

Science Curriculum Overview – Year 9

Year 9		HT1	HT2	HT3	HT4	HT5	HT6
	Topic	9A Genetics and Evolution 9E Making Materials 9I Forces and Motion	9B Plant Growth 9F Reactivity 9J Force fields and Electromagnets	Recap of KS3 Biology, chemistry and Physics through lessons and projects	Recap of KS3 Biology, chemistry and Physics through lessons and projects	CB1 Key concepts of Biology CC1-2 States of matter, methods of separating and purifying substances CP1 Motion	CP2 Forces
subject	Why this and why now?	<p>9A – in year 7 and 8 students learn about adaptations and variation and this is extended further in this unit to look at what happens if an organism does not adapt to changing environments</p> <p>9E- students apply what they know about different chemicals to learn how they are used to make new materials and how bonding affects the properties of materials</p> <p>9I –students develop their understanding of forces and energy to understand how these combine to make objects move</p>	<p>9B – in year 8 students learn how plants reproduce and in this unit students build on their knowledge of plants to learn about chemical reactions, plant adaptations and uses of plants in farming</p> <p>9F – previously in KS3 students have learnt about atoms and chemical reactions. In this unit students learn why chemical reactions happen and how different factors affect the rate of chemical reactions</p> <p>9J – students develop their knowledge of electricity, magnetism and gravity to compare different fields and their effects</p>	This is to ensure fundamental knowledge, skills and understanding from KS3 in year 7 and 8 is retained and any misconceptions are addressed. This will ensure mastery of the KS3 curriculum as topics are linked together for example exchange systems is linked to respiration	This is to ensure fundamental knowledge, skills and understanding from KS3 in year 7 and 8 is retained and any misconceptions are addressed. This will ensure mastery of the KS3 curriculum as topics are linked together for example exchange systems is linked to respiration	<p>CB1 This Biology unit builds on the KS3 national curriculum to deepen understanding of the structure and function of cell organelles in animal, plants and bacteria, how to prepare microscope slides and calculate magnification, the structure and function of specialised cells in the reproductive system and exchange surfaces, the action of enzymes and how they are denatured. Finally, the unit moves to the transport of substances using diffusion, osmosis and active transport.</p> <p>CC1-2 This Chemistry unit builds on KS3 by recapping the particle model, how to separate substances but then application of separation techniques to making water potable (drinkable).</p>	<p>CP2 This Physics unit builds on motion in that motion is caused by forces and that Newton proposed 3 laws of motion that must always be applied. The unit then brings together motion and forces to explore stopping distances and crash hazards.</p>

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<p>What is the essential knowledge that needs to be remembered?</p>	<p>9A Genetics and Evolution Causes of environmental variation, discontinuous and continuous variation, classification, inherited variation, normal distribution curves, discovery of DNA, DNA structure, importance of DNA, relationship between genes, chromosomes and DNA, extinction, competition, preserving biodiversity, Darwin's theory of evolution</p> <p>9E Making materials Know the properties of ceramics and how they are made, polymer structures and uses, how composite materials are made and uses, problems of making and using materials, recycling and materials</p> <p>9I Forces and Motion</p>	<p>9B Plant Growth Chemical reactions in plants, aerobic respiration, rates of photosynthesis, adaptations of plants, products from plants, how farmers grow crops, how selective breeding is carried out, problems caused by farming</p> <p>9F Reactivity Know why explosions happen, review chemical and physical changes, gas pressure, compare the reactivity of metals, rusting and prevention of rust, energy from chemical reactions, exothermic and endothermic changes, displacement reactions, extracting metals from their ores</p> <p>9J Force fields and Electromagnets Force fields, magnetic and gravitational, static electricity</p>	<p>DNA, variation and adaptation, evolution and natural selection, biodiversity</p> <p>Project – animal smuggling - endangered animals, conservation and preserving biodiversity</p> <p>Project – enzyme investigation – planning an investigation into the effect of enzymes on gelling agents</p> <p>Project – teeth – communicating cause of tooth decay to the public</p> <p>Chemistry revision and projects Separating substances Filtration, distillation, chromatography, particle model, states of matter and mixtures</p> <p>Chemical reactions Atoms, elements, compounds, writing</p>	<p>Periodic table Metals and non-metals, groups in the periodic table and trends and properties in groups</p> <p>Earth and atmosphere Changing atmosphere, structure of the Earth, Earth resources and rock cycle</p> <p>Project – carbon capture – research how we can deal with carbon dioxide in the future</p> <p>Project – Electrolysis – Planning an investigation into electrolysis</p> <p>Project – Nanoparticles – Communicating with</p>	<p>CB1 Key concepts in Biology – Microscopes including parts of a microscope, how to calculate total magnification, preparing slides of plant cells, comparing light and electron microscopes, converting between sizes i.e. millimetres to micrometres, cell biology including animal, plant and bacterial cells, specialised cells and how they are adapted using egg, sperm and ciliated epithelial cells as examples, stem cells and cell differentiation, enzymes in nutrition, how enzymes work and what happens when they are placed in unfavourable conditions, transport of</p>	<p>CP2 Forces – forces, calculating resultant forces, mass and weight and the key difference between them, Newton's three laws of motion, calculating momentum, stopping distances and what factors affect thinking and braking distances, crash hazards.</p>

		<p>Know how forces affect objects and the way they move, energy resources and how they are used to move things, energy stores and transfers, calculating speed, distance time graphs, increasing sizes of forces, turning forces and forces in equilibrium, work done and how machines magnify forces</p>	<p>and its effects, current electricity and how it can be measured and controlled, resistance and how to calculate it, factors that affect resistance, how electricity can produce magnetism, electromagnets and their uses</p>	<p>equations, types of reaction, energy in reactions and speeding up reactions Physical and Chemical Reactivity series, acids and alkalis, indicators, neutralisation, reactions of acids and metals, properties of materials</p>	<p>the public the uses of nanoparticles Physics revision and projects Models in science Earth, moon and sun, solar system and beyond, particle model, pressure, diffusion and Brownian motion Energy Energy resources, energy stores and transfers, transferring energy by heating, paying for energy Forces Forces around us, balanced and unbalanced forces, controlling forces, speed Waves and fields Describing waves, sound and light waves, gravitational and magnetic fields, electric fields Machines Work done, moments and levers, electricity, electromagnets and moments Project – Ears and Eyes – research into bionic ears and eyes Project – Going faster – planning an investigation to find how different variables affect the</p>	<p>substances using diffusion and osmosis CC1-2 States of Matter: Separating substances: – states of matter, mixtures and how to separate substances using filtration, crystallisation, paper chromatography and distillation, how to purify drinking water CP1 Motion – scalars and vectors, calculating speed and acceleration, calculating velocity and using both distance / time graphs and velocity / time graphs to determine, speed, acceleration and distance</p>	
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What is the assessment intent and how will you assess?	Each unit is assessed using an end of topic assessment and this will address any misconceptions and the teacher will re teach areas that students have not fully understood either a full lesson or in the 'do now'	Each unit is assessed using an end of topic assessment and this will address any misconceptions and the teacher will re teach areas that students have not fully understood either a full lesson or in the 'do now'	KS3 Year 9 baseline from active learn for Biology, Chemistry and Physics this assessment will baseline acquired knowledge, skills and understanding from KS3 and allow us to highlight gaps and misconceptions that need to be overcome before KS4 curriculum is taught.		Assess prior knowledge and understanding using baseline Formative assessment throughout lesson including rewind grids, quick quizzes and retrieval tasks Cumulative assessment CB1, CC1-2 and CP1-2	Assess prior knowledge and understanding using baseline Formative assessment throughout lesson including rewind grids, quick quizzes and retrieval tasks Cumulative assessment CB1, CC1-2 and CP1-2
What should the end point look like?	9A Genetics and Evolution Identify types of environmental variation and causes, explain problems with classification, identify types of inherited variation, explain how sexual reproduction causes variation, identify normal distribution, describe the structure of DNA, describe importance of DNA and the relationship between genes, chromosomes and DNA, explain how extinction occurs, explain how adaptations affect survival, explain how to preserve biodiversity, explain natural selection 9E Making Materials Identify ceramics and describe their uses, properties of ceramics,	9B Plant Growth Explain photosynthesis and respiration, explain factors that affect the rate of photosynthesis, describe how leaves, roots and stems are adapted for their functions, explain how substances enter and leave plants, explain how and why plants make different substances, explain the importance of nitrates, describe how pests and human populations alter food supply, explain how farmers boost food production, explain how plant varieties can be created, use models for example food webs and the carbon cycle to explain changes in an ecosystem, recognise the advantages and disadvantages of different farming methods 9F Reactivity	Biology revision and projects Cells, systems and movement Identify parts of animal, plant, bacteria and protista cells, describe function of organ systems and also the organisation of cells, tissues and organs, explain how muscles, ligaments and tendons work together to allow movement Exchange Systems Describe and explain how animals and plants get nutrition through digestive system (animals) and photosynthesis (plants), describe what is meant by a balanced diet, describe and explain gas exchange in the lungs (humans) and stomata (plants), link ideas to gas exchange to the damage caused by smoking Reproduction and health	Periodic table Identify on the periodic table where metals and non-metals, name and identify groups in the periodic table and describe the properties of groups in the periodic table Earth and atmosphere Describe how the atmosphere has changed over time, describe the structure of the Earth, State the advantages and disadvantages of recycling and describe the rock cycle Project – carbon capture – research how we can deal with rising carbon dioxide	CB1 Key concepts in Biology Identify parts of a microscope, use a microscope to magnify plant cells, calculate total magnification, image size, actual size and magnification, compare the resolution and magnification of light and electron microscopes, convert between different size units, identify and describe the function of organelles in a plant and animal cell, use standard form, identify structures in a bacterial cell and describe their function, explain the difference between plasmid and chromosomal DNA, describe and explain the structure and function of enzymes and how they	CP2 Forces Identify forces, describe when forces are balanced and unbalanced, calculate resultant forces, use the formula $F=ma$ to investigate the acceleration of trolleys down a ramp, describe Newton's 3 laws of motion, calculate and describe momentum, identify features that make cars safe against crash hazards, define stopping distances, describe factors that affect thinking and braking distances, calculate stopping distances, describe and explain how road surface and conditions of brakes affect stopping distances

	<p>name examples and uses of polymers, explain the main properties of polymers, describe how polymers are made, explain composite materials and give examples, describe and justify the uses of some composite materials, explain thermal decomposition, explain exothermic and endothermic reactions, explain problems caused by making and using materials, describe recycling and explain the advantages of recycling</p> <p><u>9I Forces and Motion</u> Recall different types of forces, explain effects of balanced and unbalanced forces, explain why moving objects have a top speed, recall ways energy is stored and transferred, recall the law of conservation of energy, state what is meant by efficiency, describe meanings of speed and mean speed, use formula speed, distance and time, use distance time graphs, describe how a simple lever can multiply forces or distances, identify the load, effort and pivot on a diagram of a lever, factors that affect the size of a moment, explain why something will balance if</p>	<p>Identify and explain the differences between physical and chemical changes, use particle theory to explain gas pressure, describe reactions of metals with water, dilute acids and air, explain how metals are placed in the reactivity series, explain how physical barriers and sacrificial protection prevent rusting, describe test for oxygen, explain how combustion reactions can be speeded up, classify changes as being exothermic or endothermic, explain why some reactions need a supply of energy, explain displacement reactions, predict displacement reactions, explain how metals are extracted based on their reactivity, explain oxidation and reduction</p> <p><u>9J Force Fields and Electromagnets</u> State what is meant by a force field, describe the shape of a magnetic field, factors that affect strength and gravity, calculate weight and mass, describe how electrically charged objects affect each other, recall how current behaves in series and parallel circuits, describe how voltage behaves in series and parallel circuits, describe factors that affect resistance, use the formula relating voltage, current and resistance, describe an</p>	<p>Structure and function of parts of the male and female reproductive system, structure and function of egg and sperm cells and how they are specialised, describe human life cycles including puberty and structure and function of a plants reproduction system, define what is meant by a drug, explain the differences between stimulants and depressants and describe what is meant by a side effect</p> <p><u>Energy in Ecosystems</u> Describe how a leaf is adapted for photosynthesis, define and explain cellular respiration including the word equation, describe how animals are interdependent on each other in an ecosystem and draw and analyse simple food chains and webs</p> <p><u>Genetics and Evolution</u> Describe and explain the relationship between genes, chromosomes and DNA and the asexual and sexual reproduction, describe adaptation and variation as being continuous and discontinuous and how variation can lead to natural selection, describe the term biodiversity and explain why it is important to maintain biodiversity</p>	<p>levels by capturing carbon</p> <p>Project – Electrolysis – plan an investigation by selecting variables, describing controls and ensuring reliability and validity</p> <p>Project – Nanoparticles – communicate to the public how we use nanoparticles</p> <p><u>Physics revision and projects</u> <u>Models in science</u> Model how the earth moves around the sun and how the moon moves around Earth, describe what makes up our solar system and describe what is meant by a galaxy and a light year</p> <p><u>Energy</u> Identify energy resources as being renewable and non-renewable, describe energy transfers and explain different energy transfers by heating, describe and explain how we pay for electricity and calculate usage</p> <p><u>Forces</u> Identify forces and use diagrams to show</p>	<p>are involved in digestion, investigate the effect of pH on enzyme activity, describe and explain transport of substances using diffusion, osmosis and active transport, investigate osmosis in potatoes</p> <p>CC1-2 States of matter and separating substances Describe the 3 states of matter in terms of particle movement, arrangement and energy, describe, identify substances as being pure or mixtures, use practical techniques such as filtration, crystallisation, distillation and chromatography to separate substances, calculate RF factor, explain how to make water potable and how desalination works</p> <p>CP1 Motion Define scalar and vector and identify scalars and vectors, calculate speed and acceleration, use distance – time graphs, use velocity – time graphs to calculate acceleration and distance</p>	
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How does it cover the NC	<p>9A heredity as the process by which genetic information is transmitted from one generation to the next</p> <ul style="list-style-type: none"> • reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta • a simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model • reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms • differences 	<p>- 9B cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope</p> <ul style="list-style-type: none"> • the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, ... chloroplasts • the role of diffusion in the movement of materials in and between cells • plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots • the role of leaf stomata in gas exchange in plants • reproduction in plants, including ... insect pollination, ... seed and fruit formation ... • the adaptations of leaves for photosynthesis • aerobic ... respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life • a word summary for aerobic respiration • the interdependence of 	<p>KS3 Working Scientifically:</p> <ul style="list-style-type: none"> -Scientific attitudes -Experimental skills and investigations -Analysis and evaluation -Measurement <p>Biology:</p> <ul style="list-style-type: none"> -Cells and organisation -The skeletal and muscular systems -Nutrition and digestion -Gas exchange systems -Reproduction -Health -Photosynthesis -Cellular respiration -Interactions and interdependencies -Inheritance, chromosomes, DNA and genes <p>Chemistry:</p> <ul style="list-style-type: none"> -The particulate nature of matter -Atoms, elements and compounds -Pure and impure substances -Chemical reaction -Energetics -The periodic table -Materials -Earth and atmosphere 	<p>Physics:</p> <ul style="list-style-type: none"> -Energy -Energy changes and transfers -Changes in systems -Describing motion -Forces - Pressure in fluids -Balanced forces -Forces and motion -Waves -Sound waves -Energy and waves -Light waves -Current electricity -Static electricity - Magnetism, -Physical changes -Particle model -Energy in matter -Space physics 	<p>KS4 working Scientifically</p> <ul style="list-style-type: none"> -Working scientifically -Development of scientific thinking -Experimental skills and strategies -Analysis and evaluation -Vocabulary, units, symbols and nomenclature <p>Key concepts of Biology (CB1)</p> <p>cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells</p> <p>enzymes</p> <p>factors affecting the rate of enzymatic reactions</p> <p>the importance of cellular respiration; the processes of aerobic and anaerobic respiration</p> <p>carbohydrates, proteins, nucleic acids and lipids as key biological molecules, the need for transport systems in</p>	<p>KS4 working Scientifically</p> <ul style="list-style-type: none"> -Working scientifically -Development of scientific thinking -Experimental skills and strategies -Analysis and evaluation -Vocabulary, units, symbols and nomenclature <p>Forces (CP2)</p> <p>forces as vectors</p> <p>acceleration caused by forces; Newton’s First Law</p> <p>weight and gravitational field strength</p> <p>decelerations and braking distances</p> <p>involved on roads, safety</p>

		<p>between species • the variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation • the variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection</p> <ul style="list-style-type: none"> • changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction • the importance of maintaining biodiversity and the use of gene banks to preserve hereditary material. <p>9E</p> <ul style="list-style-type: none"> • chemical symbols and formulae for elements and compounds • the concept of a pure substance • the identification of pure substances • combustion, thermal decomposition, oxidation and displacement reactions • chemical reactions as the rearrangement of atoms • representing chemical reactions using formulae and using equations • exothermic and 	<p>organisms in an ecosystem, including food webs and insect-pollinated crops • the importance of plant reproduction through insect pollination in human food security • how organisms affect, and are affected by, their environment, including the accumulation of toxic materials • the importance of maintaining biodiversity ...</p> <p>N.B. Statements in italics cover revision from other units</p> <p>9F</p> <ul style="list-style-type: none"> • the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure • changes of state in terms of the particle model • a simple (Dalton) atomic model • chemical symbols and formulae for elements and compounds • conservation of mass in changes of state and chemical reactions • chemical reactions as the rearrangement of atoms • representing chemical reactions using formulae and using equations • combustion, thermal decomposition, oxidation and displacement reactions • energy changes on changes of state (qualitative) • exothermic and endothermic chemical reactions (qualitative). <p>9J</p>			<p>multicellular organisms, including plants</p> <p><u>Particle Model and Separating mixtures (CC1-2)</u></p> <p>changes of state of matter in terms of particle kinetics, energy transfers and the relative strength of chemical bonds and intermolecular forces</p> <p><u>Motion (CP1)</u></p> <p>speed of sound, estimating speeds and accelerations in everyday contexts</p> <p>interpreting quantitatively graphs of distance, time, and speed</p>	
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		<p>endothermic chemical reactions (qualitative) • properties of ceramics, polymers and composites (qualitative) • the production of carbon dioxide by human activity and the impact on climate • Earth as a source of limited resources and the efficacy of recycling.</p> <p>91</p> <p>speed and the quantitative relationship between average speed, distance and time (speed = distance/ time) • the representation of a journey on a distance–time graph • relative motion: trains and cars passing one another • simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged • work done and energy changes on deformation • non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity • forces as pushes or pulls, arising from the interaction between two objects • using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces •</p>	<ul style="list-style-type: none"> • comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with ... changes in positions in a field, in elastic distortions and in chemical compositions • non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity • electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge • potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current • differences in resistance between conducting and insulating components (quantitative) • separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects • the idea of electric field, forces acting across the space between objects not in contact • magnetic poles, attraction and repulsion • magnetic fields by plotting with compass, representation by field lines • the magnetic effect of a current, electromagnets, D.C. motors 				
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	<p>forces: associated with deforming objects; stretching and squashing</p> <ul style="list-style-type: none"> - springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water • forces measured in newtons, measurements of stretch or compression as force is changed • other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels • energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change • comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions • using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes. 	<p>(principles only)</p> <ul style="list-style-type: none"> • gravity force, weight = mass × gravitational field strength (g), on Earth $g = 10 \text{ N/kg}$, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only). 				
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