

Science Curriculum Map

We have approached the teaching of KS3 and KS4 in a spiral curriculum method. Students experience the 3 Sciences as building upon current knowledge throughout the 5 years. Key concept content for GCSE is repeated at points through year 10 and 11 to allow pupils to grasp the key ideas of science fully.

KS2 prior learning	Chemistry
	Biology
	Physics

Year	What do students learn?	Why?	Tier 3 keywords	Threshold concepts	Literacy	Assessment
7	Block 1 <ul style="list-style-type: none"> Chemistry- Particle model Chemistry- Pure and impure substances 	Block 1 These topics underpin all of the sciences; matter is made from particles and organisms are made from cells.	Model, particle, diffusion, gas pressure, vibration, solution, solute, solvent, soluble, insoluble, saturated solution filtration, distillation, chromatography, chromatogram membrane, cytoplasm, nucleus, chloroplast, vacuole, cell wall,	Know that matter is made of particles. Differences in the structure of animal and plant cells.	Reading Information about different diseases. Writing	Baseline test during first weeks at HWA to assess

<ul style="list-style-type: none"> • Biology - Cells and organisation <p>Block 2</p> <ul style="list-style-type: none"> • Chemistry - Atoms and elements and the periodic table • Physics – Forces • Biology - Nutrition and digestion <p>Block 3</p> <ul style="list-style-type: none"> • Physics - Energy changes and transfers • Biology – Microbes and disease • Biology – Reproduction <p>Block 4</p> <ul style="list-style-type: none"> • Chemistry/Physics - Physical changes • Chemistry -Chemical reactions – acids and alkalis • Physics - Magnetism • Physics – Electrical circuits 	<p>The pure and impure topic starts to build on practical based skills which are essential for all practicals e.g. filtration as well as the practical equipment names and health and safety precautions.</p> <p>Block 2</p> <p>Atoms topic builds on particle topic with further detail. Students are introduced to the periodic table early in year 7 so that they have practise in identifying elements and deepening their understanding.</p> <p>Forces topic is essential in Physics as it helps pupils to explain how the same forces that hold the universe together also hold atoms together and help us to move around</p> <p>Digestion and nutrition build on learning from KS2 and is very applicable to their everyday life. Their understanding ranges from links to PSHE (what makes a healthy diet), P.E. (why is energy needed where it comes from) so students can explain what happens to food after eat after we eat it.</p> <p>Block 3</p> <p>We are learning this so students can explain simple energy transfers which builds from knowledge from KS2 and into equations for KS4.</p> <p>Both Biology topics have significant relevance to students in terms of wellbeing when growing older. Students will be having inoculations in year 8&9 and important that they understand the significance of these. The reproduction topic explains the science behind reproduction and how human babies are made; which will link to PSHE</p> <p>Block 4</p> <p>Students can explain the difference between physical changes and chemical reactions so they can identify these in their everyday lives and in the various practicals during their science curriculum.</p>	<p>membrane, tissue, variable, sample size, evaluate, magnification</p> <p>element, compound, atom, molecule, symbol,</p> <p>drag, upthrust, weight, mass, density</p> <p>intestine, villus, liver, pancreas, carbohydrates, protein, enzyme, absorption</p> <p>Conduction, convection, radiation, insulator, conductor,</p> <p>bacteria, viruses, fungi, measles, chickenpox, infection, pathogen vaccination, inoculation and immunisation, antibiotic, anti-microbial, ovary, testis, oviduct, uterus, menstruation, ovulation, fertilisation, placenta, sperm, gestation, hereditary and inherited, baby and foetus, puberty and adolescence, fuse</p> <p>Physical, chemical, state, mass, diffusion, Brownian motion</p>	<p>Difference between atoms, elements, compounds & mixtures.</p> <p>Identify when forces are balanced and unbalanced.</p> <p>Order of digestive organs.</p> <p>Difference between conduction, convection and radiation</p> <p>Difference between pathogens and bacteria, viruses and fungi.</p> <p>Identify the difference between physical and chemical reactions.</p> <p>Know the difference between acids, alkalis</p>	<p>Using key terms, descriptions of states of matter</p> <p>Making a model of a cell and evaluation report on friction investigation, spring investigation etc. long answer assessment explaining heat transfers</p> <p>Write a story/ create a storyboard about the journey of the sperm cell to the egg cell</p> <p>Make a model of sperm cell or an egg cell and evaluate the model</p> <p>Write a full investigation into the resistance of a wire.</p> <p>Oracy</p> <p>Using key terms -writing methods for separating substances e.g. rock salt & sea water using discussion Class discussion on forces misconceptions</p>	<p>current knowledge.</p> <p>'Badger' assessed tasks</p> <p>Term 3 DOYA</p> <p>Term 6 DOYA</p>
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Year	What do students learn?	Why?	Tier 3 keywords	Threshold concepts	Literacy	Assessment
8	<p>Block 1</p> <ul style="list-style-type: none"> Chemistry: chemical reactions Physics: forces and motion <p>Block 2</p> <ul style="list-style-type: none"> Biology: cellular respiration and gas exchange Physics: waves <p>Block 3</p> <ul style="list-style-type: none"> Biology: evolution Chemistry: energy in chemical reactions Chemistry: metals and reactivity <p>Block 4</p> <ul style="list-style-type: none"> Biology: photosynthesis 	<p>Block 1</p> <p>Using knowledge from year 7; students will further develop their understanding of reactions to include word and symbol equations which is a fundamental skill.</p> <p>Block 2</p> <p>Using knowledge from year 7; students will further understand forces to explain how to predict the future motion of an object using a scientific law. The laws are also a key part of Physics GCSE.</p> <p>Block 2</p> <p>Linking knowledge on cells and organisms students will learn fundamental biology equations for photosynthesis and respiration; so they can explain how plants and animals get the energy they need for life.</p> <p>Waves is a large topic at GCSE which is broken down into learning so that students can describe how sound and light transfer information for sight and sound.</p> <p>Block 3</p>	<p>Elements, compounds reactant, product, word equation</p> <p>Speed, distance, time, metres, miles, kilometres, seconds, m/s, km/h, mph, resultant, acceleration</p> <p>lung, trachea, bronchus, ribcage, red blood cell, haemoglobin, artery, vein, breathing, ventilation, inspire, respire, inhale, exhale</p> <p>image, reflection, pitch, frequency, amplitude, wave</p> <p>inheritance, species, variation, environmental characteristics, genetic characteristics, survival, adaptation.</p>	<p>Difference between reactants and products.</p> <p>Mass and weight are not the same.</p> <p>Recall the equations for respiration. Respiration is not breathing.</p> <p>Know how sound waves are formed.</p>	<p>Reading</p> <p>About how some animals and plants have become endangered or extinct. Different energy suppliers information to make a judgement.</p> <p>Writing</p> <p>Extended response analysis and evaluation of rusting experiment. Core practical - Investigate how length of wing of a helicopter affects the time of flight A conclusion explaining results from an investigation into the angles of refraction. onclusion of investigation into exo and endothermic reactions Written method for making copper sulfate crystals.</p>	<p>Term 3 DOYA</p> <p>Term 6 DOYA</p>

	<ul style="list-style-type: none"> Biology: relationships in an ecosystem Chemistry: earth and atmosphere 	<p>To understand how variation can lead to new species or extinction. To describe that some reactions take in energy and some reactions release energy We are learning this so we can describe where the metals we use in everyday life come from and how we process them.</p> <p>Block 4</p> <p>We are learning this so that we can explain why plants are so important for the survival of all life on Earth. To explain how organisms depend on each other in an ecosystem. So they can describe the atmosphere, and what we can do to keep it healthy for humans in the future.</p>	<p>Heat, thermal, exothermic, endothermic, bonds, activation energy. salt, reaction, product</p> <p>palisade cell, chlorophyll, biomass, glucose and sugar, photosynthesis, biomass, community, habitat, pyramid of numbers, predator, carnivore, environment, ecosystem, environmental conditions, quadrat sampling, transect, population sizes, reliable data, vegetation cover, acid rain, catalytic converter, air and water quality, global warming, magma, core, crust, lava, turbine, generator, national grid, fuel, hydroelectricity, geothermal, ozone, global warming, carbon cycle, decomposer, respiration, photosynthesis</p>	<p>Understand how evolution occurs.</p> <p>Energy is not used up in reactions.</p> <p>The equation for photosynthesis.</p> <p>How to interpret food webs.</p> <p>How global warming is caused.</p>	<p>Written piece about the advantages and disadvantages of pesticides.</p> <p>Oracy Explanation of metal extraction linked to reactivity series. How light affects the rate of photosynthesis investigation Letter to your MP campaigning for/against a local power station. Comparing different types of ways to generate electricity.</p>	
Year	What do students learn?	Why?	Tier 3 keywords	Threshold concepts	Literacy	Assessment
9	<p>Terms 1 and 2: Biology</p> <ul style="list-style-type: none"> Biology key concepts: microscopes, cells, enzymes and transport Biology processes: mitosis, meiosis, inheritance, variation, nervous system <p>Terms 3 and 4: Chemistry</p> <ul style="list-style-type: none"> Chemistry: states of matter, filtration, crystallisation, chromatography, distillation, drinking water Chemistry key concepts: atoms, elements, bonding, metals Chemistry: acids and alkalis, neutralisation, acid reactions 	<p>Terms 1 and 2: Biology</p> <p>Key concepts in Biology which are on both papers:</p> <ul style="list-style-type: none"> Cells are building blocks of life (links to KS3 cells) further parts of the cell are learnt and links to processes such as respiration Enzymes allow important processes to happen inside organisms (e.g. digestion) links to KS2 & 3 but further understanding of how enzymes function and their importance included Transport allows pupils to understand how substances can move between cells. <p>Processes allow students to understand why we are all different:</p> <ul style="list-style-type: none"> Processes of growth in animals and plants which links to cells taught earlier Ideas about how we inherit variation and how mutation leads to more dramatic types of variation. Links to KS3 (reproduction & evolution) but pupils now learn about how 	<p>Lens, magnification, resolution, aerobic respiration, chlorophyll, eukaryotic, mitochondrion, ribosome, acrosome, ciliated epithelial cell, cilium, diploid, enzyme, epithelial cell, gamete, haploid, flagellum, plasmid, prokaryotic, catalyst, substrate, synthesis, active site, denatured, specific, optimum, active transport, diffusion, osmosis</p> <p>Anaphase, cytokinesis, interphase, metaphase, prophase, telophase, spindle fibres, differentiation, elongation, meristem, stem cell, axon, dendrite, dendron, myelin sheath, neurotransmission, receptor cell, stimulus, neurotransmitter, reflex arc, synapse, chromosome, genome, meiosis, mitosis, zygote, base (DNA), complementary base pair, double helix, dominant, recessive, heterozygous, homozygous, Punnett square, mutation,</p>	<p>Recall the differences between eukaryotic and prokaryotic cells.</p> <p>Enzymes speed up reactions but are not used up.</p> <p>Differences between diffusion, osmosis and active transport.</p> <p>Most cells contain 23 pairs of chromosomes, gametes contain 23 chromosomes.</p>	<p>Reading Text about the discovery of the structure of the atom over time.</p> <p>Writing Methods/ conclusion/ evaluation for the core practicals: osmosis in potato, chromatography, distillation, making a soluble salt, car acceleration on a ramp,</p> <p>Oracy Describing the roles of the structure of a cell. Describing how a stimulus is detected in the body through a reflex arc.</p>	<p>End of topic assessments from Edexcel which give an estimated grade.</p> <p>Y9 PPE Term 6</p>

<p>Terms 5 and 6: Physics</p> <ul style="list-style-type: none"> Physics: vector and scalar measurement, speed, acceleration, velocity, forces, Newton's laws, momentum, stopping distances Physics: energy stores and transfers, efficiency, non-renewable and renewable resources 	<p>sexual reproduction leads to variation, further detail about DNA structure & its importance</p> <ul style="list-style-type: none"> Understanding how the body responds to environmental stimulus <p>Terms 3 and 4: Chemistry</p> <p>There are several core/ required practicals included to increase pupil engagement (biology topics are light on practical elements). Real life application for how drinking water is purified.</p> <p><i>Links to KS3 content: particle model, pure & impure, chemical and physical reactions; now applying this to different investigations and applications</i></p> <p>Key concepts in Chemistry which are on both papers:</p> <ul style="list-style-type: none"> Atoms make up all substances (links to KS3; atoms & periodic table; now looking in detail at the inside of atom) How model of the atom has changed over time with scientists involved (also links to Physics later in the course) Use of periodic table to work out atom structure is fundamental (KS3; periodic table in more depth including how to use the data on the table) Bonding completes understanding from KS3 about differences between atoms, elements, mixtures and compounds Commonly used chemicals in science experiments Formation of word and symbol equations from information provided Core practical applies knowledge of whole topic <p><i>Links to KS3; acids & alkalis, metals & reactivity; now looking at how neutralisation can be investigated accurately, what are the features of acids and alkalis</i></p> <p>Terms 5 and 6: Physics</p>	<p>Particle, crystallisation, filtrate, insoluble, residue, solute, solvent, chromatography, stationary phase, mobile phase, chromatogram, Distillation, still, aquifer, chlorination, desalination, precipitate, sedimentation</p> <p>Atom, compound, element, proton, neutron, electron, shell, nucleus, subatomic particles, atomic number, mass number, isotopes, relative atomic mass, inert, period, group, electronic configuration, anion, cation, electrostatic forces, ionic bond, covalent bond, lattice structure, molecule, intermolecular forces, polymer, delocalised electron, fullerene, graphite, graphene, nanotubes, lubricant, lattice, malleable</p> <p>Aqueous solution, concentrated, dilute, dissociate, pH meter, burette, end-point, crystallisation, titration, pipette, effervescence, half equation, ionic equation, oxidation, reduction, spectator ions,</p> <p>Acceleration, displacement, magnitude, momentum, scalar quantity, vector quantity, velocity, gradient, deceleration, centripetal force (higher only), mass, weight, gravitational field strength, thinking distance, braking distance, stopping distance, crumple zone,</p> <p>Chemical energy, elastic potential energy, gravitational potential energy, joules, kinetic energy nuclear energy, Sankey diagram, thermal energy, dissipated, efficiency, emit, infrared radiation, thermal conductor, thermal insulator, climate change,</p>	<p>Difference between DNA, chromosomes, genes and alleles.</p> <p>Recall the order of a reflex arc.</p> <p>Reasons for separating substances.</p> <p>Structure of the atom (Bohr model).</p> <p>Recall that acid + base -> salt + water.</p>	
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		<p>Fundamental concepts in Physics:</p> <ul style="list-style-type: none"> • Introduction of several equations to learn for exams earlier (KS3; forces types helps understanding as now applying force diagrams to different scenarios, developing understanding of how forces can be calculated) • Key scientist, Newton, his discoveries • Stopping distances related to everyday life in a car and future tests for driving licence • Links to everyday life with choosing appliances based on efficiency • Links to everyday life with electricity production & links to global warming & atmosphere (also in Chemistry course) • Further calculations and required practical <p><i>Links to KS3; energy changes and electricity; now applying knowledge of energy to its production and evaluating these ways</i></p>		<p>Difference between acceleration and velocity.</p> <p>Energy is not lost from a situation; it transfers in its form</p>		
Year	What do students learn?	Why?	Tier 3 keywords	Threshold concepts	Literacy	Assessment
10	<p>Term 1</p> <p>Both Chemistry and Biology topics start with re-teach from Y9 of the key concepts</p> <p>Biology: Natural Selection and health</p> <p>Term 2</p> <p>Chemistry: groups of the periodic table and extracting metals</p> <p>Terms 3 and 4</p> <p>Physics: Waves, radioactivity and the EM spectrum</p> <p>Physics: Energy and forces and effects</p> <p>Term 5</p>	<p>Term 1</p> <p>This content can appear on both papers (4 out of the 6). Gives time for re-teaching gaps in knowledge from the assessment in yr9. Topics finish off the content for paper 1 and relate well to everyday life. These topics are very engaging as a start to year 10.</p> <p>Term 2</p> <p>Topics finish off the content for paper 1 and link to previous Chemistry topics well (atoms, periodic table). Also extend knowledge about the patterns in reactivity of groups and why this occurs. More difficult content in the extracting metals topic (e.g. electrolysis) which needs to be embedded over time.</p> <p>Terms 3 and 4</p> <p>These two physics topics finish the content for paper 1 and relate well to each other. The energy</p>	<p>Binomial system, ancestor, classification, domain, genus, kingdom, species, artificial selection, breed, genetic engineering, genetically modified organism, yield, diabetes, ligase, plasmid, recombinant DNA, restriction enzyme, sticky end</p> <p>Communicable disease, correlation, immune system, non-communicable disease, pathogen, cirrhosis, deficiency disease, cardiovascular disease, stent, stroke, AIDS, cholera, diarrhoea, haemorrhagic fever, host, HIV, malaria, protist, tuberculosis, ulcer, epidemic, vector, chlamydia, lysozyme, physical barrier, chemical barrier, antibody, antigen, immunisation, lymphocyte, memory lymphocyte, clinical trial, colony, penicillin, pre-clinical testing, double-blind trial</p> <p>Alkali metals, diatomic, halide, halogen, inert, noble gas,</p>	<p>Reasons why artificial selection is important.</p> <p>Difference between communicable diseases and non-communicable diseases.</p>	<p>Reading</p> <p>Different view-points on the use of GM foods. Articles on various communicable and non-communicable diseases. Articles on nuclear/ radioactive disasters.</p> <p>Writing</p> <p>Explaining how vaccines lead to immunity. Method/ results/ conclusion for different electrolysis practicals. Description of the hormones involved in the menstrual cycle.</p> <p>Oracy</p> <p>Recalling various everyday uses of the EM spectrum.</p>	<p>End of topic assessments from Edexcel which give an estimated grade.</p> <p>Term 6 Y10 PPE</p>

<p>Biology: Plants and hormones and menstrual cycle and diabetes</p> <p>Term 6</p> <p>Chemistry: Quantitative analysis</p>	<p>topic extends knowledge about the EM spectrum. These are the first parts of paper 2 content.</p> <p>Term 5</p> <p>First paper 2 topics for biology; chosen for their application to real life and the building up of knowledge from KS3 & yr10 (cells, photosynthesis; now applying to plant adaptations and structure) to understand plants functions in depth.</p> <p>Term 6</p> <p>Students struggle with these calculations so placed near end of yr10 to build on chemistry knowledge of atoms, periodic table and equations from Physics, so students are more able and confident when approaching Chemistry calculations.</p>	<p>Electrolysis, anode, cathode, cation, electrode, electrolysis, electrolyte, inert, redox reaction, bioleaching, leachate, ore, phytoextraction, corrosion, rusting, tarnish, closed system, dynamic equilibrium, endothermic, exothermic, open system, reversible reaction</p> <p>Amplitude, electromagnetic waves, frequency, hertz, longitudinal wave, medium, transverse wave, wavelength, refraction, interface, normal, infrared, ultraviolet, vacuum, visible light, angle of incidence, angle of refraction, incident ray, gamma rays, microwaves, radio waves, x-rays, oscillations, fluorescence, radiotherapy. Alpha particle, nucleon, absorption spectrum, emission spectrum, ionising radiation, background radiation, cosmic rays, dose, Geiger-Muller tube, beta particle, radioactive decay, gamma ray, penetrate, positron, unstable, nuclear equation, becquerel, half-life, contamination, irradiated, Watts, work done, electric field, force field, static electricity, free body force diagram,</p> <p>Cellulose, gas exchange, guard cell, lipid, palisade cell, protist, starch, sucrose, stoma, nitrate, companion cell, lignin, potometer, sieve tube, translocation, transpiration Adrenal gland, endocrine gland, pituitary gland, target organ, thyroid gland, adrenalin, fight-or-flight response, glycogen, negative feedback, thyroxine, oestrogen, progesterone, ART, corpus luteum, FSH, IVF, LH, homeostasis</p> <p>Empirical formula, molecular formula, Avogadro constant, mole</p>	<p>Atoms can form ions by losing or gaining electrons.</p> <p>Recall the EM spectrum in order (either high to low frequency or vice versa).</p> <p>Differences between alpha, beta and gamma radiation.</p> <p>Equation for work done.</p> <p>Equation for photosynthesis and respiration in plants.</p> <p>Homeostasis.</p>	<p>Suggesting appropriate methods of contraception and the success of these.</p>	
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Year	What do students learn?	Why?	Tier 3 keywords	Threshold concepts	Literacy	Assessment
11	<p>Term 1</p> <p>Chemistry: key concepts revision, rates of reaction, endo and exothermic, fuels and earth science</p> <p>Term 2</p> <p>Biology: Ecosystems, key concepts revision, exchange in animals</p> <p>Term 3</p> <p>Physics: electricity, forces, magnetism, EM induction, particle model</p>	<p>Term 1</p> <p>Build on gaps identified in yr10 assessment. Rates of reaction topic is highly engaging and includes a couple of required practicals which pupils need to be very familiar with. The fuels and earth science topic was a key weakness in 2018 exams possibly due to it being taught at the end of yr11. Therefore it has been moved to a more prominent place</p> <p>Term 2</p> <p>Ecosystems needs to be taught earlier in year 11 for weather conditions to be able to complete outdoor practicals. Build on weaknesses from yr10 exam. Exchange in animals is also covered in PE GCSE and knowledge of the plant topic in yr10 builds to understand exchange in animals. Also opportunity to recap transport in yr9</p> <p>Term 3</p> <p>These physics topics relate very well to each other as they build from electricity, forces, magnets and then how these will be used in electromagnets. The particle model covers content taught earlier in Chemistry and should build on understand rather than being 'left to last'.</p>	<p>Activation energy, endothermic, exothermic, active site, catalyst, denatured, reaction profile.</p> <p>Crude oil, feedstock, finite resource, hydrocarbon, fractionating column, ignite, viscosity, alkane, general formula, homologous series, carbon monoxide, complete combustion, incomplete combustion, haemoglobin, acid rain, weathering, alkene, cracking, saturated, unsaturated.</p> <p>Causal link, climate change, global warming, greenhouse effect, infrared, resolution.</p> <p>Ecosystem, community, interdependent, quadrat, abiotic factors, belt transect, biotic factors, predation, host, mutualism, parasite, eutrophication, overfishing, reforestation, potable, decomposer, crop rotation, nitrogen-fixing bacteria.</p> <p>Aerobic respiration, alveolus, erythrocyte, plasma, platelet, valve, aorta, atrium, deoxygenated blood, oxygenated blood, pulmonary artery, pulmonary vein, septum, stroke volume, tendon, vena cava, ventricle, lactic acid.</p> <p>Ampere, potential difference, voltage, charge, coulomb, ohm, resistance, direct proportion, diode, LDR, LED, thermistor, power, watt, a.c. , d.c. , hertz, national grid, circuit breaker, earth wire, fuse, live wire, neutral wire. Induced magnet, permanent magnet, electromagnet, solenoid, Fleming's left-hand rule, magnetic flux density, motor effect, tesla.</p>	<p>How to calculate relative molecular mass from atomic masses on the periodic table,</p> <p>Recall the definition of activation energy.</p> <p>What the boiling point of a substance means.</p> <p>Differences between abiotic factors and biotic factors.</p> <p>The structure of the heart.</p>	<p>Reading</p> <p>Article on heart disease in the UK.</p> <p>Article on ecosystem problems; deforestation, eutrophication, overfishing.</p> <p>Writing</p> <p>Extended writing on the use of fractional distillation.</p> <p>Extended writing on the journey of blood through the body and heart.</p> <p>Oracy</p> <p>Explaining how to set up various circuits to test voltage, current, resistance.</p> <p>Explaining how to correctly wire a plug and describing the functions of the various components.</p>	<p>End of topic assessments from Edexcel which give an estimated grade.</p> <p>Term 2 Y11 PPE Term 2</p> <p>Term 3 Y11 PPE Term 4</p>

			Electromagnetic induction, transformer, step-down transformer, transmission lines,	Difference between voltage/ potential difference and current		
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