

Huntington School: Science Department




Curriculum Intent: Key Stage Four Science

The science department at Huntington School will have a curriculum which creates learners who will thrive in a changing world by giving them the knowledge to:

- Confidently and accurately work scientifically and solve scientific problems;
- Think creatively to overcome and tackle problems with resilience and an open mind-set;
- Appreciate and enjoy the uniqueness of science as a discipline;
- Seek further knowledge and skills independently, based upon a fascination of learning;
- Achieve great exam results that allow our students to progress to the next steps in their lives as scientifically informed citizens.

We will develop this in our students by:

- Using purposeful practical activities with an emphasis on understanding scientific ideas rather than participation.
- Highlighting the relevancy of science to the modern world.
- Assessing pupils starting points and their progress by using effective questioning.
- Creating a true multi- disciplinary approach to science where scientific skills are deployed confidently across all three sciences.
- Using guided practice and modelling to scaffold student's problem solving abilities.
- Being reflective practitioners who constantly evaluate and improve our practice.

	Big Idea	Foundations of KS3 	Y10 	Y11 
Biology	The cellular basis of life	<p>B1- Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. Stem cells. Cellular transport</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Use prefixes centi, milli, micro and nano.</p> <p>Recognise, draw and interpret images of cells.</p> <p>Evaluate the practical risks and benefits, as well as social and ethical issues, of the use of stem cells in medical research and treatments</p> <p>Recognise, draw and interpret diagrams that model diffusion (including osmosis).</p> <p>Use of isotonic drinks and high energy drinks in sport.</p>	<p>B1 –Cells This topic will be reviewed at the end of year 10, prior to the end of year exam.</p> <p>B4- Bioenergetics Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.</p> <p>Plants perform the endothermic reaction photosynthesis in the presence of light. We study the reaction and what can limit its rate as well as looking at how the product Glucose can be used to make useful products for all living organisms.</p>	<p>B5-Homeostasis and response - Cells in the body can only survive within narrow physical and chemical limits. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems the nervous system and hormonal coordination are studied in detail in this unit.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Evaluate the benefits and risks of procedures carried out on the brain and nervous system</p> <p>Evaluate information around the relationship between obesity and diabetes, and make recommendations taking into account social and ethical issues</p> <p>Students should be able to describe how kidney dialysis works.</p> <p>Evaluate the advantages and disadvantages of treating organ failure by mechanical device or transplant</p> <p>Interpret and explain simple diagrams of negative feedback control.</p>
	Heredity and life cycles	<p>B1-Cells this topic covering chromosomes and their role in the cell cycle and mitosis.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Use models and analogies to develop explanations of how cells divide</p>	<p>B1 –Cells This topic will be reviewed at the end of year 10, prior to the end of year exam.</p>	<p>B5-Homeostasis and response The use and effectiveness of contraception.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Show why issues around contraception cannot be answered by science alone.</p> <p>Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.</p> <p>B5-Homeostasis and response Control of human and plant hormones and reproduction.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Developments of microscopy techniques have enabled IVF treatments to develop.</p>

				<p>Understand social and ethical issues associated with IVF treatments</p> <p>Evaluate from the perspective of patients and doctors the methods of treating infertility.</p> <p>Understand how the everyday use of hormones as weed killers has an effect on biodiversity</p> <p>B6- Inheritance Variation and Evolution. We continue work started in year 9 on Cell Division, including revision of B1 Mitosis, by looking at how gametes are produced in Meiosis.</p> <p>We look at what the Sexual and asexual Reproduction are along with the advantages and disadvantages of both.</p> <p>The structure and basic function of DNA is covered. Before looking at mutations and the mechanism of inheritance.</p> <p>The use of this in cloning and genetics is then studied.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Modelling behaviour of chromosomes during meiosis</p> <p>Historical developments of our understanding of the causes and prevention of malaria.</p> <p>Interpret a diagram of DNA structure but will not be required to reproduce it.</p> <p>Modelling insertions and deletions in chromosomes to illustrate mutations</p> <p>Appreciate that embryo screening and gene therapy may alleviate suffering but consider the ethical issues which arise</p> <p>Interpret information about genetic engineering techniques and to make informed judgements about issues concerning cloning and genetic engineering, including GM crops</p> <p>Our current understanding of genetics has developed over time.</p>
	Organisms and their environment	<p>B2 –Organisation We will learn about the human digestive system, respiratory system circulatory system. With a specific focus on the causes and treatment of coronary heart disease, We will also learn how the plant’s transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water</p>	<p>B2 –Organisation There are links with this content to Plant tissues, the leaf. This topic will be reviewed at the end of year 10, prior to the end of year exam.</p>	<p>B7 – Ecology Organisms live in complex communities and are adapted to survive with the Abiotic and Biotic factors present. Human life often depends on careful interaction with the environment and we study the positive and negative interactions and their impact on Biodiversity as a whole. We also look at how nutrients are cycled through ecosystems. Food chains and food webs are also studied to look at the relationships. Between organisms and how</p>

		<p>and carbon dioxide that they need for photosynthesis.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>To use other models to explain enzyme action.</p> <p>Evaluate risks related to use of blood products.</p> <p>Evaluate methods of treatment bearing in mind the benefits and risks associated with the treatment.</p> <p>Interpret data about risk factors for specified diseases.</p>		<p>biomass is transferred. Apply the Biology learnt to help humans live in a more sustainable way.</p> <p>Working scientifically skill include (but are not limited to):</p> <p>Recording first-hand observations of organisms.</p> <p>Interpret graphs used to model predator-prey cycles.</p> <p>Interpret and explain the processes in diagrams of the carbon cycle, the water cycle.</p> <p>Explain how waste, deforestation and global warming have an impact on biodiversity.</p> <p>Understand the conflict between the need for cheap available compost to increase food production and the need to conserve peat bogs and peatlands as habitats for biodiversity and to reduce carbon dioxide emissions.</p> <p>Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications.</p> <p>Explain why evidence is uncertain or incomplete in a complex context.</p> <p>Evaluate given information about methods that can be used to tackle problems caused by human impacts on the environment. Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information.</p> <p>Interpret population and food production statistics to evaluate food security.</p> <p>Understand that some people have ethical objections to some modern intensive farming methods.</p> <p>Evaluate the advantages and disadvantages of modern farming techniques.</p> <p>Understand how application of different fishing techniques promotes recovery of fish stocks.</p>
--	--	--	--	--

	Variation, adaptation and evolution		<p>B3-Infection and Response. The evolution of resistant bacteria evolves.</p> <p>B3-Infection and Response We study how plants are adapted for defence.</p>	<p>B6- Inheritance Variation and Evolution. Students will learn about Selective Breeding, Evolution by Natural Selection, Speciation, the evolution of Resistant Bacteria. Using this gene technology artificially in Genetic engineering.</p> <p>Finally this topic covers the formation and use of fossils and how and why organisms may become extinct.</p> <p>Working scientifically skill include, (but are not limited to:</p> <p>Use the theory of evolution by natural selection in an explanation.</p> <p>Explain the benefits and risks of selective breeding given appropriate information and consider related ethical issues.</p> <p>Interpret information about genetic engineering techniques and to make informed judgements about issues concerning cloning and genetic engineering, including GM crops</p> <p>Students should appreciate that the theory of evolution by natural selection developed over time and from Data gathered by many scientists.</p> <p>Extract and interpret information from charts, graphs and tables.</p> <p>Appreciate why the fossil record is incomplete.</p> <p>Understand how scientific methods and theories develop over time and use this to interpret evolutionary trees.</p>
Chemistry	Atomic Structure and patterns of reactivity	<p>C1 – Atomic structure and the periodic table. This topic is fundamental to all aspects of chemistry. Aspects of this topic will feature across both years.</p> <p>Students study the model of the development of the atom and the periodic table.</p> <p>Looking at Groups 1 and 7; they will describe patterns of behaviour in chemical reactivity.</p> <p>Working scientifically: Using models to develop understanding and an appreciation of how scientific thinking and theories develop over time.</p>	<p>Links to this topic: This topic can be linked with every topic covered in the specification.</p> <p>This topic will be reviewed at the end of year 10, prior to the end of year exam.</p>	<p>Links to this topic: This topic can be linked with every topic covered in the specification.</p>
	Bonding, structures and properties	<p>C2 – Bonding, structures and properties. This topic underpins how compounds behave and react. This topic builds on the particle model covered at KS3 and extends the thinking towards specific models of the different types of bonding. This topic builds upon the content studied in C1.</p>	<p>Links to this topic: This topic can be linked with every topic covered in the specification.</p> <p>This topic will be reviewed at the end of year 10, prior to the end of year exam.</p>	<p>Links to this topic: This topic can be linked with every topic covered in the specification.</p>

		Working scientifically: Using models to develop understanding, and to help explain properties		
	Amount of substance		<p>C3 – Quantitative Chemistry. This topic looks at how we measure the amount of substance in Chemistry and how it applies to the Chemical industry.</p> <p>Working scientifically: Students will be required to translate between units and interpret tables of data and complete suitable analysis.</p>	<p>Links to this topic:</p> <p>This topic can be linked with every topic covered in the specification.</p>
	Chemical reactions and processes		<p>C4 – Chemical changes. This topic includes the reactions of acids, reactivity of metals and electrolysis. Reactions of acids builds upon the acids and alkalis topic at KS3. Three types of neutralisation are covered. Reactivity metals covers how metals are extracted in industry. Electrolysis looks at the procedure of producing pure metals and starting materials for common chemical reactions.</p> <p>Working Scientifically: Students will produce a sample of a pure, dry salt by means of a neutralisation reaction. Students will look at writing a logical method, seek to evaluate and make improvements. Students will complete an accurate titration. This involves specific practical skills; involving reading new equipment accurately, working safely and recording data to a specific convention. Students will write a logical method and use calculations to interpret their results. Students will design a hypothesis into the electrolysis rules and design a practical to test their hypothesis.</p> <p>C5 – Energy Changes This topic explores how energy is transferred during a chemical reaction. It moves onto looking at chemical cells and hydrogen fuel cells.</p> <p>Working Scientifically: Students measure an energy change; they should be able to write a logical method, evaluate for improvements and complete data analysis.</p> <p>C8 – Chemical Analysis In this topic, students will look at how Chemists identify different substances, either by the use of instrumental methods or by simple lab tests.</p> <p>Working Scientifically: Students will carry out a chromatography experiment to identify the components of a mixture or formulation. They will analyse their results by means of Rf calculations.</p> <p>Students will also carry out a range of chemical tests for positive ions, gases, and negative ions. They will then use these tests to identify an unknown substance.</p>	<p>C6 – Rate and extent of chemical change This unit explores what is the rate of reaction and how do we measure it. It looks at the different factors that can cause a reaction rate to change and the particle theory reasoning behind it. Students then explore the ideas of chemical equilibria and the effect on industrial reactions and how this influences the conditions they choose.</p> <p>Working Scientifically: Students design a full investigation into the effect of changing the concentration on the rate of a chemical reaction using a suitable monitoring method. Students will plan; select suitable variables, write a logical method, record results, analyse results and evaluate the method chosen.</p>

	<p>Earth Chemistry (including organic chemistry)</p>	<p>C9 – Chemistry of the atmosphere This topic covers the composition of the Earth’s atmosphere in the modern era and the human impact upon it. Combustion reactions and the environmental effects are explored and the consequences of global warming, climate change are dealt with. Students will explain how the Earth’s atmosphere has changed over 4.5 billion years.</p> <p>Working Scientifically: Students will see how scientific theories have changed over time, how models are used to simplify complex reactions. How peer review evidence is more trustworthy and how to link scientific theory to everyday occurrences.</p>		<p>C7 – Organic Chemistry In this topic students will learn about the finite resource of crude oil. They will look at the process of fractional distillation and cracking to make more useful substances. The use of alkanes for fuels and combustion reactions will be studied. Other organic compounds such as alkenes, alcohols, carboxylic acids and esters will be introduced and some of their reactions and properties explored.</p> <p>C10 – Using resources This topic explores how humans use the Earth’s natural resources and sustainable development. Students will learn how to construct a life cycle assessment and the different ways that countries can produce potable water.</p> <p>Working Scientifically: Students will analyse different samples of water for their salt content and will complete a simple distillation of salty water.</p>
Physics	Energy & Matter	<p>P1 – Energy In this topic students will learn about energy changes in a system, and the ways energy is stored before and after such changes, conservation of energy and efficiency and energy resources. Working Scientifically: Students will carry out an experiment to determine specific heat capacity of a material. Students will also carry and an investigation to determine the effectiveness of different materials as thermal insulators and the factors that affect the thermal insulation properties of a material.</p> <p>P3 – Particle model of matter In this topic, students will learn about internal energy, changes of state and the particle model. Students will also be introduced to how the particle model relates to pressure. Working Scientifically: Students will carry out an experiment to determine the densities of regular and irregular shaped objects and liquids.</p>	<p>Links to this topic: The Energy topic can be linked with every topic covered in the specification.</p> <p>These topics will be reviewed at the end of year 10, prior to the end of year exam.</p>	<p>Links to this topic: The energy topic can be linked with every topic covered in the specification.</p> <p>Students will return to these topics at the end of year 11 as part of the revision process for their terminal exams.</p>
	Electricity	<p>From KS3 students will have a basic understanding of what electrical current is, resistance and series and parallel circuits.</p>	<p>P2 – Electricity. In this topic students will develop their understanding of electrical current and electrical circuits from KS3. They will also be introduced to different types of resistors, linking electrical current to energy transfer, domestic uses and electrical safety and the National grid. Students completing the separate science course will also learn about Static electricity.</p>	<p>Students will return to this topic at the end of year 11 as part of the revision process for their terminal exams.</p>

			<p>Working Scientifically: Students will carry out an experiment to determine the densities of regular and irregular shaped objects and liquids.</p>	
Atomic Physics	From KS3 students will have an understanding of the structure of an atom.	<p>P2 – Atomic structure. In this topic students will build on their understanding of atomic structure and will learn about the development of the atomic model over time. Students will also be introduced to radioactive decay, nuclear radiation, and half-life. Students completing the separate science course will also learn about hazards and uses of nuclear radiation, nuclear fission, and nuclear fusion.</p> <p>Working Scientifically: Students will carry out an investigation to determine the factors that affect the resistance of an electrical circuit, and an investigation to determine the I-V characteristics of different circuit elements.</p>	Students will return to this topic at the end of year 11 as part of the revision process for their terminal exams.	
Forces and motion	From KS3 students will have an understanding of different types of forces and how to calculate a resultant force in 1 dimension. Students will also be able to calculate the speed of an object.	<p>P4 – Forces and motion. In this topic students will build on their understanding of forces and motion. They will initially learn about scalar and vector quantities, contact and non-contact forces, weight, and resultant forces. They will also be introduced to 2 dimensional resultant forces. Students will also learn about Hooke’s Law and relate force, extension and energy.</p> <p>In the motion section of the topic students will learn about the differences between speed and velocity, distance and displacement and will be introduced to how to define and calculate acceleration. Students will also learn how to draw and interpret distance-time and velocity-time graphs. Finally, students will combine what they have learnt about forces and motion when they are introduced to Newton’s laws of motion, momentum and relate these to forces and braking.</p> <p>Students completing the separate science course will also learn about moments, pressure, and changes in momentum.</p> <p>Working Scientifically: Students will investigate the relationship between force and extension for a spring and carry out an investigation to determine the effect of varying the force and mass on the acceleration of an object.</p>	<p>Students will complete this topic at the start of year 11.</p> <p>Students will return to this topic at the end of year 11 as part of the revision process for their terminal exams.</p>	
Waves, magnetism and electromagnetism.	From KS3 students will have an understanding of how waves transfer energy and the basic properties of light and sound waves. Student will also have a basic understanding of magnetism and attractive and repulsive forces.		<p>P6 – Waves. In this topic students will build on their basic understanding of waves and learn about the differences between transverse and longitudinal and wave properties. All students will also be introduced to the concept of the Electromagnetic spectrum and the properties and uses of the different types of EM waves. Separate science students will also learn about reflection and refraction, sound waves and the ear, applications of waves for detection and exploration, lenses and visible light and black body radiation.</p>	

				<p>Working Scientifically: Students will carry out an investigation to measure the frequency, wavelength and speed of waves in a ripple tank and in a solid. They will also carry out an investigation to determine how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. Separate science students will also investigate the reflection and refraction of light by different substances.</p> <p>P7 – Magnetism and electromagnetism. In this topic students will initially build upon their understanding of magnetism from KS3 and then be introduced to the differences between permanent and induced magnets, and magnetic fields. Students will then learn about electromagnetism and the motor effect.</p> <p>Students completing the separate science course will then learn about the generator effect, loudspeakers and microphones and transformers.</p>
	Earth in space	From KS3 students will have an understanding of our solar system and earths place in it.		<p>P8 – Space physics. This topic is for students completing the separate science course only. In this topic students will learn about the stability of orbital motions and satellites, the life cycle of a star and how red-shift provides evidence for the big bang theory of the start of the universe.</p>
Assessment	<p>There are many formative assessment opportunities to assess understanding of learning and to inform future planning. Teacher feedback will be given on a task at least once per half term. End of topic assessments are used to assess understanding, these will be mark by their teacher. Other feedback tools can be used for formative assessments e.g. peer feedback.</p> <p>Each year group will have 1 formal test per year (which consists of a full past exam paper).</p>			
Feedback	<p>Verbal feedback is recognised as having the greatest impact on student progress and will be at the core of our everyday teaching in Science at all key stages. Students will usually receive immediate verbal feedback on their contributions, ideas and questions in class. Verbal feedback is often given <i>whilst</i> students are completing tasks, students will usually act on this feedback and improve their work immediately, therefore there is no need for it to be recorded. Students may also receive immediate verbal feedback on their performance on short formative tasks such as mini-quizzes. Verbal feedback can be given on an individual, small group or whole-class basis.</p>			

Other in-lesson feedback. In science, students will receive feedback on short activities/tasks/quizzes/their Extended Learning (homework) frequently from lesson to lesson. Frequent use will be made of self- or peer- marking as an efficient method of students receiving immediate feedback and improving their work/knowledge/understanding.

Teacher feedback on specific tasks. Students will be provided with feedback from their teacher on their performance on specific tasks. This feedback could take many forms, again including (but not limited to) this list. This feedback will always provide guidance on how students' work, knowledge or understanding can be improved and/or what students need to do next to make more progress. This feedback may also identify strengths/weaknesses in students' work, if appropriate to the task.

Y10 and Y11

Teacher feedback will be given on a specific task at least once task per half term in *each* of Biology, Chemistry and Physics; this will usually include/consist of past exam questions on topics studied.

Student responses. Students are expected to act on all feedback. DIRT (Dedicated Improvement and Reflection Time) may be given in lessons for students to improve/correct/re-attempt their work or to complete tasks set in response to their identified areas of need. It should be clear that students' work, knowledge or understanding has improved as a result of the feedback given. Automatic feedback on Teams will also be used to ensure that students receive effective and timely feedback.

Teacher feedback on tests/exams. Students will be provided with detailed feedback on formal tests, end of year exams and mock exams. This feedback could take many forms, including (but not limited to):

- a) marking and annotations on test papers
 - b) written feedback addressed to individuals, small groups or on a whole-class basis
 - c) verbal feedback addressed to individuals, small groups or on a whole-class basis
 - d) re-teaching of specific science content, in response to areas of need identified during the marking process
 - e) use of markschemes or other written resources (e.g. model answers) which provide feedback on how to improve specific answers and/or describe common mistakes/misconceptions
 - f) feedback grids to identify areas of strength and weakness and/or guide students to reflect on their performance
- Test feedback in science will always (i) identify (or allow students themselves to identify) areas of strength and weakness, and (ii) provide guidance on how students' exam responses can be improved and/or what students need to do next to improve their exam responses/performance in the future.

Homework

Frequency: Homework tasks will be set on a weekly basis. Students are encouraged if they find a task challenging to seek support from their teacher.

Types of tasks:

- Reinforce and extend learning in class e.g. to practise examination questions.
- Research in preparation for future tasks e.g. research properties of chemical elements, the applications and implications of using stem cells.
- Embed key subject content in long term memory, e.g. the formulae for calculations.

	<ul style="list-style-type: none">▪ Practise and develop skills e.g. review and annotation of class notes, graph plotting, identifying patterns, drawing conclusions, answering past exam questions.▪ Extension of learning from the lesson e.g. comprehension questions related to key learning.▪ Review learning by producing mind maps, revision cards etc.▪ Learning and revision for class tests and examinations.▪ Improvement and use of DIRT time to improve or develop set tasks.▪ Wider/topical reading & summarise - around the subject.
How can I support my child at home?	<ul style="list-style-type: none">▪ Asking them about what they are learning▪ Helping them with homework tasks, especially quizzing them during revision homeworks.▪ Encourage them to watch the news and discuss real-life examples related to the content covered in lessons.▪ Encourage them to watch videos on Oak National Academy if they are unsure about a topic▪ CGP revision resources that can be purchased from the department