalysts. <u>Measuring waves</u> • Transverse and longitudinal waves. • Properties of waves. • Required practical: waves. • Reflection of waves (Triple Science only). • Sound waves (Triple Science only). • Waves for detection and exploration (Triple Science only). <u>Particle explanations</u> • Density of materials. • Particle motion in gases. • Pressure in gases (Triple Science only). • Increasing the pressure of a gas (Triple Science only).		Students will be taught knowledge and skills from the following components on rotation: <u>Bioenergetics</u> • Photosynthetic reaction. • Factors affecting the rate of photosynthesis. • Required practical: effect of light on rate of photosynthesis. • Uses of glucose from photosynthesis. • Aerobic and anaerobic respiration. • Response to exercise. • Metabolism. <u>Sexual and asexual reproduction</u> • Sexual and asexual reproduction. • Advantages and disadvantages of sexual and asexual reproduction (Triple Science only). • Meiosis. • Hormones in human reproduction. • Contraception. • Use of hormones to treat infertility. • DNA structure (Triple Science only). <u>Acids, bases and ions</u> • Reactions of acids with metals. • Neutralisation of acids and salt production. • Soluble salts. • The pH scale and neutralisation. • Strong and weak acids. • Required practical: titrations (Triple Science only). <u>Electrolysis</u> • 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. <u>Energy Changes</u> • Energy transfer during exothermic and endothermic reactions. • Reaction profiles. • The energy change of reactions. • Cell and batteries (Triple Science only). • Fuel cells (Triple Science only). <u>Forces make things change</u> • Resultant forces. • Newton's First Law. • Newton's Second Law.	

- Fractional distillation and petrochemicals.
- The properties of hydrocarbons.
- Cracking and alkenes.
- The structure and formula of alkenes.
- The reactions of alkenes (Triple Science only).
- Alcohols (Triple Science only).
- Carboxylic acids (Triple Science only).
- Addition polymerisation (Triple Science only).
- Condensation polymerisation (Triple Science only).
- Amino acids (Triple Science only).
- DNA and other naturally occurring polymers (Triple Science only).

Material properties

- Properties of ionic compounds.
- Properties of small molecules.
- Polymers.
- Giant covalent structures.
- Properties of metals and alloys.
- Metals as conductors.
- Diamond.
- Graphite.
- Graphene and fullerenes.
- Sizes of particles and their properties (Triple Science only).
- Uses of nanoparticles (Triple Science only).

Energy of moving objects

- Work done and energy transfer
- Power
- Kinetic Energy
- Gravitational Potential Energy
- Forces and Elasticity
- Elastic Potential Energy
- Energy Efficiency

Circuit calculations

- Standard circuit diagram symbols.
- Electrical charge and current.
- Current, resistance and potential difference.
- Energy Resources.
- Static charge (Triple Science only).
- Electric fields (Triple Science only).

- Newton's Third Law.
- Stopping distance, reaction time and braking distance.
- Momentum.
- Conservation of Momentum.
- Changes in Momentum (Triple Science only).
- Moments, levers, and gears (Triple Science only).
- Pressure in a fluid (Triple Science only).
- Atmospheric Pressure (Triple Science only).

Circuit components

- Resistors
- Series and parallel circuits

Students who have opted to study GCSE Separate Sciences have further study within each component. This is highlighted blue.

Most students follow the AQA GCSE Combined Science: Trilogy specification. Those that have opted to study the Separate Science pathway follow the AQA GCSE Biology, Chemistry and Physics specification.

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	N/A
Year 11	Students will be taught knowledge and skills from the following components on rotation: <u>Human activity and impact</u> • How materials are cycled. • Biodiversity. • Waste management. • Land use. • Deforestation. • Global warming. • Maintaining biodiversity. • Trophic Levels in an ecosystem (Triple Science only). • Pyramids of Biomass (Triple Science only). • Transfer of Biomass (Triple Science only). • Food production (Triple Science only). <u>Maintaining health</u> • Vaccination. • Antibiotics and painkillers. • Culturing microorganisms (Triple Science only). • Required practical: the effect of antibiotics on bacterial growth (Triple Science only). • The discovery and development of drugs. <u>Chemical Analysis</u> • Pure substances. • Formulations. • Chromatography. • Test for hydrogen. • Test for oxygen. • Test for carbon dioxide. • Test for chlorine. • Flame tests (Triple Science only). • Metal hydroxides (Triple Science only). • Carbonates (Triple Science only). • Halides (Triple Science only). • Sulfates (Triple Science only). • Instrumental methods (Triple Science only). • Flame emission spectroscopy (Triple Science only). <u>Earth and the atmosphere</u> • The proportions of different gases in the atmosphere. • The Earth's early atmosphere. • How oxygen increased in Earth's atmosphere. • How carbon dioxide decreased in Earth's atmosphere. • Greenhouse gases. • Human activities which contribute to an increase in greenhouse gases in the atmosphere.		Students will be taught knowledge and skills from the following components on rotation: <u>Explaining evolution and speciation</u> • Variation. • Evolution. • Selective breeding. • Genetic engineering. • Evidence for evolution. • Fossils. • Extinction. • Resistant bacteria. • Cloning (Triple Science only). • Theory of evolution (Triple Science only). • Speciation (Triple Science only). <u>Chemical equilibrium</u> • Reversible reactions. • Energy changes and reversible reactions. • Equilibrium. • The effect of changing conditions on equilibrium. • The effect of changing concentration. • The effect of temperature changes on equilibrium. • The effect of pressure changes on equilibrium. <u>Sustainability</u> • Using the Earth's resources and sustainable development. • Potable water. • Wastewater treatment. • Alternative methods of extracting metals. • Life cycle assessment. • Ways of reducing the use of resources. • Corrosion and its prevention (Triple Science only). • Alloys as useful materials (Triple Science only). • Ceramics, composites and polymers (Triple Science only). • The Haber process (Triple Science only). • The production and use of NPK fertiliser (Triple Science only). <u>Electromagnetic waves</u> • The types of electromagnetic waves • The properties of electromagnetic waves. • The uses and applications of electromagnetic waves. • Lenses (Triple Science only). • Visible light (Triple Science only). • Required practical: light (Triple Science only). • Emission and absorption of infrared (Triple Science only). • Perfect black bodies (Triple Science only).		During the summer term, pupils will engage in revision sessions in order to allow for maximum preparation for their GCSE examinations. Students who have opted to study GCSE Separate Sciences have further study within each component. This is highlighted blue. Most students follow the AQA GCSE <u>Combined Science: Trilogy</u> specification. Those that have opted to study the Separate Science pathway follow the AQA GCSE <u>Biology</u>, <u>Chemistry</u> and <u>Physics</u> specification.	

- Global climate change.
- The carbon footprint and its reduction.
- Atmospheric pollutants from fuels.
- The properties and effects of atmospheric pollutants.

Nuclear physics

- The structure of an atom.
- Mass number, atomic number and isotopes.
- The development of the model of the atom.
- Radioactive decay and nuclear radiation.
- Nuclear equations.
- Half-lives and the random nature of radioactive decay.
- Radioactive contamination.
- Background radiation (Triple Science only).
- Different half-lives of radioactive isotopes (Triple Science only).
- Uses of Nuclear radiation (Triple Science only).
- Nuclear radiation (Triple Science only).
- Nuclear fission (Triple Science only).
- Nuclear fusion (Triple Science only).

Magnetism and Electromagnetism

- The poles of a magnet.
- Magnetic fields.
- Electromagnetism.
- Fleming's left-hand rule.
- Electric motors.
- Loudspeakers (Triple Science only).
- Induced potential (Triple Science only).
- The uses of the generator effect (Triple Science only).
- Microphones (Triple Science only).
- Transformers (Triple Science only).

Mains electricity

- Direct and alternating potential difference.
- Mains electricity and the structure of a plug.
- Power.
- Energy transfers in everyday appliances.
- The National Grid.

Space physics

- Our solar system (Triple Science only).
- The life cycle of a star (Triple Science only).
- Orbital motion, natural and artificial satellites (Triple Science only).