STOCKSBRIDGE HIGH SCHOOL

Strategic Five-Year Plan: Science

	Year 11 - Master	Year 10 - Secure	Year 9 - Embed	Year 8 - Develop	Year 7 - Introduce
Biology Skills Acquired	• Student have completed all required practicals for Biology by Year 11 so all skills will be revisited in the revision of all required practical components ahead of the final exam.	**RP 7 –** • AT 1 – use appropriate apparatus to record time. • AT 3 – selecting appropriate apparatus and techniques to measure the process of reaction time. • AT 4 – safe and ethical use of humans to measure physiological function of reaction time and responses to a chosen factor. ***RP 8 -*** • *AT 1 – use appropriate apparatus to record length and time.* • *AT 3 – selecting appropriate apparatus and techniques to measure the growth of shoots or roots.* • *AT 4 – safe and ethical use of plants to measure physiological function of growth in response to light or gravity.* • *AT 7 – observations of biological specimens to produce labelled scientific drawings.* **RP 9 -** • AT 1 – use appropriate apparatus to record length and area. • AT 3 – use transect lines and quadrats to measure distribution of a species. • AT 4 – safe and ethical use of organisms and response to a factor in the environment. • AT 6 – application of appropriate sampling techniques to investigate the distribution and abundance of organisms in an ecosystem via direct use in the field. • AT 8 – use of appropriate techniques in more complex contexts including continuous sampling in an investigation. ***RP 10 -*** • *AT 1 – use appropriate apparatus to record temperature and pH.*	**RP1 –** • AT 1 – use appropriate apparatus to record length and area. • AT 7 – use a microscope to make observations of biological specimens and produce labelled scientific drawings. ***RP2 –*** • *AT 1 – use appropriate apparatus to record length and area.* • *AT 3 – use appropriate apparatus and techniques to observe and measure the process of bacterial growth.* • *AT 4 – safe and ethical use of bacteria to measure physiological function and response to antibiotics and antiseptics in the environment.* • *AT 8 – the use of appropriate techniques and qualitative reagents in problem-solving contexts to find the best antibiotic to use or the best concentration of antiseptic to use.* **RP3 -** • AT 1 – use appropriate apparatus to record mass and time. • AT 3 – use appropriate apparatus and techniques to observe and measure the process of osmosis. • AT 5 – measure the rate of osmosis by water uptake. **RP4 –** • AT 2 – safe use of a Bunsen burner and a boiling water bath. • AT 8 – use of qualitative reagents to identify biological molecules. **RP5 –** • AT 1 – use appropriate apparatus to record the volumes of liquids, time and pH. • AT 2 – safe use of a water bath or electric heater.	**Across Years 7 and 8, students are introduced to, and will develop the following key skills that are fundamental to being a successful Scientist:** **1. Construct and carry out a scientific method** a. Methods written should be impersonal and in the present tense. b. They should be written as a numbered bullet-pointed list **2. Identify independent, dependent & control variables** a. Students should be able to independently recognise these in experiments b. They should also be able to discuss the importance of control variables **3. Produce a graph to present data** a. Students can select the most appropriate graph to present data b. It should contain fully labelled axes with appropriate scales c. Draw lines of best fit, including straight lines and curves **4. Draw conclusions and apply findings to everyday life** a. Conclusions should be justified with exemplar data Students will also develop other skills across other experiments they complete, but the above are highlighted in the curriculum and will be specifically developed in selected experiments at set intervals throughout the academic year,	

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		• *AT 3 – the use of appropriate apparatus to measure anaerobic decay.*
		• *AT 4 – safe use of microorganisms.*
		• *AT 5 – measurement of rate of decay by pH change.*
			• AT 5 – measure the rate of reaction by the colour change of iodine indicator.
			• AT 8 – use of qualitative iodine reagent to identify starch by continuous sampling
				When skills are covered: (Number matches up to the skills shown above)
				• Half Term I
				  ○ Energy from food - 2
					When skills are covered: (Number matches up to the skills shown above)
					• Half Term 1
					  ○ Microscopes – 1
					• Half Term 2
					  ○ Food tests - 4

Chemistry Skills Acquired	**RP 6 –**
	• AT 1 – use of appropriate apparatus to make and record a range of measurements accurately
	• AT 4 – safe use of a range of equipment to purify and/or separate chemical mixtures including chromatography.
	
	RP 7 –
	• *AT 2 – safe use of a Bunsen burner.*
	• *AT 8 – use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products including gas tests, flame tests, precipitation reactions.*
		RP 4 –
		• AT 1 – use of appropriate apparatus to make and record a range of measurements accurately, including mass, temperature, and volume of liquids.
		• AT 3 – use of appropriate apparatus and techniques for conducting and monitoring chemical reactions.
		• AT 5 – making and recording of appropriate observations during chemical reactions including changes in temperature.
		• AT 6 – safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes.
		RP 5 –
		• AT 1 – use of appropriate apparatus to make and record a range of measurements accurately, including mass, time, temperature, and volume of liquids and gases.
		• AT 3 – use of appropriate apparatus and techniques for conducting and monitoring chemical reactions.
		• AT 5 – making and recording of appropriate observations during chemical reactions including the measurement of rates of
			• AT 2 – safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater.
			• AT 3 – use of appropriate apparatus and techniques for conducting chemical reactions, including appropriate reagents.
			• AT 4 – safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, filtration, crystallisation.
			• AT 6 – safe use and careful handling of liquids and solids, including careful mixing of reagents under controlled conditions.
			RP 2 –
			• *AT 1 – use of appropriate apparatus to make and record a range of measurements accurately, including volume of liquids.*
			• *AT 8 – the determination of concentrations of strong acids and strong alkalis.*
			RP 3 –
			• AT 3 – use of appropriate apparatus and techniques for conducting and monitoring chemical reactions.
			• AT 7 – use of appropriate apparatus and techniques to draw, set up and use
				Across Years 7 and 8, students are introduced to, and will develop the following key skills that are fundamental to being a successful Scientist:
				
				• **Construct and carry out a scientific method**
				  ○ Methods written should be impersonal and in the present tense.
				  ○ They should be written as a numbered bullet-pointed list
				
				• **Identify independent, dependent & control variables**
				  ○ Students should be able to independently recognise these in experiments
				  ○ They should also be able to discuss the importance of control variables
				
				• **Produce a graph to present data**
				  ○ Students can select the most appropriate graph to present data
				  ○ It should contain fully labelled axes with appropriate scales
				  ○ Draw lines of best fit, including straight lines and curves
				
				• **Draw conclusions and apply findings to everyday life**
				  ○ Conclusions should be justified with exemplar data
				
				Students will also develop other skills across other experiments they complete, but the above are highlighted in the curriculum and will be specifically developed in selected experiments at set intervals throughout the academic year,	

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		reaction by a variety of methods such as production of gas and colour change. • AT 6 – safe use and careful handling of gases, liquids and solids, including careful mixing of reagents under controlled conditions, using appropriate apparatus to explore chemical changes. **RP 8 –** • AT 2 – safe use of appropriate heating devices and techniques including use of a Bunsen burner and a water bath or electric heater. • AT 3 – use of appropriate apparatus and techniques for the measurement of pH in different situations. • AT 4 – safe use of a range of equipment to purify and/or separate chemical mixtures including evaporation, distillation.	electrochemical cells for separation and production of elements and compounds. • AT 8 – use of appropriate qualitative reagents and techniques to analyse and identify unknown samples or products including gas tests for hydrogen, oxygen and chlorine.	**When skills are covered: (Number matches up to the skills shown above)** • Half Term 1 o Making an indicator – 1 • Half Term 3 o Displacement – 4 • Half Term 4 o Iron nail investigation - 1	**When skills are covered: (Number matches up to the skills shown above)** • Half Term 1 o Heating water – 1, 3

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Physics Skills Acquired	**RP 8 –** • AT 4 – make observations of waves in fluids and solids to identify the suitability of apparatus to measure speed, frequency and wavelength. ***RP 9 –*** • *AT 4 – make observations of the effects of the interaction of electromagnetic waves (light) with matter.* • *AT 8 – make observations of waves in fluids and solids to identify the suitability of apparatus to measure the effects of the interaction of waves with matter* **RP 10 –** • AT 1 – use appropriate apparatus to make and record temperature accurately. • AT 4 – make observations of the effects of the interaction of electromagnetic waves with matter	**RP 3 –** • AT 1 – use appropriate apparatus to measure and record length accurately. • AT 6 – use appropriate apparatus to measure current, potential difference and resistance. • AT 7 – use circuit diagrams to construct and check series and parallel circuits. **RP 4 –** • AT 6 – use appropriate apparatus to measure current and potential difference and to explore the characteristics of a variety of circuit elements. • AT 7 – use circuit diagrams to construct and check series and parallel circuits including a variety of common circuit elements. **RP 6 –** • AT 1 – use appropriate apparatus to make and record length accurately. • AT 2 – use appropriate apparatus to measure and observe the effect of force on the extension of springs and collect the data required to plot a force-extension graph. **RP 7 –** • AT 1 – use appropriate apparatus to make and record measurements of length, mass and time accurately. • AT 2 – use appropriate apparatus to measure and observe the effect of force. • AT 3 – use appropriate apparatus and techniques for measuring motion, including determination of speed and rate of change of speed (acceleration/deceleration).	**RP 5 –** • AT 1 – use appropriate apparatus to make and record measurements of length, area, mass and volume accurately. Use such measurements to determine the density of solid objects and liquids. **RP 1 –** • AT 1 – use appropriate apparatus to make and record measurements of mass, time and temperature accurately. AT 5 – use, in a safe manner, appropriate apparatus to measure energy changes/transfers and associated values such as work done. ***RP 2 –*** • *AT 1 – use appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, volume and temperature.* • *AT 5 – use, in a safe manner, appropriate apparatus to measure energy changes/transfers*	**Across Years 7 and 8, students are introduced to, and will develop the following key skills that are fundamental to being a successful Scientist:** • **Construct and carry out a scientific method** o Methods written should be impersonal and in the present tense. o They should be written as a numbered bullet-pointed list • **Identify independent, dependent & control variables** o Students should be able to independently recognise these in experiments o They should also be able to discuss the importance of control variables • **Produce a graph to present data** o Students can select the most appropriate graph to present data o It should contain fully labelled axes with appropriate scales o Draw lines of best fit, including straight lines and curves • **Draw conclusions and apply findings to everyday life** o Conclusions should be justified with exemplar data Students will also develop other skills across other experiments they complete, but the above are highlighted in the curriculum and will be specifically developed in selected experiments at set intervals throughout the academic year,	
				When skills are covered: (Number matches up to the skills shown above) • Half Term 4 o Insulation practical – 3	**When skills are covered: (Number matches up to the skills shown above)** • Half Term 4 o Hooke's Law – 3 • Half Term 6 • Making & testing electromagnets - 2

Biology Knowledge					
	Ecology (B7) • Adaptations, interdependence and competition • Organisation of an ecosystem – SEP contained • Biodiversity and the effect of human interaction on ecosystems • *Trophic levels in an ecosystem* • *Food production* **Once students have completed the course, they will revise content from Year 9 in order to prepare for their February Mock Exams and then for external exams in May.**	**Organisation (B2)** • Principles of organisation • Animal tissue, organs and organ systems • Plant tissues, organs and systems **Homeostasis (B5)** • Homeostasis • The human nervous system – *SEP contained* • Hormonal coordination in humans – *SEP contained* • *Plant hormones* **Genetics and Evolution B6** • Reproduction – SEP contained • Variation and evolution – Sep contained • The development and understanding of genetics and evolution – SEP contained Classification of living organisms	**Respiration and gas exchange** • Embed key knowledge about the structure and function of gas exchange system in humans • Embed the mechanism of breathing linking to gas exchange • Embed the impact of exercise, asthma and smoking on gas exchange • Embed the role of gas exchange in plants **Cell Biology (B1)** • Cell structure • Cell division • Transport in cells **Bioenergetics (B4)** • Photosynthesis • Respiration **Infection and response (B3)** • Communicable diseases • *Monoclonal antibodies* • *Plant disease*	**Nutrition and Digestion, photosynthesis, and Gas exchange** • Develop understanding of the problems linked to an unbalanced diet • Develop understanding how leaves are adapted to make food for plants • Develop the process of respiration in humans and microorganisms **Health and drugs** • Embed the effects of recreational drugs on behaviour, health and life process **Relationships in an ecosystem** • Develop understanding of how organisms rely on each other in an ecosystem • Develop and link ideas about reproduction to human food production • Develop understanding that organisms are affected by their environment - C **Genetics and Evolution** • Introduce and develop the understand of inheritance, DNA and genes • Introduce and develop the difference between species and how this can be caused	**Cells and organisation** • Introduce that cells are the fundamental units of living organisms **Nutrition and Digestion** • Introduce the importance of a healthy diet and the role different nutrients have in plants and animals • Introduce the role of diffusion in the movement of materials in cells **Reproduction** • Introduce the process of reproduction in plants and animals **Respiration and Photosynthesis** • Introduce the meaning of respiration and the difference between aerobic and anaerobic respiration • Introduce the importance of photosynthesis and its link to plants and the atmosphere **Gas Exchange** • Introduce the structure and functions of the gas exchange system in humans **Skeletal and Muscular Systems** • Introduce the role and function of the skeletal system

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				• Introduce and develop the understanding of natural selection and extinction	

Chemistry Knowledge					
	Chemical Analysis C8 • Purity, formulations and chromatography • Identification of common gases • *Identification of ions by chemical and spectroscopic means* **Chemistry of the atmosphere C9 – links to B7** • The composition and evolution of the Earth's atmosphere • Carbon dioxide and methane as greenhouse gases Common atmospheric pollutants and their sources **Using resources C10** • Using the Earth's resources and obtaining potable water • Life cycle assessment and recycling • *Using materials* • *The Haber process and the use of NPK fertilisers – links to C6* **Once students have completed the course, they will revise content from Year 9 in order to prepare for their February Mock Exams and then for external exams in May..**	**Quantitative C3** • Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations • Use of amount of substance in relation to masses of pure substances • *Yield and atom economy of chemical reactions* • *Using concentrations of solutions in mol/dm3* *Use of amount of substance in relation to volumes of gases* **Rates of reactions C6** • Rate of reaction • Reversible reactions and dynamic equilibrium **Organic chemistry C7** • Carbon compounds as fuels and feedstock • *Reactions of alkenes and alcohols* • *Synthetic and naturally occurring polymers* •	**Pure and impure substances** • Embed the concepts of pure substance • Embed atoms, elements, and compounds to understand mixtures and how to separate them **Atomic structure - C1** • A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes – Links to P4 • The periodic table • *Properties of transition metals* **Bonding C2** • Chemical bonds, ionic, covalent and metallic • How bonding and structure are related to the properties of substances – Links to P3 • How bonding and structure are related to the properties of substances • *Bulk and surface properties of matter including nanoparticles* **Chemical changes C4** • Reactivity of metals • Reactions of acids • Electrolysis **Energy changes C5** • Exothermic and endothermic reactions • *Chemical cells and fuel cells*	**Basic to chemistry** • Develop chemical symbols and simple understanding of model to explain scientific ideas **Properties of materials** • Develop understanding of the periodic table and atoms to place different elements in a reactivity series. • Introduce and Develop the properties of ceramics, polymer and composites in a qualitative way **Chemical Reactions** • Develop chemical reactions are a rearrangement of atoms • Develop understanding of different chemical reactions including combustion, thermal decomposition, oxidation and displacement reactions **Acids and alkalis** • Develop understand of reactions of acids, metals and alkalis and their products **Energy changes and catalysts**	**Throughout this introduction to Chemistry chemical equations will be used to strength knowledge and understanding** **Atoms, elements, compounds and the Periodic table** • Introduce the chemical symbols and simple understanding of model to explain scientific ideas - FI • Introduce the key ideas of the periodic table and how to use it **Particulate nature of matter** • Introduce 3 states of matter properties and process of changing state. • Introduce the difference between metals and non-metals, linking to their properties **Earth and Atmosphere** • Introduce the structure and composition of the earth linking to different rock formations and their cycles -

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				• Develop qualitative understanding of energy changes in different reactions	

Physics Knowledge						

	Electromagnetism and magnetism – P7
	• Permanent and induced magnetism, magnetic forces and fields
	• The motor effect – SEP contained
	• *Induced potential, transformers and the National Grid*
	
	Space (separate only) - P8
	• *Solar system; stability of orbital motions; satellites*
	• *Red shift*
	
	Once students have completed the course, they will revise content from Year 9 in order to prepare for their February Mock Exams and then for external exams in May.
		Electricity – P2
		• Current, potential difference and resistance
		• Series and parallel circuits
		• Domestic uses and safety
		• Energy transfers
		• *Static electricity*
		
		Forces – P5
		• Forces and their interactions
		• Work done and energy transfer
		• Forces and elasticity
		• *Moments, levers and gears*
		• *Pressure and pressure differences in fluids*
		• Forces and motion
		• Forces, accelerations and Newton's Laws of motion
		• Momentum
		• *Changes in momentum*
		
		Waves – P6
		• Waves in air, fluids and solids – *SEP contained*
		• Electromagnetic waves – *SEP contained*
		
		Black body radiation
			Describing motion
			• Embed the relationship between average speed, distance and time including the equation
			• Embed the journey of objects on a distance time graph
			• Introduce and embed relative motion
			
			Particle model of matter (GCSE P3 and KS3)
			• Changes of state and the particle model
			• Physical changes
			  ○ Brownian motion in gases
			  ○ diffusion in liquids and gases driven by differences in concentration
			  ○ the difference between chemical and physical changes
			• Internal energy and energy transfers
			• Particle model and pressure
			Energy – P1
			• Energy changes in a system, and the ways energy is stored before and after such changes
			• Conservation and dissipation of energy
			Atomic structure - P4
			• Atoms and isotopes links to C1
			• Atoms and nuclear radiation
			• *Hazards and uses of radioactive emissions and of background radiation*
			• *Nuclear fission and fusion*
			
			Space physics
			• Embed understanding forces linking to gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only)
			• our Sun as a star, other stars in our galaxy, other galaxies
			• the seasons and the Earth's tilt, day length at different times of year, in different hemispheres
			• the light year as a unit of astronomical distance.
			•
				Reflection and refraction
				• Introduce and develop key terms to observe transverse waves – water
				• Develop the properties of light waves and how they interact with different materials.
				Lenses and colour
				• Develop how different colours are based on frequencies, linking ideas to the eye and a camera
				Waves properties and Sound
				• Develop the difference between light waves and waves in matter
				• Introduce and develop the key properties of sound waves
				Introduce and develop the application of sounds waves in the use of a loudspeaker, linking to human hearing and auditory ranges
				Energy systems and Changes in systems
				• Introduce and Develop understanding about types of energy, energy systems and the conservation of energy
				• Introduce and Develop understanding of how changes in a system can happen linking to physics and mechanical processes (ie Work done)
				Energy changes and transfers
				• Introduce and Develop energy changes due to heating and thermal equilibrium – look at process of conduction
				• Introduce and Develop moments as a turning effect linking to leavers
				• Introduce and Develop are range of processes that can cause changes and transfers in energy
				Calculation of fuel uses and costs
				• Introduce and Develop key ideas of the calculation of fuel values from a wide range source.
				• Introduce and Develop key ideas of power rating and cost of using electricity
				Pressure
				• Develop the application of forces over an area as pressure linking to the equation
				• Develop the factors that can affect the pressure in fluids.
					Forces
					• Introduce the basic ideas of forces can how they can represent in the real world.
					• Introduce how forces can change an objects shape linking to key terminology
					
					• Introduce forces diagrams with 2 or more forces acting, link this to the terms balanced or unbalanced forces
					• Introduce how an objects motion can change if balanced or unbalanced forces are acting
					
					Electricity
					• Introduce the key ideas of electricity using the following terminology – Current, series and parallel circuits, charge
					• Introduce how current, potential difference and resistance are linked in series and parallel circuits
					• Introduce the ideas that static electricity is caused by a movement of electrons
					
					Magnetism and Electromagnetic spectrum
					• Introduce magnetic poles using the key terms attraction and repulsion
					• Introduce how a compass works in a magnetic field – C
					• Introduce the properties and uses of an electromagnet and motors

Wider curriculum Links	**Art**
	• Understanding how art informs and enhancing aspects outside of the art room
	  ○ Students need to be able to recall processes and draw diagrams to represent these – E.g. Carbon cycle, methods for experiments such as water purification and the production of potable water
	
	Geography – From Y10
	• Evidence for a changing climate
	• Causes and effects of global warming
	• Approached to managing climate change – mitigation and adaptation
	• The greenhouse effect
	  ○ Students cover this in Year 11 when studying C9 - Chemistry of the Atmosphere
	
	Geography – From Y11
	• Sustainable forest management
	• Interdependence and biodiversity
	• Impact of human activity – Deforestation
	• Sustainability
	  ○ This content is covered in B7 - Ecology
		Geography – From Y11
		• Global water supply
		• Increasing water supply
		• Sustainable water use
		  ○ Students cover the use of Earth's resources – in particular – water. This includes the definition of potable water as well as the treatment of sewage.
		  ○ Links to water cycle in Y7 Geography and KS2 Science
		
		Life – From Y11
		• Contraception and STIs
		• Pregnancy choices
		  ○ B5 – Homeostasis. Students look at pregnancy hormones, menstruation as well as STIs briefly. Pathogens are covered in B3 and students need to be able to state the symptoms of specified diseases – HIV, gonorrhoea.
			Geography – From Y7
			• Fossil fuels
			• CO_2 emissions
			• Greenhouse effect
			• Impact of human activity – use of fossil fuels
			  ○ Students calculate fuel values from a range of sources – Can link to renewable and non-renewable sources in Y8
			  ○ Covered in Year 9 – P1. Students only need to be able to discuss advantages and disadvantages of each energy source
			
			Life
			• Different types of addictions
			• Drug classifications
			• Party drugs
			  ○ Health topic in Science covered effects of recreational drugs on behaviour, health and life processes
			
			PE – From Y10/Y11
			• Understand how to review fluid intake to maintain hydration during sport and activity. Develop knowledge and understanding of hydration and its impact on participant engagement.
			
			  ○ Students cover osmosis as part of B1 – Cell Biology. They do a required practical using potatoes in different molar sugar solutions and calculate percentage change in mass as
				English
				• Discuss recent historical events that have changed the world – encourage opinion sharing
				  ○ Students develop an understanding of inheritance, DNA and genes. Links can be made into looking at the work of Watson and Crick; as well as later work into the Human Genome Project
				
				PE – From Y10/Y11
				• Explore how to recognise the features of a healthy diet. Review nutritional habits that require improvement and suggest methods to help participants enhance their participation in sports.
				
				  ○ Developing understanding of the problems linked to an unbalanced diet covered in Y8 Science. The nutrients that make up a balanced diet are covered in Y7.
					Art
					• Basics of mark making, tonal work and considered detail
					  ○ Students produce drawings of eukaryotic cells after observing under the microscope
					
					English
					• Offer personal opinions of those views with explanations
					  ○ Importance of a healthy diet – Students can express personal opinions on constitutes a healthy diet and justify their opinion
					
					Geography
					• The water cycle
					• Erosion, transportation and deposition
					• Landforms
					  ○ Students look at the rock cycle in Science – Water cycle covered at KS2
					
					Life
					• Introduction to puberty
					• Boys and girls body changes
					• Periods and erections
					  ○ Puberty and body changes are covered at KS2 Science but are referred to in Y7 Biology briefly. The focus in Science is more

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			a measure of water loss or gain. Students look at cell lysis and crenation – Linked to excessive water intake. • Investigate the body systems and how their structures provide functionality for sport and activity. ○ Covered in B2 – Organisation. Students look at the heart and lungs in terms of structure and function as well as their role in terms of gas exchange and respiration. • Explore how the body systems work together and the benefits of regular participation in sport and activity on each system. ○ B4 – Bioenergetics looks at the body's response to exercise; linking increased activity to increased breathing rate and the reasons for this on a physiological level		around the reproductive organs as well as menstruation and the mechanics of fertilisation **PE** • Introduce PE specific language based around the musculoskeletal system ○ Muscles and joints as well as the skeleton are covered in Science. The names of bones as well as antagonistic muscles are featured.