

Science KS5 Department 2023-2024

	YEAR 12 Biology	YEAR 12 Chemistry	YEAR 12 Physics	YEAR 12 Applied	YEAR 13 Biology	YEAR 13 Chemistry	YEAR 13 Physics	YEAR 13 Applied
TERM 1	<p>Biology key concepts 1 Students develop their understanding of the structure of animal, plant and bacterial cells.</p> <p>Biology Key concepts 2 Students learn that metabolic processes are catalysed by enzymes and the importance of their structure in different environmental conditions</p>	<p>Atoms ions and compounds Students learn about atomic structures, isotope formation, how to calculate relative atomic mass and deduce chemical formulae</p> <p>Amount of substance Students learn about molar calculations and how to deduce moles of substance</p>	<p>Motion Students study motion with uniform acceleration, including free-fall, and utilize graphing techniques to display and interpret data.</p> <p>Electricity: charge and current Students learn about the essentials of electric current and charge within electrical</p>	<p>Unit 1 (examined) Science fundamentals LO1: Understand the chemical structures of elements and compounds LO3: Understand cell organisation and structures LO4: Understand the principles of carbon</p>	<p>Neural communication Students learn about how electrical systems are used to monitor and respond to any deviation from the body's steady state, including action potentials and transmission between neurons at synapses</p> <p>Patterns of inheritance and variation</p>	<p>Acids, Bases, Ph and Buffers Students learn how to recognise Bonsted- Lowry acids as well as learning how to calculate pH for strong acids, weak acids and strong bases. This then leads on to Buffer solutions and understanding how they are used in the body.</p> <p>Carbonyls and carboxylic acids In this topic students look at the properties</p>	<p>Thermal physics – continued from year 12. Students learn about the thermal equilibrium for 2 bodies in contact and study the absolute scale of temperature. Leading onto the kinetic model for all states and Brownian motion in terms of the kinetic model of matter.</p> <p>Oscillations Students learn about the nature</p>	<p>Unit 2 (examined) Laboratory techniques LO2: Be able to separate, identify and quantify the amount of substances present in a mixture LO1: Understand the importance of health and safety and quality systems to industry</p>

		<p>reacted from equations</p> <p>Electrons and Bonding Students learn about electron structure and how this relates to ionic and covalent bonds</p> <p>Shapes of molecules and intermolecular forces Students learn about the shapes of molecules and ions, electronegativity and polarity and intermolecular forces between molecules</p>	<p>circuits. Students also consider the mechanisms by which conductors, semiconductors and electrolytes conduct.</p> <p>Introduction to physics Student begin looking at scientific skills and the nature of quantities. This allows them to develop techniques needed to investigate physical quantities.</p> <p>Nature of quantities Students learn about the nature and calculations of scalar and velocity</p>	chemistry	<p>Students learn how genetic and environmental factors contribute to variation within a population. Further developing their understanding of natural selection. Students also learn about artificial selection that humans can use to produce similar changes in plants and animals.</p>	<p>and reactions of the carbonyl groups and their derivatives.</p>	<p>of oscillations for both free and forced vibrations. Looking at the techniques and procedures for the simple harmonic oscillator as well as the velocity during harmonic motion.</p> <p>Gravitational fields Students learn about the nature of gravitational fields and how the field strength and gravitational potential change with a distance from a point mass.</p>	
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			<p>quantities, including the resolving of a vector into its perpendicular components.</p> <p>Electricity: energy, power and resistance</p> <p>Students learn about how potential difference and electromotive force are different in terms of the energy transfers involved in a circuit. Students also learn how to calculate the resistivity of a property of a material.</p>					
	YEAR 12	YEAR 12	YEAR 12 Physics	YEAR 12	YEAR 13 Biology	YEAR 13 Chemistry	YEAR 13 Physics	YEAR 13

	Biology	Chemistry		Applied				Applied
TERM 2	<p>Nucleic acids Students learn about the structure of DNA in more detail and how DNA replicates.</p> <p>Enzymes Students develop their understanding of enzymes, their importance and the factors that limit their use. This is also linked to specific biological systems</p> <p>Cell membranes Students learn about the structure of the cell membrane and the</p>	<p>Acids and Redox reactions Students learn about Acids, Bases and neutralisation; how to carry out titrations and redox reactions.</p> <p>Organic Chemistry- Basic concepts of organic chemistry Students learn about organic chemistry, nomenclature of organic substances, how to represent organic compounds and Isomerisation</p> <p>Alkanes Students learn</p>	<p>Forces in action Students look more in depth at the relationship between mass and weight and the techniques and procedures used to determine the terminal velocity of a body falling in a variety of fluids.</p> <p>Completion of Electricity unit</p> <p>Electrical circuits Students develop their understanding of the circuits involving series and parallel arrangements of components, looking in</p>	<p>Unit 1 (examined) Science fundamentals LO4: Understand the principles of carbon chemistry</p> <p>Unit 6 (coursework) Control of hazards in the laboratory LO1: Understand the types of hazard in the laboratory LO2: Use health and safety procedures to minimise the risk of hazards in the</p>	<p>Biology Hormonal communication Students learn about how specific hormones bring about an effect. Students learn more about how the kidneys and liver remove toxic products from metabolism as well as diabetes as a defect in hormone communication</p> <p>Homeostasis Students further develop their understanding of animal responses involving nervous, hormonal and</p>	<p>Enthalpy and Entropy This topic builds on from the year 12 enthalpy topic with more complex examples and learning why some reactions happen and others do not.</p> <p>Amines, amino acids and polymers Students look at the chemical properties of amine groups. This develops on to the properties of amino acids and the concept of stereoisomerism. The topic ends with polymerisation.</p> <p>Organic synthesis</p>	<p>Astrophysics and cosmology Students learn the current ideas about astrophysics and cosmology, including the question: what are dark matter and dark energy?</p> <p>Mock exam for Modules 1, 2, 3, 5</p> <p>Electric fields Students learn why electric fields exist, how they exert forces on charged particles and how their characteristics compare with gravitational fields.</p> <p>Nuclear and particle physics</p>	<p>Unit 2 (examined) Laboratory techniques LO3: Be able to determine the concentration of an acid or base using titration LO6: Be able to use aseptic technique</p> <p>Mock exam for Unit 2</p>

	<p>importance of the components that build them. Students also develop their understanding of transport across cell membranes.</p> <p>Cellular division and organisation Students further their understanding of mitosis, meiosis, stem cells and how these cells build into tissues and organs.</p>	<p>about the properties of alkanes and are introduced to alkane reaction mechanisms</p> <p>Periodicity Students learn about trends in the periodic table and ionisation energies of common elements</p> <p>Reactivity trends Students learn about group 2 metals, the halogens and quantitative analysis</p>	<p>particular at Kirchoff's laws. Students also learn how to determine the potential divider, or potentiometer arrangement can be used to share the potential difference across a cell.</p>	<p>laboratory</p>	<p>muscular coordination and learn how plants use hormones to respond to environmental changes.</p> <p>Manipulating genomes Students learn how manipulating genomes can provide many benefits such as the treatment of disease, as well as DNA profiling in forensics and determination of a risk of a certain disease. Ethics are also discussed within this section of the implications of using genetic techniques.</p>	<p>This topic collates the organic reactions learnt in year 12 and 13 so that multi step synthetic routes can constructed.</p> <p>Redox and Electrode potentials. Students learn how to write redox equations and use these equations to make predictions and interpretations of reactions. They then apply this knowledge to redox titrations. Students then learn how to set up, and measure cell potentials and apply this understanding to explain how fuel cells and batteries work.</p>	<p>Students learn about the developments in nuclear and particle physics, the laws that govern the behaviour of radioactive decay and the uses of society of radioactive dating, nuclear fission and nuclear fusion.</p>	
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					Cloning and biotechnology Students learn how farmers exploit natural vegetative propagation in the production of uniform crops, as well as the role of scientists in the production of artificial plant and animal clones. Students also learn how microorganisms are used in biotechnology to produce food, drugs and other products.			
	YEAR 12 Biology	YEAR 12 Chemistry	YEAR 12 Physics	YEAR 12 Applied	YEAR 13 Biology	YEAR 13 Chemistry	YEAR 13 Physics	YEAR 13 Applied

TERM 3	<p>Exchange surfaces and breathing Students further develop their knowledge on specialised exchange surfaces in humans, fish and insects. Looking at the importance of Fick's Law.</p> <p>Transport in animals Students learn about the differences in open and closed circulatory systems, including the structure of the mammalian heart. Students also learn about the structure and function of</p>	<p>Alkenes Students learn about the properties of alkenes and how these relate to their chemical reactions</p> <p>Alcohols Students learn about the properties of Alcohols and their reactions</p> <p>Haloalkanes Students learn about the chemistry of haloalkanes and the impact of organohalogen compounds on the environment</p> <p>Enthalpy Students learn about enthalpy changes during</p>	<p>Work, energy and power Students learn about the principal of conservation of energy for a variety of energy transfers. Students also look into the qualitative and quantitative exchange between kinetic and gravitational potential energies.</p> <p>Materials Students develop their understanding of Hook's Law, stress, strain and ultimate tensile strength. They are then introduced to the Young</p>	<p>Unit 1 (examined) Science fundamentals LO5: Understand the importance of inorganic chemistry in living systems</p> <p>Unit 6 (coursework) Control of hazards in the laboratory LO3: Design a safe functioning laboratory to manage the risk presented by hazards</p> <p>Mock exam for Unit 1</p>	<p>Transport in animals Students learn about the differences in open and closed circulatory systems, including the structure of the mammalian heart. Students also learn about the structure and function of blood vessels, transport mediums and the transport of oxygen and carbon dioxide.</p> <p>Classification and evolution Students learn about how the classification system developed through history,</p>	<p>Complete redox and electrode potentials as above.</p> <p>Transition Elements. Students learn about the physical and chemical properties of elements in the D block including how iron is used within haemoglobin to transport oxygen. This topic includes qualitative analysis work.</p> <p>Chromatography and Spectroscopy In this topic students learn about different techniques that can be used to check the purity and structure of organic molecules.</p>	<p>Capacitors Students learn techniques and procedures used to investigate capacitors in series and parallel circuits, the uses of capacitors as an energy storage device and how to complete exponential graphs for the charging and discharging of a capacitor and their constant-ratio property.</p> <p>Medical imaging Students will learn about the physics behind the variety of medical imaging techniques, how each one works and why each method has proved to be</p>	<p>Unit 2 exam Laboratory techniques</p> <p>Unit 6 (coursework) Control of hazards in the laboratory Current year 13 to complete (2023)</p> <p>Unit 21 (coursework) Product testing techniques LO1: Understand the influence of regulatory bodies on development of consumer products</p> <p>LO2: Understand how product testing determines the development of consumer products</p>

	<p>blood vessels, transport mediums and the transport of oxygen and carbon dioxide.</p> <p>Classification and evolution Students learn about how the classification system developed through history, including how new technology has improved how species are classified. Students also further develop their understanding of evolution and the importance of genetic variety for survival.</p>	<p>chemical reactions and how these can be calculated from bond enthalpies; Hess' law and enthalpy cycles</p>	<p>modulus.</p> <p>Waves Students develop their understanding of longitudinal and transverse waves, in particular electromagnetic waves and light. Students are introduced to how standing or stationary waves set up on strings or an air column.</p>		<p>including how new technology has improved how species are classified. Students also further develop their understanding of evolution and the importance of genetic variety for survival.</p> <p>Biodiversity Students learn about the importance of biodiversity, how to sample an ecosystem and calculate its biodiversity. Students also learn about the ecological, economic and aesthetic reasons for biodiversity,</p>	<p>Students learn how to interpret NMR spectra.</p>	<p>useful.</p> <p>Electromagnetism Students will learn about magnetic field patterns for a long straight current-carrying conductor, a flat coil and a solenoid. In addition to the forces acting on a charged particle in magnetic and electric fields. Including how a velocity selector in a mass spectrometer works.</p>	
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	Biodiversity Students learn about the importance of biodiversity, how to sample an ecosystem and calculate its biodiversity. Students also learn about the ecological, economic and aesthetic reasons for biodiversity, e.g., developing medicines, as well as the positive and negative impacts humans have.				e.g., developing medicines, as well as the positive and negative impacts humans have.			
	YEAR 12 Biology	YEAR 12 Chemistry	YEAR 12 Physics	YEAR 12 Applied	YEAR 13 Biology	YEAR 13 Chemistry	YEAR 13 Physics	YEAR 13 Applied
	Transport in plants Students learn	Organic Synthesis Students learn	Quantum Physics	Unit 1 (examined) Science	Teaching modules complete and	Teaching modules complete and	Teaching modules complete and	Unit 21 (coursework) Product testing

<p>TERM 4</p>	<p>about the transport systems in dicotyledonous plants, in particular the movement of water through a plant via transpiration. Students also further develop their understanding of translocation and plant adaptations.</p> <p>Communicable diseases Students further their understanding of pathogens and explore the differences between the non-specific and specific immune responses.</p>	<p>about practical techniques in organic chemistry and synthetic routes for synthesising compounds</p> <p>Spectroscopy Students learn about mass spectroscopy and how to deduce structure using data from infrared spectroscopy</p> <p>Periodic table and energy - Reactions, rates and equilibrium Students also learn about controlling the position of equilibrium during a reaction.</p> <p>Revision and mock exams</p>	<p>Students learn about what quantum physics means and how to use Planck equation, and the understanding of wave particle duality through photoelectric effect.</p> <p>Continuation of waves topic.</p> <p>Revision and mock exams</p>	<p>fundamentals LO2: Understand reactions in chemical and biological systems</p> <p>LO6: Understand the structures, properties and uses of materials</p>	<p>consolidated then students placed onto a targeted and bespoke revision rota to prepare them for mock exams</p>	<p>consolidated then students placed onto a targeted and bespoke revision rota to prepare them for mock exams</p>	<p>consolidated then students placed onto a targeted and bespoke revision rota to prepare them for mock exams</p>	<p>techniques LO3: Be able to use quantitative titration techniques on consumer products LO4: Be able to use extraction and separation techniques on consumer products</p>
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	Students also learn about how plants defend against pathogens and how medicines are developed. Revision and mock exams							
	YEAR 12 Biology	YEAR 12 Chemistry	YEAR 12 Physics	YEAR 12 Applied	YEAR 13 Biology	YEAR 13 Chemistry	YEAR 13 Physics	YEAR 13 Applied
TERM 5	Genetics of living organisms Students learn how the genetic control of metabolic reactions determines an organism's growth, development and function. Including the effect of gene mutation on	Aromatic Chemistry Students learn about the molecule benzene and how electrophilic substitution occurs as well as learning about the structural properties of the molecule phenol Rates of Reaction Students learn	Thermal physics Students learn about the thermal equilibrium for 2 bodies in contact and study the absolute scale of temperature. Leading onto the kinetic model for all states and Brownian motion in terms of the kinetic model of	Revision and Unit 1 exam Unit 2 (examined) Laboratory techniques LO4: Be able to examine and record features of biological samples LO5: Be able to identify cations and anions in				Unit 1 and Unit 2 retakes as necessary

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	protein function.	about orders, rate equations and rate constants and how factors, such as concentration, can influence the progress of a reaction.	matter. Continues into year 13. Circular motion Students study the period and frequency for an object in circular motion and develop their understanding of the relationship between centripetal force and centripetal acceleration.	samples				
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