Subject overview for: Science

1. Subject overview

The overall aim of the science curriculum at John Masefield High School is to ensure that all students:

- 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 of science, today and for the future.

We have employed a top-down approach to curriculum planning, firstly looking at the key knowledge we expect students to acquire at A Level and using this to help plan our GCSE curriculum and then planning our Year 7, 8 and 9 curriculum. This has allowed us to develop a spiral curriculum where the key concepts are regularly revisited allowing students to grow in confidence and develop a secure understanding as they progress through their education.

2. Year 7, Year 8 and Year 9 summary (Key Stage Three)

The Key Stage 3 Science Curriculum at JMHS has been carefully designed to engage students and build upon the key knowledge that they have developed during primary school. Students arrive at JMHS from a wide variety of feeder primary schools, with differing curricula for Science and therefore we aim to ensure that all students have the same basic understanding of Science by the end of Year 7 and that any gaps in knowledge have been addressed. The JMHS Science curriculum has been sequenced to allow students to accumulate knowledge in a logical order and have the opportunity to revisit key concepts, providing a foundation of understanding for students to develop mastery before entering the GCSE curriculum. We aim to provide a broad curriculum, therefore, in addition to covering the requirements of the National Curriculum for Key Stage 3 Science, we provide lessons that are practical-focused and provide many opportunities for students to design and carry out a range of experiments to supplement and enhance their theoretical knowledge going above the requirements of the National Curriculum where possible.

Summary of Content:

At Key Stage 3 students cover each of the three disciplines (Biology, Chemistry and Physics) on a rotational basis, over three topics per term.

Year Group	Term	Topics Covered		
7	**Autumn**	Working Scientifically: Introduction to Science	Biology: Cells	Chemistry: The Particle Model
	Spring	Biology: Reproduction	Chemistry: Separating Mixtures	Physics: Forces and Energy
	Summer	Biology: Feeding Relationships and Classification	Chemistry: Chemical Reactions	Physics: Electricity
8	**Autumn**	Biology: Food and Digestion	Chemistry: The Periodic Table	Physics: Waves
	Spring	Biology: Respiration and Gas Exchange	Chemistry: Acids and Alkalis	Physics: Heating and Cooling
	Summer	Biology: Photosynthesis	Chemistry: Reactions of Metals	Physics: Space
9	**Autumn**	Biology: Health and Disease	Chemistry: Earth and Atmosphere	Physics: Motion and Pressure
	Spring	Biology: Genetics	Chemistry: Extracting Metals	Physics: Electricity and Magnetism
	Summer	During the Summer term of Year 9 students begin their transition to GCSE content by revisiting the key concepts in Biology, Chemistry and Physics.		

3. Year 10 and Year 11, GCSE summary (Key Stage Four)

Students in Key Stage 4 follow the Edexcel GCSE course of study. This will either be Combined Science or Separate Science. Students are invited to apply for Separate Science at the end of Year 9. Applications are reviewed carefully, considering a range of factors, including academic performance to ensure that all students are empowered to take a course which they will enjoy and will maximise their achievement. As a faculty, we have fully reviewed the exam specification and planned bespoke schemes of work that allow students to achieve all the prescribed learning objectives of their course. There is a clear rationale for the teaching sequence of the various topics and a clear programme of practical work embedded within the schema that supports the core practical element of the GCSE.

a. Edexcel GCSE Combined Science

Year Group	Term	Topics Covered		
10	**Autumn**	CB1 Key Concepts in Biology CB2 Cells and Control	CC4&13 The Periodic Table CC5,6 & 7 Bonding	CP5 Light and the EM Spectrum CP6 Radioactivity
	Spring	CB3 Genetics CB4 Natural Selection	CC10 Electrolytic processes CC11 Using and Obtaining Metals	CP1 Motion CP2 Forces and Motion
	Summer	CB5 Health and Disease	CC8 Acids and Alkalis CC9 Moles	CP3&7 Conservation of Energy
11	**Autumn**	CB6 Plant structure and hormones	CC14&15 Rates of Reaction CC12 Dynamic Equilibrium	CP9 Electricity CP10 & 11 Magnetism
	Spring	CB7 Hormonal coordination CB8 Exchange and Transport	CC16 & 17 Fuels and Earth's Atmosphere	CP12 &13 Particle model and Forces and Matter
	Summer	**Exam period**		

b. Edexcel GCSE Separate Sciences (Biology, Chemistry and Physics)

Year Group	Term	Topics Covered		
		Biology	**Chemistry**	**Physics**
10	**Autumn**	SB1 Key Concepts in Biology SB2 Cells and Control	SC4 &17 Groups of the Periodic Table SC5,6 & 7 Bonding SC25 Qualitative analysis	SP5 Light and the EM Spectrum SP6 Radioactivity
	Spring	SB3 Genetics SB4 Natural Selection and Genetic Modification	SC10 & 16 Electrolysis, Chemical cells & fuel cells SC11 Obtaining Metals SC13 Transition metals and Alloys	SP1&2 Motion and Forces SP3 Conservation of Energy
	Summer	SB5 Health and Disease	SC8 Acids and Alkalis SC9 Moles SC14 Quantitative analysis	SP7 Astronomy SP8&9 Forces doing work and their effects
11	**Autumn**	SB6 Plant Structure and hormones	SC18 Rates of Reaction SC19 Heat energy changes SC12&15 Reversible reactions and dynamic equilibria SC22 Hydrocarbons	SP10&11 Electricity and Static Electricity SP12 Magnetism and the Motor Effect SP13 Electromagnetic Induction

	Spring	SB7 Animal control and coordination SB8 Exchange and Transport	SC23 Alcohols and carboxylic acids SC24 Polymers SC20 Fuels SC21 Earth and Atmosphere SC26 Bulk and surface properties	SP14 Particle Model SP15 Forces and Matter
	Summer	**Exam period**		

4. Sixth Form courses

We provide the opportunity for students in the sixth form to study Biology, Chemistry and Physics at A Level. The curriculum for these courses has been carefully designed to allow students to build upon their knowledge from GCSE and develop a wide-ranging understanding of these disciplines of science that will not only allow them excel in their examinations but will provide them with the relevant theoretical and procedural knowledge to access university education or a scientific career or apprenticeship.

OCR A-level Biology

Year Group	Term	Topics Covered	Sequencing rationale
12	**Autumn**	• Topic 2.1.2 Biological molecules • Topic 2.1.4 Enzymes • Topic 2.1.5 Biological membranes • Topic 4.2.2 Classification and evolution • Topic 4.2.1 Biodiversity	During the first term students learn the key knowledge behind living organisms, as well as how they are classified and observed.
	Spring	• Topic 2.1.3 Nucleic acids • Topic 2 .1.1 Cell structure • Topic 2.1.6 Cell division • Topic 3.1.1 Exchange surfaces • Topic 3.1.3 Transport in plants	Students apply their knowledge to processes within cells and organisms as a whole.
	Summer	• Topic 3.1.2 Transport in animals • Topic 4.1.1 Communicable diseases • Topic 6.3.1 Ecosystems • Topic 6.3.1 Populations and sustainability	Students apply basic principles covered previously to processes within humans as well as consider the interactions between humans and the rest of the living world.
13	**Autumn**	• Topic 6.1.2 Patterns of inheritance • Topic 6.1.1 Cellular control • Topic 5.1.4 Hormonal control • Topic 6.2.1 Cloning and Biotechnology • Topic 5.1.2 Excretion and Homeostasis	Students develop knowledge of the micro and macro processes that control the human body
	Spring	• Topic 6.1.3 Manipulating genomes • Topic 5.1.3 Neuronal communication • Topic 5.1.5 Plant and Animal responses • Topic 5.2.1 Photosynthesis • Topic 5.2.2 Respiration	Students cover the most challenging material that brings together topics taught previously
	Summer	**Exam period**	

Edexcel A-level Chemistry

Year Group	Term	Topics Covered	Sequencing rationale
12	**Autumn** Inorganic and physical	• Topic 5 Formulae, equations and amounts of substance • Topic 1 Atomic structure and the periodic table	During the first term students revisit key knowledge from GCSE
	Autumn Organic and physical	• Topic 9 Reaction kinetics • Topic 10 Chemical equilibrium • Topic 6.1 Introduction to organic chemistry	
	Spring Inorganic and physical	• Topic 2 Chemical bonding and structure • Topic 3 Redox reactions • Topic 4 Inorganic chemistry and the periodic table	Students build upon their foundation of knowledge to develop their understanding of types of structure, types of reaction and energy changes in reactions
	Spring Organic and physical	• Topic 6.2 Organic chemistry continued • Topic 7 Modern analytical techniques • Topic 8 Chemical energetics	
	Summer Inorganic and physical	• Topic 11 Further equilibrium	Students develop mastery on key knowledge from the spring term and apply knowledge in real life context
	Summer Organic and physical	• Topic 17.1 Orbitals and reactions in organic chemistry • Topic 16 Further kinetics	
13	**Autumn** Inorganic and physical	• Topic 12 Acid-base equilibria • Topic 13 Further energetics	Students recap and revisit underpinning concepts from year 12 and use their understanding to explain chemical and physical properties
	Autumn Organic and physical	• Topic 17.2 Functional groups in organic chemistry	
	Spring Inorganic and physical	• Topic 14 Further redox • Topic 15 Transition metals	Students widen their understanding to ensure a broad knowledge in the field of chemistry
	Spring Organic and physical	• Topic 17.3 Organic analysis and organic synthesis	
	Summer	**Exam period**	

Edexcel A-level Physics

Year Group	Term	Topics Covered	Sequencing rationale
12	**Autumn**	• Topic 1 working as a Physicist • Topic 2 mechanics • Topic 3 Electric circuits	Students build the basic mathematical skills required and extending GCSE core knowledge
	Spring	• Topic 4 materials • Topic 5 waves and the particle nature of light	These concepts have a basis in GCSE but are constructing new schema for students.
	Summer	• Topic 5 waves and the particle nature of light • Introduction to topic 6 further mechanics • Core practical work	Students extending knowledge taught in Topic 2, revisiting underpinning concepts
13	**Autumn**	• Topic 7 electric and magnetic fields • Topic 9 thermodynamics • Topic 8 Nuclear and particle Physics • Topic 11 gravitational fields	Topic 7 builds on Topic 3 and extending further knowledge. Topic 8 requires foundational understanding from Topic 7. New content and real-life applications are also taught here.

	Spring	• Topic 10 Nuclear radiation • Topic 12 Space • Topic 13 Oscillations	Topic 10 synthesises knowledge from GCSE and Topic 8. Topic 12 and 13 require pre-existing knowledge of Topic 8 and Topic 5.
	Summer	**Exam period**	

5. Contribution to preparing for life in modern Britain/equalities

By studying Science at John Masefield High School students are by default mirroring the key qualities and characteristics of modern British citizenship. Science has to be a democratic process as each individual piece of evidence and information is judged on their own merits. In the study of Physics and Chemistry in particular, well-defined theories and laws govern the movement of objects and the reactions of elements and molecules. We teach our students that they can and should challenge these laws through experimentation and the presentation of evidence. We always encourage these challenges and questions to be met with mutual respect in an atmosphere of sensible debate and discussion. And ultimately Science is egalitarian in that we acknowledge the contribution of all faiths and ethnicities. There are no divisions in science along these or other lines, such as gender. Where controversy exists, such as in the study of evolution through natural selection or debates on safety of vaccines in Biology we encourage alternative viewpoints to be held up to the current evidence-based paradigm.

6. Contribution to careers provision

There is a constant focus on the broad range of skills that a scientist requires in the 21st century throughout Years 7 to 13 at JMHS. We believe that the principles of the scientific method, using creativity and imagination to come up with hypotheses and then collecting evidence to test these hypotheses and develop them into theories, are key drivers in the development of students. Specifically, we encourage students to think of scientists as the ultimate problem-solvers. We look at real-time problems such as the need to find replacements for fossil fuels, to find technical solutions to enable manned deep-space exploration and how to design new and more effective medicines and vaccines. We seek to alter the perception that scientists are white, middle-aged men in lab coats by discussing the work of Rosalind Franklin on the structure of DNA, or Jocelyn Bell-Burnell and her discovery of pulsars. We bring up real world examples of Nobel Prize winners in lessons and discuss their contribution such as Jennifer Doudna and Emmanuelle Charpentier who were the first women to share a Nobel Prize for Chemistry. More importantly, throughout all of our topics in Science, we encourage students to see themselves as future scientists, technological experts, engineers and problem solvers by giving them the chance to collect their own evidence and make their own decisions.