

Dudley Academies Trust

Statement Curriculum Intent – Science 2021-2022

We believe that students deserve a broad and ambitious science curriculum, rich in skills and knowledge, which ignites curiosity and prepares them well for future learning or employment.

Science is taught through 12 big ideas linking Biology, Chemistry and Physics, they are sequenced through a spiral curriculum that supports student progression through years 7-11. The big ideas help to define the ultimate goal of the Science curriculum, they provide a framework to help students organise knowledge, this framework directly supports what we know about how students learn in science e.g. grouping related ideas together, moving from concrete to abstract ideas and revisiting and building upon the same idea multiple times.

How will this be achieved in our curriculum?

The big ideas allow students to develop scientific knowledge and conceptual understanding. Our scheme of learning aims to give students an understanding of the key ideas, the links between structure and function in living organisms, the particulate model as the key to understanding properties and interactions with matter in all its forms and the resources and means of transfer of energy as key determinants of all these interactions. It develops an understanding of the nature, processes and methods of science through different types of science enquiries that help to answer scientific questions about the world around them. Students are taught about working scientifically through a range of practical investigations that are always clearly related to the science content. We ensure students are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future. We teach students to be critical about information and to evaluate strategies and behaviours that could have an impact on the environment.

How does assessment fit in?

Being part of a MAT has allowed us to develop common assessments. These are summative which allow pupils to demonstrate their growing understanding of the subject and teachers to assess the impact of their teaching. Summative assessments in years 7-9 are taken 3 times a year and in years 10-11 6 times a year, enabling teachers to focus on formative assessment from lesson to lesson. Question level analysis is used to plan reteach Green for Growth lessons focussing on questions where students underperformed. The Demonstrate task is an independent activity this should involve an exam or specification-based question that allows the class teacher to evaluate the progress achieved in a lesson. This activity should be challenging and assess the extent to which pupils have met the progress indicators. The Connect task is an activity designed to address misconceptions or mistakes from the previous lesson's Demonstrate task. The regular use of demonstrate and connect tasks in lessons ensure that students embed knowledge into their long-term memory, freeing up working memory to attend to current learning. The increased consistency in the use of connect tasks shows teacher expertise in identifying the highest leverage gap to address misconceptions ensuring that students demonstrate progress. We are conscious of the role that literacy and vocabulary plays and we explicitly teach the meaning of subject-specific language using word consciousness.

Curiosity Creates Innovation

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key diagnostic question	How do cells make organisms?					
Cells and Systems	Structure. Cell structure and specialised cells. Diffusion. Unicellular organisms. Levels of organisation. Gas exchange. Skeleton, movement muscles. Tissues and organs. Digestive system.	Cellular processes. Photosynthesis, leaf structure. Respiration- aerobic and anaerobic.	Microscopy. Resolving and magnification Eukaryotes and prokaryotes Animal and plant cells (algae) Cell specialisation Cell transport Diffusion, osmosis, active transport, surface area.	Respiration and Photosynthesis Uses, metabolism, liver and lactic acid, limiting factors, energy transfers, monitoring rate and limiting factors. Organisation in plants and animals Blood, blood vessels, heart, xylem, phloem, transpiration.	Homeostasis, structure and function of the nervous system. Hormonal coordination Hormones, blood glucose control, diabetes, contraception, menstrual cycle, use of hormones to treat infertility, negative feedback. Homeostasis in action	https://www.myworldofwork.co.uk/sites/default/files/Biology-BGE-body-systems-and-cells.pdf
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show. Tier 3 words- mitochondria, ribosomes, tissue, organ, photosynthesis, diffusion, osmosis, active transport, limiting, homeostasis, hormones, aerobic, anaerobic, chloroplast, cytoplasm, palisade, tropism, lactic acid, phloem, xylem, transpiration					
Numeracy	Choosing appropriate ranges, numbers, and values for measurements and observations. Interpret data of inhaled and exhaled air.	Measure heart rate and breathing rate	Calculating surface area, use formula to calculate magnification, orders of magnitude,	Rate of enzyme action, plotting straight line graphs, drawing tangents	Calculating reaction times. Calculating percentage changes,	

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Careers Links
Key Diagnostic Question	How does your body keep you healthy?					
Microbes and Health	Health and lifestyle Nutrients Digestion, food and tests, bacteria, enzymes, drugs, alcohol, smoking	Microbes and Pathogens, body defences, antibiotics, STD's.	Digestive system Structures, lipids, proteins carbohydrates, food tests, enzymes, factors affecting enzymes, liver, gall bladder.	Communicable diseases Disease, Bacterial, fungal, protist and viral diseases, human defence, Preventing and treating disease and non-communicable diseases Vaccination, antibiotics, painkillers, drugs.		https://microbiologysociety.org/careers.html
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show. Tier 3 words- carbohydrates, protein, enzyme, virus, bacteria, protist, antibiotic, antitoxin, painkiller, lipid, lipase, amylase, protease, fungal, white blood cell, platelets, mucus, cilia, phagocytosis					
Numeracy	Interpret data of drug use. Drawing graphs.	Analysis of antibiotic usage data, analysis of data on disease.	Calculating rates of reaction.	Use of scatter diagrams to identify trends and interpret data.		

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key diagnostic Question	Why do giraffes have long necks?					
Genetics and Evolution	Reproduction in plants and animals Adolescence, reproductive systems, fertilisation, seed dispersal.	Adaptation and inheritance Variation, inheritance, natural selection, extinction.	Cell division Chromosomes, Mitosis and the cell cycle, Stem cells, Cell differentiation, Cancer		Sexual and asexual reproduction, meiosis, DNA, inheritance, genetic crosses, genetic diseases. Variation, natural selection, selective breeding, genetic engineering, ethics. theory of evolution, evidence for evolution, fossils, extinction, resistant bacteria.	https://www.myworldofwork.co.uk/sites/default/files/Biology-BGE-inheritance.pdf https://www.myworldofwork.co.uk/sites/default/files/Biology-antenatal-and-postnatal-screening.pdf
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show. Tier 3 words- stamen, sepal, ovary, oviduct, fertilisation, gametes, genes, chromosomes, phenotype, genotype, heterozygous, homozygous, dominant, recessive, mitosis, differentiation, speciation, classification, resistance, implantation, continuous, discontinuous					
Numeracy	Using data to calculate percentages, calculate mean	Tally charts, histograms of inherited data	Analysis of data for cancer related diseases.		Calculate probability from genetic crosses	

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	What cycles in an ecosystem?					
Interdependence		Ecosystem processes Food chains and webs Ecosystems Adaptation Competition, sampling techniques		Interdependence Abiotic/biotic factors, communities, sampling, adaptations, competition. Organising an ecosystem Nutrient cycles, decomposition Biodiversity and Ecosystems global warming, pollution, deforestation, land use, waste management, biodiversity. (Current year 11)	Interdependence Abiotic/biotic factors, communities, sampling, adaptations, competition. Organising an ecosystem Nutrient cycles, decomposition Biodiversity and Ecosystems global warming, pollution, deforestation, land use, waste management, biodiversity. (Current year 9 and 10)	
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show. Tier 3 words- producer, consumer, predator, prey, herbivore, carnivore, omnivore, adaptation, quadrat, random, abiotic, biotic, nutrient, cycle, biodiversity, methane, deforestation, pollution, biomass, trophic, decomposition, surface area to volume ratio					
Numeracy		Calculating mean, median, mode, estimating population sizes, tally charts		Analysing data over time for global warming, calculating estimate populations, means, use of predator prey graph analysis		

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	How are particles arranged in materials?					
Particles and Bonding	Particles and their behaviour. Particles model, states of matter, changes of state, density, diffusion, pressure Separation Techniques Mixtures, solutions, solubility, filtration, evaporation, distillation, chromatography	Ceramics, polymers, and composites	Atomic structure and separating techniques Atoms, separating mixtures, chromatography, nuclear structure, isotopes, ions Ionic and covalent bonding States of matter, ionic bonding, simple molecules. Bonding and properties Giant covalent, fullerenes, graphene, metallic bonding, nanoparticles	Chemical analysis: gases Pure substances and mixture, chromatography, tests for gases Crude oil and fuels Products from crude oil, cracking and alkenes		https://www.myworldofwork.co.uk/sites/default/files/Chemistry-crude-oil.pdf https://www.myworldofwork.co.uk/sites/default/files/Chemistry-chemical-analysis.pdf
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show. Tier 3 words- particles, boiling, condensing, evaporation, sublimation, chromatography, filtration, crystallisation, diffusion, solubility, polymers, ceramics, composite, proton, neutron, electron, nucleus, ionic, covalent, isotope, ion, crude oil, alkane, alkene, distillation, polymerisation, mixture					
Numeracy	Calculating density, measuring Rf values in chromatography		Identifying number of electrons to transfer in ionic bonding.	Analysing fractional distillation data, calculating numbers of hydrogen and carbon in alkanes, calculating Rf values		

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
	Key Diagnostic Question			Why do scientists write chemical equations?		
Amounts and Equations	Elements, atoms and compounds elements, compounds, atoms, molecules, formulae Word equations Conservation of mass	Symbol formula, formula mass		Equations and formulae. Balanced equations, Relative formula mass. Mole calculations Using moles Reacting masses Concentration		
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate Tier 3 words- atom, element, compound, conservation, mass, mole, concentration, titration, volume					
Numeracy	Balancing equations, present information in tables and graphs. Interpret observations and data, calculate percentage of an element in a compound	Balancing equations, present information in tables and graphs. Interpret observations and data, calculate percentage of an element in a compound		Calculating RfM, moles, reacting masses,		

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	How can I make more product faster?					
Physical Chemistry	Endothermic and exothermic reactions	Measuring rates.		Rates of reaction Calculating rates, Factors that affect rates, Collision theory, Catalysts Extent of chemical change Equilibrium Energy changes Endo/exothermic reactions Reaction profiles	Using resources, potable water, Alternative methods of metal extraction. Equilibrium, effects of changing conditions.	
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate Tier 3 words- endothermic, exothermic, collision, catalyst, equilibrium, temperature, concentration, surface area, potable, extraction, corrosion, alloy, fertiliser, thermosetting, thermosoftening					
Numeracy	Measuring temperature change	Measuring rates, using balances, gas syringes, interpreting graphical data		Measuring rates, using balances, calculating rate of reaction, drawing tangents to calculate rate of reaction, interpreting graphical data of rates of reaction. Calculating energy changes using bond energies, drawing energy profile diagrams, measuring temperature change, balancing half equations	Extract and interpret information from charts and graphs, make estimates, use ratios, fractions and percentages, translate information between graphical and numerical form	

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	What are the different types of reactions?					
Types of Reactions	<p>Reactions</p> <p>Chemical reactions, burning fuels, decomposition, Acids and Alkalis</p> <p>Acids and alkalis, pH and indicators, neutralisations, making salts. Endothermic and exothermic reactions</p>	<p>Periodic Table</p> <p>Metals and non-metals, Groups and periods, Grp1, Grp7, Grp 0</p> <p>Metals and acids</p> <p>Reactions of acids, reactions of metals, displacement reactions</p> <p>The Earth</p> <p>Atmosphere, rocks, rock cycle, C-cycle, recycling, climate change</p>	<p>The Periodic table</p> <p>History of the periodic table, electronic structure, Reactions of Groups 1,7 and 8, explaining trends</p>	<p>Reactivity series</p> <p>Chemical changes: oxidation OIL RIG</p> <p>Electrolysis of molten compounds</p> <p>Extraction of Al, Half-equations,</p> <p>Chemical changes: acids. Neutralisation & making soluble salts.</p> <p>pH Scale and acid strength.</p>	<p>Effects of human activities</p> <p>Earth's resources</p> <p>Wastewater, life cycle assessments</p> <p>Chemistry of our atmosphere.</p>	<p>https://www.myworldofwork.co.uk/sites/default/files/Chemistry-BGE-reactions-of-metals.pdf</p>
Literacy	<p>Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate</p> <p>Tier 3 words- acid, alkali, neutralisation, indicator, combustion, decomposition, displacement, igneous, sedimentary, metamorphic, climate, greenhouse, methane, reduction, oxidation, redox, concentration, strength, base, insoluble, soluble</p>					
Numeracy	<p>Balancing equations, use of measuring equipment</p>	<p>Use of graphical data, plot data into appropriate graphical form</p>	<p>Use orders of magnitude, balancing equations,</p>	<p>balancing ionic equations, using data to explain trends</p>	<p>Use orders of magnitude, extract and interpret information from graphs and charts, use ratios, fractions and percentages</p>	

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	How is energy transferred?					
Energy	Energy Food and fuels, energy transfer, stores, cost of energy, energy resources.	Temperature, conduction, convection, radiation, energy and power, machines	Energy transfer by heating Conduction, infrared*, specific heat capacity and insulation. Energy stores/transfers, energy conservation gpe., Ek, Ee, Ep, dissipation, work, power and efficiency. Energy resources. wind/water, sun, geothermal, nuclear, fossil, environment and issues.	Density, change of state, states, internal, latent heat, gas pressure, Atomic structure and radiation. Atomic structure, discovery of nucleus, alpha, beta and gamma, half-life, radiation in medicine,		https://www.myworldofwork.co.uk/sites/default/files/Physics-radiation.pdf
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate Tier 3 words- energy, transfer, conservation, thermal, light, chemical, gravitational, hydroelectric, solar, tidal, conduction, convection, radiation, power, machine, infrared, insulator, conductor, density, dissipation, efficiency, alpha, beta, gamma, Becquerel, fission, fusion, half-life					
Numeracy	Plotting graphs using data, calculating energy transfers, calculating cost of energy using equations	Using equations to calculate energy and power	Recall and calculate using a variety of equations, rearranging equations, calculating percentages, analysis of renewable and non renewable data, change the subject of an equation	Plotting half life graphs, using half-life graphs to calculate half-life, use of standard form, balancing nuclear equations, calculating density.		

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	How are magnets and electricity similar?					
Electricity and Magnetism		Electricity and magnetism Static, circuits, current, p.d., series and parallel, resistance, magnets, fields, electromagnets	Electricity: current and potential difference Static, drawing fields, current, charge, potential difference and resistance, component characteristics, series and parallel Electricity in the home d.c. and a.c. cables and plugs, power and p.d, energy transfer, efficiency		Magnetism and Electromagnetism Magnets and electromagnetic fields, electric motors, Motor effect.	https://www.myworldofwork.co.uk/sites/default/files/Physics-electricity.pdf
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate Tier 3 words- static, charge, electron, series, parallel, magnet, electromagnet, solenoid, core, induced, component, resistor, thermistor, filament lamp, diode, earth, neutral, live, fuse, motor, permanent, temporary, transformer, generator					
Numeracy		Calculating current, resistance and potential difference using equations, interpreting data on magnets and electromagnets	Recall and calculate using a variety of equations, rearranging equations, calculating percentages, use of standard form, converting units, change the subject of an equation			

Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	What is a force?					
Forces	Forces Deformation, effects, drag, contact and non-contact, friction, balanced and unbalanced, resultant forces, Hooke's Law	Motion and pressure Speed, speed/distance graphs, pressure in (s),(l) and (g) Turning forces Space Moons, seasons, Solar System, night and day, Universe, scale		Forces in balance Vectors and scalars, resultant forces, centre of mass, stability, parallelogram and resolution of forces Forces and motion Acceleration, weight and terminal velocity, braking, momentum, and elasticity Motion Distance time graphs including area under curve, speed and velocity, acceleration.		https://www.myworldofwork.co.uk/sites/default/files/Physics-forces.pdf https://www.myworldofwork.co.uk/sites/default/files/Physics-astronomy.pdf
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate Tier 3 words- deformation, contact, non-contact, resistance, drag, gravity, weight, balanced, resultant, speed, distance, moment, equilibrium, universe, solar system, planet, vector, scalar, lever, acceleration, terminal velocity, velocity, momentum, elasticity, pressure, limescale, star, red-shift, big-bang,					
Numeracy	Calculating extension, balancing forces	Use of equation to calculate speed, changing the subject of an equation, plotting speed/distance graphs, analysing graphs		Calculating resultant forces, using equations, changing the subject of equations, use of protractors to measure angles, use of scales, converting scales, interpreting speed and velocity graphs, drawing tangents to calculate velocity, calculating		

				distance using the area under a graph		
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Big Idea	Year 7	Year 8	Year 9	Year 10	Year 11	Career Links
Key Diagnostic Question	How are waves similar and different?					
Waves	Sound Longitudinal, wave properties, echo, ultrasound, ear Light Luminous and non-luminous, reflection, refraction, eye, camera, colour, filters	Energy transfer by radiation			Properties of waves Transverse and longitudinal waves, properties, calculating period and wave speed, reflection and refraction, Electromagnetic waves Spectrum, uses and applications	http://www.physics.org/careerprofile.asp?ProfileId=24
Literacy	Tier 2 words- describe, explain, compare, contrast, define, identify, justify, predict, show, calculate Tier 3 words- wave, longitudinal, transverse, ultrasound, echo, luminous, non-luminous, reflection, refraction, filters, infrared radiation, black body, wave speed, wavelength, seismic, spectrum, diverging, converging, concave, convex, principal axis, principal focus, transmission, translucent, transparent, opaque					
Numeracy	Measuring sound, using speed, distance and time.	Record temperature, plotting line graphs, analysing data of different materials			Calculating frequency, wavelength, velocity, time period, speed, distance and time. Measuring angles of reflection and refraction, calculating magnification, using scales	

Other career links

Biology	General	https://www.rsb.org.uk/careers-and-cpd/careers/career-resources
Chemistry	General	http://www.rsc.org/careers/future/teachers-and-careers-advisers
Chemistry	Careers videos chemicals and Pharma	Careers videos Chemicals and pharma https://icould.com/stories/job-types/chemicals-and-pharmaceuticals/
Chemistry	Careers in chemistry	https://www.myworldofwork.co.uk/sites/default/files/Chemistry-BGE_0.pdf
STEM careers	comprehensive resource on stem careers	STEM Careers Toolkit: http://www.cegnet.co.uk/uploads/resources/STEM_Careers_Toolkits.pdf
STEM careers	classroom speakers	STEM Ambassadors - find speakers to come into your classroom https://www.stem.org.uk/STEM-ambassadors
STEM careers	engineering careers	Engineering http://www.tomorrowengineers.org.uk/
STEM careers	green careers	Green careers http://www.cegnet.co.uk/uploads/resources/Cegnet_briefing_-_Teaching_about_Green_Careers.pdf
STEM Careers	women in science and engineering	WISE Women in Science and Engineering https://www.wisecampaign.org.uk/
STEM careers	Year of engineering	Year of Engineering lesson plans https://www.yearofengineering.gov.uk/lesson-ideas
STEM careers	careers in science and engineering	Careers in science and engineering https://www.wfsf.org/resources/leala-pedagogical-resources/texts-accompanying-video-resources/5-lessonplan-1igniteyour-future/file
STEM careers	careers in medicine	Medicine https://www.medicalmavericks.co.uk/for-teachers
STEM careers	careers in medicine	Medicine http://broughttolife.sciencemuseum.org.uk/broughttolife/teachers/curriculumlinks
STEM careers	careers in automotive industry	Motor Vehicle http://www.autocity.org.uk/index.php/schools-teachers-career-advisors/

STEM careers	health care carers videos	Healthcare careers videos https://www.youtube.com/channel/UCxGgYSuq0XR0siPOJVq8trQ
STEM careers	science and engineering careers	https://www.pearson.com/content/dam/one-dot-com/one-dot-com/uk/documents/educator/secondary/resources/careers-resources/year9/lesson4/Y9 Lesson plan 4 Promoting science technology engineering and mathematics.doc https://www.pearson.com/content/dam/one-dot-com/one-dot-com/uk/documents/educator/secondary/resources/careers-resources/year9/lesson4/Y9 L4 Activity 4.1 Job overview.doc https://www.pearson.com/content/dam/one-dot-com/one-dot-com/uk/documents/educator/secondary/resources/careers-resources/year9/lesson4/Y9 PowerPoint 4.1 Introduction to Lesson 4.ppt
STEM Careers	NHS KS3	https://www.stepintothens.nhs.uk/
STEM Careers	NHS careers	https://www.healthcareers.nhs.uk/
STEM Careers	Transport	Transport Careers http://www.plotr.co.uk/careers/worlds/a-better-connected-future-transport-careers