Marshland HIGH SCHOOL

Marshland Curriculum Overview Science

Curriculum Intent
Our science curriculum is underpinned by the 7 big idea strands: cells and organisms; ecosystems; matter; chemical change; Earth; energy; and forces. The spiral curriculum reviews prior learning and builds on this knowledge throughout the five years from Year 7 to Year 11, preparing students for their exams and to use their knowledge to problem solve in everyday life. Significant effort has gone into sequencing schemes of learning, ensuring concrete knowledge is taught before abstract knowledge to provide students with the foundations they need to aid understanding. The design is based on the pillars of knowledge, linked to the big idea strands and builds in a hierarchical manner. For example, in chemistry time is invested in particles and atom structure leading onto electronic structure, ions, bonding etc. Content is carefully chosen to give pupils a strong set of foundations for learning science. In addition to carefully sequenced science knowledge, emphasis is placed on mathematical and literacy knowledge. With this knowledge, pupils will be able to grasp key science concepts to articulate knowledge with speed and accuracy (fluency). Practical activities are important in science, with consideration given to timescales for introducing particular practical exercises, leading to additional opportunities to apply fundamental skills to develop expertise. For example, it is important that students can measure the volume of a liquid using a measuring cylinder, they cannot just do this once to become an expert, but need to revisit this skill at several points. Science Capital is integrated into the curriculum. This gives students the opportunity to consider how Science is involved in and influences their everyday lives, as well as highlighting Science in their local area and the career opportunities available.

How does our curriculum build upon previous learning?	
KS3	In line with the national curriculum, KS2 covers basic foundational knowledge based around the Big Idea strands. Biology - linked to cells and organisations, students will look at digestive and circulatory systems; diet and lifestyle and classifying living things. Within ecosystem they will cover food chains; grouping living things using characteristics; life cycles and the reproduction of plants. Chemistry - linked to matter, students will look at basic properties of materials and states of matter. Within chemical change they will learn about basic separation techniques, and within Earth observe features of rocks and the water cycle. Physics - within energy, students learn about light reflections and shadows; sound travelling by vibrations and related patterns; simple series circuits in electricity along with common conductors and insulators. Within Forces, students study attraction and repulsion of magnets and the solar system, including why we have day and night. There is some focus on working scientifically within KS2. The focus is on basic enquiry, controlling variables and recording observations with tables and charts. We are well aware that practical equipment is limited within many primary schools and often an area where students have less prior knowledge. KS3 builds on these big ideas reviewing, expanding and explaining learning within KS2.

How does our curriculum build upon previous learning?	
	For example, in KS2 students learn about the states of matter. We build on this knowledge by introducing particle theory in Y7, which in turn helps explain heat energy transfers such as conduction in Y8. Another example is magnets, taught at KS2 in the context of do they attract or repel. KS3 builds on that knowledge to observe and explain the magnetic fields that cause attraction and repulsion to happen. At the start of a topic, questioning checks retained prior knowledge from KS2 which is used to inform our planning to meet the needs of the students within lessons. Practical skills are explicitly taught, with time taken to show pupils how to use key equipment and carry out specific skills such as identifying variables; recording and analysing data and evaluating the method used. Y8 students pull these skills together to carry out a full investigation into an area for their Y8 project.
KS4	Although knowledge taught in KS4 is largely linked to the exam specification, it still builds within the big idea strands. Y7 foundation knowledge of particle theory is needed to understand and explain bonding structures and properties, as well as the explanations of differences between evaporation and boiling, amongst many other things. Additionally, with magnets they take their understanding of magnetic fields and apply this to electromagnets and solenoids within KS4. Knowledge gained in Y7 about cells is built on throughout the years leading to learning about specialised cells, tissues and organs, specific organ systems and diffusion. Practical skills are built upon in KS4, with these skills relating to a variety of different contexts, as well as the required practical exercises. Questions based around planning; analysing data and evaluating are of a higher demand.

What do students ***do*** with this knowledge or these skills?	How do we help students secure knowledge in long-term memory?
Students use their knowledge and skills in a variety of activities within their lessons: • Questions • Tarsias • Extended writing tasks • Mathematical calculation questions • Planning experiments (including hypothesis; prediction; methods and risk assessment) • Carrying out experiments in a safe manner • Designing tables of results • Analysing data from tables • Drawing a variety of graphs • Analysing data from graphs • Forming conclusions & evaluations • Problem solving • Exam questions	Securing knowledge in long term memory is the vital goal of our course, in fact, it is by our definition, learning. Some examples of how we achieve this are listed below. It is crucial to note that this is not a tick list and not all of these (or perhaps any of them) will be observed in a given lesson. Science teachers will use these, as appropriate, to support the context of what they are teaching. • Quizzing for memory retrieval practice, both in lessons and homework • Increasing storage strength by slowly removing scaffolding, interleaving questions from different topics and asking questions of incrementing demand • Targeted questioning in class that supports pupils in engaging in retrieval practice. • Spaced practice lessons that are designed to check prior understanding and address gaps that arise • Core questions and answers provided to students to work on practising at home, with homework quizzes to support the practice of these

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How does our curriculum align to the national curriculum?

KS3 covers the national curriculum throughout Y7 to Y9 and builds on knowledge from KS2. Some GCSE knowledge has been moved into Y9 to provide a challenging curriculum.
KS4 covers the exam specification. However, this provides a guide for required knowledge and as a result, the curriculum is sequenced in a way that allows for building knowledge and skills to develop, rather than just following the sequencing of the specification itself.

How do we check student understanding and monitor progress?

Understanding is checked regularly within lessons through:

- regular retrieval quizzing and low stakes testing
- use of whiteboards to ensure all students are providing a response to identify gaps quickly
- targeted hands-down questioning with a 'no-opt out' policy
- live marking whilst students are completing tasks to give in the moment feedback and opportunity for improvement.

This allows teachers to have a good understanding of their pupils and their needs. Misconceptions can be addressed quickly before they become concreted into the long-term memory.
In addition, summative assessments are used in the form of core question assessments and written assessments. Core question assessments contain a mixture of multiple choice and free answer questions from the core questions students are given at the start of every topic. Written assessments focus on the ability of students to apply their knowledge in new contexts at agreed points. Outcomes from summative assessments are then used to identify the need for group or individual interventions.

Curriculum sequencing

Year	Autumn	Spring	Summer
7	**Electricity** Static Electricity, Components, Circuits, Magnetism, Electromagnetism, Earth's Magnetism **Matter** Particle Theory, Chemical and Physical Changes, Separation Techniques, Atomic structure, periodic Table	**Chemical Reactions** Gas Tests, Compounds and Chemical Formulae, Ceramic, Polymers, Composites, Types of Reactions **Cells & Reproduction** Microscopes, Cells, Organ Systems, Skeleton, Muscles, Joints, Human reproduction	**Ecology** Ecosystems, Sampling, Adaptations, Predator/Prey, Photosynthesis, Plant Reproduction, Food Chains and Webs **Forces** Force Names and Diagrams, Resultant Force, Moments, Terminal Velocity, Speed/Time Graphs, Distance/Time Graphs

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Curriculum sequencing			
Year	**Autumn**	**Spring**	**Summer**
8	**Solutions** Solubility, Separation Techniques, Diffusion, Pressure in Fluids **Energy** Energy Stores and Transfers, Conservation of Energy, Heat Transfer, Work Done, Energy Resources, Power Stations, Light, Sound	**Food & Digestion** Specialised Cells, Balanced Diet, Energy Calculations, Good Bacteria, Circulatory System, Respiratory System, Diffusion, Respiration, Exercise **Space** Days & seasons, Planets, Phases of the moon, eclipses, Satellites and Stars	**Health** Disease, Body Defences, Antibiotics and MRSA, Natural Selection. Variation, Evolution **Principles of Chemistry** States of Matter, Changes of State, Heat Energy Transfer, Endothermic and Exothermic Reactions, Atoms, Electronic Structure, Periodic Table **Year 8 Project** – Full investigation. Research, plan, preliminary experiment, modify, investigate, analyse, conclude and evaluate.
9	**Biology: Cells** Cell Parts & Functions, Specialised Cells, Microscopes, Diffusion, Osmosis, Active Transport **Chemistry: Atoms & the Periodic Table** Atoms, Elements and Compounds, Separation Techniques, Development of Atomic Structure, Ions, Periodic Table, Group 1/7/0, Electronic Structure **Physics: Energy** Stores of Energy, Energy Transfers, Kinetic Energy, Gravitational Potential Energy, Efficiency, Energy Associated with Movement	**Biology: Health** Communicable and Non-communicable Disease, Drugs, Alcohol, Smoking, Drug Development, Immune system, Vaccines **Chemistry: Bonding** States of Matter, Ions and Isotopes, Structure and Bonding, Ionic/Covalent/Metallic Bonding **Physics: Electricity** Circuit Components, Charge Flow Calculation, Current and Potential Difference, Resistance, AC/DC, Plugs, Fuses/Circuit Breakers, National Grid, Fuel Bills	**Biology: Ecology** Communities, Abiotic/Biotic Factors, Cycling Materials, Biodiversity, Land Use, Deforestation, Global Warming, Maintaining Biodiversity, Seed Banks **Chemistry: Earth & Atmosphere** Earth Structure, Sedimentary Rocks, Earth's Atmosphere, Carbon Cycle, Greenhouse Gases, Climate Change, Human Impact, Pollutants from Fuels **Physics: Forces** Forces, balanced and unbalanced forces, terminal velocity, speed, distance-time graphs, road safety
10	**Biology:** Cells; Organisation **Chemistry:** Atoms & The Periodic Table, Chemical Reactions **Physics:** Atomic structure & Radiation; Forces	**Biology:** Organisation continued; Infection and Response **Chemistry:** Bonding; Quantitative Chemistry **Physics:** Energy; Electricity	**Biology:** Infection and Response continued; Bioenergetics **Chemistry:** Energy Changes; Rates of Reaction **Physics:** Electricity cont.**;** Particles

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Curriculum sequencing			
Year	**Autumn**	**Spring**	**Summer**
11	**Biology**: Homeostasis; Inheritance **Chemistry:** Organic Chemistry; Analysis **Physics:** Waves; Magnets	**Biology:** Inheritance continued; Ecology **Chemistry**: Earth Atmosphere; Earth's resources **Physics:** Space (Triple only); Forces (review); Prep for exams	**Biology:** Prep for exams **Chemistry:** Prep for exams **Physics:** Prep for exams
Rationale for this sequencing	The Y7 curriculum builds on concepts from KS2, starting with foundation concepts to the big idea of science, especially in chemistry and physics modules, which have threads that run through all topics. Little knowledge of chemical reactions is taught at KS2 so, when this is introduced in Y7, we focus on observations that show a chemical reaction has taken place; identifying if a change is a chemical or physical. Building on this in Y8, we begin to name specific types of reactions and start to recognise these from word equations. By Y10 reactions are linked to a context, for example, reduction and displacement are linked to metal extraction. In physics we begin with fundamental topics where this knowledge is key to understanding further concepts. For example, in Y7, we look at what a force is and the different types and causes, in Y8 this relates to Space and in Y10 to Newton's laws of motion and complex calculations. Biology is a little more compartmentalised as knowledge does not thread through all topics in the same way as it does with chemistry and physics. However, big ideas build throughout the year groups. For example, cells are taught in Y7, and in Y8 students learn how specific cells are adapted in relation to bacteria and viruses. We are restricted when some practical work can take place, for example, examining insects in the pond and measuring daisies on the field using quadrats is a summer Ecology study. Y7, Y8 and Y9 topics are on rotation to reduce some issues associated with practical work logistics.		

How does this curriculum prepare students for the transition to post-16 pathways?
Many Marshland students progress onto science-related courses with some moving into sixth form courses in biology, chemistry or physics. GCSE knowledge and skills lead directly into KS5 with initial modules relating to fundamental knowledge from KS4, for example, understanding atoms and bonding structures is key. From this point models change and expand allowing students to use models that cover more than just the first 20 elements of the Periodic Table. In KS4 biology, students learn about the basic structure of DNA, whilst in KS5 they learn about RNA and the DNA replication process, and as well as understanding amino acids combine to make proteins, they also need to know the chemical structures of those amino acids. Some students attend college and complete courses in Engineering, Forensic science, Animal care, Veterinary nursing, and Nursing & Paramedics. Their foundation knowledge in Science supports their understanding and their ability to problem solve, helping them to progress.