



SUNNYDOWN SCHOOL

SCIENCE CURRICULUM PLAN

Subject	Science	Year group	Y11
Subject Intent	<p>In Y11, students will continue to develop their scientific knowledge and skills for Combined Science Trilogy. They will study through working scientifically, a series of practicals, and a focus on literacy and communication in order to cultivate confidence in expressing their understanding of the three disciplines biology, chemistry and physics. <i>Students benefit from an exceptionally broad curriculum that promotes the development of inclusive learning opportunities, differentiated to meet the needs of all students.</i></p> <p>In Y11 Biology, the broader theme of 'Biological responses' is subdivided into: 'Homeostasis', 'The human nervous system', and 'Hormonal coordination'. The theme of 'Genetics and reproduction' includes 'Reproduction', 'Variation and evolution', and 'Genetics and evolution'. The theme of 'Ecology' includes 'Adaptations, interdependence, and competition', 'Organising an ecosystem', and 'Biodiversity and ecosystems'.</p> <p>In Chemistry: the broader theme of 'Rates, equilibrium, and organic chemistry' is subdivided into 'Rates and equilibrium' and 'Crude oil and fuels'. The theme of 'Analysis and the Earth's resources' includes 'The Earth's atmosphere', 'The Earth's resources', and 'Chemical analysis'.</p> <p>In Physics: the wider theme of 'Forces in action' is subdivided into 'Forces in balance', 'Motion' and 'Force and motion'. The theme of 'Waves and electromagnetism' is studied by 'Wave properties', 'Electromagnetic waves', and "Electromagnetism,</p>		

Term	Topic	Core learning	Key concepts	Sequencing
Autumn 1	<p>Unit: Rates, equilibrium and Organic chemistry</p> <p>1. Rates and equilibrium</p>	<p>Students will learn about the factors that affect the rate of a reaction such as temperature, surface area, concentration, pressure and catalyst. They have to be able to explain the effect of these factors on the rate of reaction using collision theory.</p> <p>Students will also learn about reversible reactions and dynamic</p>	<p>Surface area catalyst collision theory activation energy reversible reaction closed system equilibrium Le Châtelier's Principle</p>	<p>Building on..... At KS3, students learnt about: the properties of the states of matter with regard to the particle model, and gas pressure. In Y10 students learned about endothermic and exothermic reactions, and the effect of different factors, including catalysts on activation energy</p>

	<p>Unit: Rates, equilibrium and Organic chemistry</p> <p>2. Organic chemistry Crude oil and fuels</p>	<p>equilibrium and apply their knowledge on endo- and exothermic reactions to predict the effect of temperature changes on the reversible reactions and the position of the equilibrium. * Higher Tier students will use Le Châtelier's principle to explain the effect of temperature and pressure on the position of the equilibrium.</p> <p>Students will learn about the different types of hydrocarbons, alkanes and alkenes in particular, and the reactions of hydrocarbons, including combustion (both complete and incomplete) and cracking, the conditions and word and symbol equations for the above processes.</p> <p>Students will also learn about crude oil and the principle and the industrial scale of the process of fractional distillation. They should be able to describe the effect of the size of the hydrocarbon molecules on their properties, including viscosity, boiling point, and flammability.</p>	<p>hydrocarbon alkane alkene cracking distillation fractional distillation fractionating column general formula structural formula displayed formula (un)saturated thermal decomposition flammability viscosity</p>	<p>Building towards... In C11 The Earth's atmosphere, students will learn about the importance of reducing atmospheric pollution caused by complete and incomplete combustion of fossil fuels. In A Level Chemistry students will do experiments and calculations to find out how rates of reactions depend on the concentration; they will also use equilibrium constants for calculations.</p> <p>Building on... At KS3 students learnt about: mixtures and simple separation techniques such as filtration, evaporation and distillation, about some combustion and thermal decomposition reactions. In Year 10 students learnt about different types of covalent bonding.</p> <p>Building towards... In C12 Students will learn about depleting the Earth's reserves of non-renewable resources. C13 they will study the pollutants from burning fossil fuels and their effects. In A Level Chemistry, about the reactions of alkanes with halogens and why they cannot occur in darkness.</p> <p>Building on... At KS3 students learnt that: The unit of force is newton (N) and how to measure a force using a newton-meter; An object is in equilibrium when the forces</p>
	<p>Unit: Forces in action</p>	<p>Students will learn about contact and non-contact forces and compare vectors and scalars by using the examples of distance and displacement. Students will learn about the application</p>	<p>scalar vector distance displacement contact/non-contact force</p>	

	1. Forces in balance	of Newton's first law of motion; balanced and unbalanced forces, resultant force and how to determine the centre of mass of an object experimentally. *Higher Tier students will analyse the forces acting on an object using a parallelogram of forces to determine the resultant force.	balanced/unbalanced force resultant force magnitude direction Newton's first law Newton's third law	acting on it are balanced. Building towards... Students will learn about forces and acceleration, and Newton's second law.
Autumn 2	2. Motion	Students will represent motion using distance-time graphs and use the gradient to determine the speed of an object; will define acceleration in terms of changes in velocity and investigate acceleration caused by an unbalanced force on ramp; they will calculate acceleration from the gradient on a velocity-time graph, calculate the distance travelled from a graph; students will apply these techniques to analyse a range of graphs. *Higher Tier students will learn in depth about circular motion; use the tangent of a line on a distance-time graph to determine speed.	speed velocity distance displacement distance-time graph velocity-time graph gradient tangent acceleration deceleration	Building on..... In Y7 students learnt about speed and its units and how to calculate speed, they also learned how to interpret simple distance-time graphs. Building towards... Students will learn about forces and acceleration later in Year 11 and in Forces and braking they will apply their knowledge of friction.
	3. Forces and motion	This topic includes: Forces and acceleration leading to Newton's second law of motion and its application; Weight and terminal velocity Forces and braking, thinking and braking distance and the effects of a range of factors on these distances Momentum	braking distance momentum elasticity extension limit of proportionality gravitational field strength, g inertia mass	Building on... In Y7 students learnt that the weight is a force due to the force of gravity on the object. This year's topic of Motion included calculating acceleration from a velocity-time graph. Students learnt about elastic potential energy stores, including the equation to calculate them, in

	<p>Unit: Biological responses</p> <p>1. The human nervous system</p>	<p>Forces and elasticity and Hooke's law * Higher Tier students will define the inertial mass of an object; derive an equation for acceleration involving the stopping distance</p> <p>Students will study the principles of homeostasis and learn about the structure and function of the human nervous system. They will learn that receptors detect a change in a stimulus and about different areas of the brain and their functions. Students should be able to describe the reflex arc and how nerve impulses are transmitted across the synapse. *Higher Tier students will learn about the treatment of brain damage; common defects of the eye and the role of new technology in the treatment of eye conditions.</p>	<p>weight Higher Tier momentum</p> <p>homeostasis receptors stimuli effectors nerves coordination centres central nervous system neurons sensory neurons motor neurons relay neurons reflex arc cerebral cortex</p>	<p>Conservation and dissipation of energy.</p> <p>Building towards... Students will further develop their physics Math skills by using inverse proportions.</p> <p>Building on... In Y10 B1 Cell structure and transport, students studied the function of different specialised cells, including nerve cells.</p> <p>Building towards... Students will apply their knowledge of the principles of homeostasis and the human nervous system in B11 Hormonal coordination.</p>
	<p>2. Hormonal coordination</p>	<p>Students will learn the principles of hormonal control and the endocrine system. They should be able to identify the main parts of the endocrine system and recall the hormones that they produce. Students should recall the blood-glucose concentration control, including the role of insulin. They should be aware of the causes and treatments of type 1 and type 2 diabetes. Students should understand how</p>	<p>endocrine system pituitary gland hormones adrenaline ADH follicle stimulating hormone luteinising hormone oestrogen testosterone glucagon insulin</p>	<p>Building on... In Y8 pupils learnt the topic of human reproduction. In Year 10, B2 Cell division students studied the role of stem cells, and in B7 Non-communicable disease, the effect of lifestyle on type 2 diabetes.</p> <p>Building towards... A Level Biology includes preparation of a dilution series a glucose solution and use of</p>

	Unit: Waves and electro-magnetism	<p>hormones are used in fertility control and contraception. *Higher Tier students should also be able to explain the role of glucagon; the process of negative feedback as applied to adrenaline and thyroxine.</p>	<p>types 1/ type 2 diabetes negative feedback ovulation menstrual cycle contraception fertility in vitro fertilisation</p>	<p>colorimetric techniques to produce a calibration curve with which to identify the concentration of glucose in an unknown 'urine' sample.</p>
	1. Wave properties	<p>In this topic the students will observe and describe the properties of mechanical and electromagnetic waves in terms of energy transfer with or without the need for a transfer medium. They will compare transverse waves and longitudinal waves by examining the relationship between the direction of propagation and the direction of the oscillations. The students will analyse wave properties such as wavelength, amplitude, and period leading to the relationships between period, frequency and wave speed, frequency, and wavelength. They will also measure the speed of sound in air and the speed of ripples on water. *Higher Tier students will investigate reflection and refraction in terms of wave fronts.</p>	<p>oscillation amplitude wavelength wave speed mechanical wave electromagnetic wave transverse wave longitudinal wave vibration echo compression rarefaction reflection refraction transmission</p>	<p>Building on... At KS3, students learnt that: The top of a water wave is called a crest and the bottom is called a trough. There are different types of waves, such as sound waves and electromagnetic waves, but they all have common properties such as refraction. Students learnt more about what an oscilloscope is used for in Electricity in the home in Y10.</p> <p>Building towards... Students will learn more about electromagnetic waves in the next topic.</p>
	2. EM waves	<p>In this topic the students will describe the electromagnetic spectrum in relation to wavelength. Students will use the wave equation to link wavelength and frequency. All parts of the EM spectrum will be</p>	<p>carrier waves charge-coupled device (CCD) contrast medium electromagnetic spectrum ionisation microwaves</p>	<p>Building on... At KS3, Y7, students learnt that light travels much faster than sound and can travel through space whereas sound cannot.</p>

		described in terms of wavelength and uses. Students will investigate the relationship between colour, temperature, and rate of emission of IR radiation. They will learn the use of radio waves in communications for television and mobile phones and transmissions of signals through optical fibres.	optical fibre radiation dose radio waves ultraviolet radiation (UV) wave speed white light Higher Tier	Building towards... A Level students will learn about refraction by a prism and the link between the speed of light and the wavelength, and therefore the light's colour.
Spring 1	Unit: Analysis and Earth's resources 1. The Earth's atmosphere	This unit includes: The volcanic activity theory of the origin of the atmosphere, students are also expected to interpret evidence concerning other theories. How the atmosphere has evolved over time, how the composition of the atmosphere has changed and how the atmosphere is being affected by human activity The effect of pollutants such as carbon monoxide, sulphur dioxide, nitrogen oxides, and particulates and the processes linked to them as global warming/dimming, acid rain, climate change.	carbon monoxide carbon dioxide sulfur dioxide nitrogen oxides Particulates Complete combustion Incomplete combustion Fossil fuels Greenhouse gases Greenhouse effect Global warming Global dimming acid rain climate change	Building on..... The KS3 knowledge about the composition of the atmosphere; the impact of carbon dioxide production on the climate. Y9 topic of climate change caused by the increasing release of greenhouse gases; The topic Crude oil and fuels was studied earlier this year. Building towards... A-level Chemistry discusses infrared spectroscopy as a way to monitor the levels of greenhouse gases in the atmosphere.
	Unit: Genetics and reproduction 1. Reproduction	Students will learn about asexual and sexual reproduction, meiosis, and a variety of genetic terms; how characteristics are inherited and expressed, how to use a Punnett square to predict ratios of different phenotypes Students should be able to describe the inheritance of genetic	sexual reproduction asexual reproduction meiosis genome proteins protein synthesis bases nucleotides gene expression	Building on... In Y10, in B2 Cell division students learnt about mitosis and the cell cycle; In B3 Organisation and the digestive system, about the protein structure and function; In B6 about the principle of vaccination, antigen and antibodies; and in B5 Communicable Diseases, about the protists life cycle

	<p>disorders and the developments in genetic engineering with the aim of curing genetic disorders; Screening for genetic disorders and the implications of using this technology.</p>	<p>mutation sex chromosomes homozygote heterozygote genotype phenotype Punnett square polydactyly cystic fibrosis Screening</p>	<p>Building towards... A Level Biology explains how different factors control the gene expression in the organism's phenotype; the applications of manipulating the gene expression.</p>
<p>2. Variation and evolution</p>	<p>This topic includes genetic and environmental variation. Evolution by natural selection contains the theory of evolution by survival of the fittest; The topic explains selective breeding as an example of artificial selection; considers the benefits and drawbacks of genetic engineering and cloning and the ethical issues and choices connected with the genetic technologies.</p>	<p>genetic variation environmental variation natural selection mutation selective breeding genetic engineering cloning tissue culture adult cell cloning ethics</p>	<p>Building on... In Y10, students learnt about the effect of alcohol on the fetus as an example of environmental variation, as well as the effect of ionising radiation causing mutations in the DNA. Earlier this year, In Reproduction they learnt about meiosis and sexual reproduction.</p> <p>Building towards.... In B15 Genetics and Evolution, students will study Darwin's theory of evolution; and in B16 students will learn about the effect of mutations and natural selection on the organism's adaptations to the environment.</p>
<p>3. Genetics and evolution</p>	<p>Students will learn Darwin's theory of natural selection, Wallace's ideas on evolution and how the current theory of speciation was established. They will study the evidence considered to support evolution, the fossils and the reasons for</p>	<p>evolution natural selection speciation extinction interbreeding fossils</p>	<p>Building on... Earlier in Y11 students studied 'Variation and evolution', the mechanism of inheritance and genetics; In Y10, B1 Cell structure and transport, they learnt the difference between prokaryotic and</p>

	<p>2. Organising an ecosystem</p>	<p>common species in a habitat.</p> <p>Students will learn how to present feeding relationships within a community by food chains and know their levels of organisation; they should understand the terms mean, mode and median and do the calculations respectively as well as plot appropriate graphs Students should recognise different material cycles through an ecosystem; explain the importance and mechanism of the carbon and water cycles.</p>	<p>quantitative sampling competition structural/behavioural/ functional adaptations extremophiles</p> <p>producers primary/secondary/ tertiary consumers predator prey condensation precipitation evaporation transpiration respiration</p>	<p>Building on... In Y7 pupils have learnt the topic of interdependence and variation, and in Y9 climate and earth resources.</p> <p>Building towards... The next ecology topic: Biodiversity and ecosystems.</p>
	<p>3. Biodiversity and ecosystems</p>	<p>Students should be able to define biodiversity as the variety of all the different organism species within an ecosystem; to explain the negative impact of human activities on reducing biodiversity including: The human population explosion Land and water pollution Air pollution Deforestation and peat destruction Global warming Students will learn about the measures taken to stop this reduction and maintain biodiversity</p>	<p>biodiversity acid rain smoke pollution smog deforestation peat bog destruction greenhouse effect global warming breeding programmes regeneration reintroduction recycling</p>	<p>Building on... Earlier this year in C11, students learnt about the Earth's atmosphere and the effect of pollutants causing global warming/dimming, acid rain and climate change.</p> <p>Building towards... The A-level topic of genetics, populations, evolution and ecosystems</p>

	<p>Unit: Analysis and Earth's resources</p> <p>3. Chemical analysis</p>	<p>In this topic, students will recall and upbuild their knowledge about the difference between pure substances and mixtures; they will learn about formulations and purity and various techniques for analysing substances, including chromatography and how to analyse a chromatogram qualitatively and quantitatively using Rf values. In addition, students should be able to describe the method of different experimental tests for gases.</p>	<p>mixture pure substance formulation chemical analysis chromatography chromatogram Rf value</p>	<p>Building on... In Y7 pupils learnt about pure substances and mixtures and some simple separation techniques, including paper chromatography. An important component in formulations are nanoparticles studied in Year 10, C3 Structure and bonding.</p> <p>Building towards... A Level Chemistry studies gas chromatography as a means of separating the substances of an unknown mixture. This includes the use of a mass spectrometer that will identify each substance by matching its mass spectrum to the corresponding one in a database.</p>
<p>Summer 1</p>	<p>Unit: Atoms, bonding and moles</p> <p>4. Chemical calculations</p>	<p>This topic includes the use of relative atomic masses to calculate relative formula masses of compounds; students will learn how to use balanced equations to work out reacting masses and how to calculate the concentration of solutions. Students should be able to use the equation number of moles = mass (g) / Ar and use moles to balance symbol equations.</p> <p>*Higher Tier students will be introduced to the concepts of oxidation and reduction in terms of losing and gaining electrons; they should be able to explain how pH relates to the concentration of H⁺ (aq) ions and the difference between strong and weak acids.</p>	<p>relative atomic mass relative formula mass mole Avogadro constant concentration</p>	<p>Building on.... the pupil's understanding of the atomic structure and subatomic particles, studied in Y10. Also, at KS3, students learnt about conservation of mass and how to represent reactions by using chemical equations. Earlier this year, students learnt C8 Rates and equilibrium.</p> <p>Building towards... The A-level course includes rate equations and reactions of ions in aqueous solutions.</p>

	<p>Unit: Waves and electro-magnetism</p> <p>3. Electro-Magnetism</p>	<p>Students will recall how to plot a magnetic field and the shape of the Earth's field. They will examine the magnetic field produced by a current and the factors that affect the direction and the strength of this magnetic field. Students will compare the field shape of a solenoid to that produced by a simple bar magnet. They will also learn about the motor effect.</p> <p>*Higher Tier students should be able to describe the principle of the motor effect and explain how this effect could be used to make an electric motor linking it to magnetic flux density of the magnetic field.</p>	<p>electromagnetic induction Fleming's left hand rule generator effect magnetic field magnetic field line magnetic flux density induced magnetism motor effect solenoid</p>	<p>Building on... At KS3 students learnt about the Earth's magnetic field and that the magnets line up with it; about electric motors and generators used to produce electricity. In Y9 they learnt about electromagnets and magnetism, and in Y10, Electricity in the home, about how alternating potential difference is displayed on the oscilloscope.</p> <p>Building towards... A-level physics includes further study of magnetic fields, electromagnetism and electromagnetic induction.</p>
<p>Summer 2</p>	<p>Revision/GCSEs</p>			