

Kings College Science Department: Curriculum Overview 2023-24

Curriculum Intent:

Students studying science at Kings College Guildford work through a broad curriculum designed support students' acquisition of substantive and disciplinary knowledge. Students will be challenged by the curriculum material, but will be supported in achieving excellent outcomes through adaptive and responsive teaching. The science curriculum at Kings College is split into KS3 and KS4. KS3 is taught across years 7, 8 and 9 and KS4 is taught across years 10 and 11.

In years 7 and 8, students study science working through 11 themes that emphasis the links between different scientific fields. Each theme is composed of 15 lessons split into three 5 lesson topics, with the students across the year group working through a rotation of these topics. In year 7, the themes will build upon their primary education learning and will be introduced to concepts the form the foundation of the science curriculum going forward. In year 8, students will further develop the ideas encountered in year 7 within a variety of contexts. In year 9 there is an explicit shift to teaching science as the separate disciplines of biology, chemistry and physics. Students will return to and expand upon ideas encountered in years 7 and 8 within this new context. Year 9 students will also be introduced to some of the foundational ideas that they will encounter in their further studies at KS4.

Climate change and sustainability are the biggest scientific challenges that this generation of students are likely to face. Therefore, themes centred on these topics are incorporated into year 7, 8 and 9, and also feature prominently at KS4.

In years 10 and 11, students will begin studying GCSE science. Most students at Kings College will study AQA Combined Science: Trilogy, though increasing numbers are taking AQA separate science GCSEs. The department is currently transitioning to a new curriculum order we hope will help students to develop their knowledge and skills in a more effective way. Current year 10s are being taught this new curriculum order, whilst current year 11s are being taught the course material in the order that it appears in the specification.

Throughout their time at Kings College, students will undertake practical work that is purposeful and moves learning forwards, as well as providing context to scientific ideas and sparking their curiosity and interest. At KS4, these practicals include, but are not limited to, required practicals specified by the exam board. Students will develop practical lab skills in addition to the examinable content related to these practicals, so that those who go on to pursue science subjects after GCSEs will be properly equipped to do so.

Year 7	Term 1		Term 2		Term 3		End points
	Transition	Structure & scale	Particles & properties	Cycles	Organisation	Resources	
	4 Lessons	15 lessons	15 Lessons	15 lessons	15 lessons	15 Lessons	
Theme		Big things are made of smaller things	Why materials behave the way they do	Patterns that repeat	How scientists group things together together	The Earth provides everything we need	
Content	The Science Lab Properties of Everyday materials Life cycles Earth, Sun & Moon	<u>Particle Theory:</u> 1. Solids, liquids & gases & Changes of states 2. Solutions 3. Diffusion 4. Conservation of Mass 5. Pressure <u>Cells, organs, organ systems:</u> 1. Cells 2. Types of animal cell 3. Major animal organs 4. Types of plant cell 5. Plant organs <u>Earth and the solar system:</u> 1. Structure of the Earth 2. The Solar System 3. Inner planets 4. Outer planets 5. The Milky Way and beyond	<u>Properties:</u> 1. Investigating properties 2. Boiling & melting points 3. Density 4. Conductivity 5. Uses of Materials <u>Pure and impure substances:</u> 1. Pure and impure 2. Cooling curves 3. Filtration & crystallisation 4. Distillation - using boiling points 5. Chromatography <u>Oxygen and the human body:</u> 1. Breathing and the lungs 2. The alveoli & gas exchange 3. The circulatory system	<u>Human reproduction:</u> 1. Life cycles & reproduction 2. Menstrual cycle 3. Fertilisation 4. Development of the foetus 5. Birth and growing up <u>Rocks and the rock cycle:</u> 1. Types of rock 2. Volcanoes 3. Weathering and erosion 4. Metamorphism 5. The rock cycle <u>Earth, Moon & Sun system:</u> 1. Day and night 2. Years and seasons 3. Phases of the Moon 4. Tides 5. Eclipses	<u>Classification of Living Things:</u> 1. Species 2. Vertebrates & invertebrates 3. Carnivore, herbivores, omnivores 4. Plants 5. Microorganisms <u>Types of energy store:</u> 1. Energy stores 2. Kinetic energy 3. Gravitational potential energy 4. Elastic potential energy 5. Thermal energy <u>Classification of chemicals:</u> 1. Metals and non-metals 2. Acids and bases 3. Elements, compounds & mixtures	<u>Earth's Atmosphere</u> 1. What is the atmosphere? 2. The Water Cycle 3. The Nitrogen Cycle 4. The Carbon Cycle 5. The Greenhouse Effect <u>Ecosystems:</u> 1. Habitats 2. Competition 3. Food chains 4. Food webs 5. Pollination and crops <u>Energy resources:</u> 1. Changing Energy Resources 2. Fossil fuels 3. Biofuels 4. Wind and solar 5. Nuclear	Substantive Knowledge: Students... <ul style="list-style-type: none"> • Can use the Particle Model to describe solids, liquids and gases, changes of state and diffusion. • Can describe cells, tissues and organs in humans and in plants. • Can state the 8 energy stores and can describe different energy resources. • Know that celestial objects are held in orbit by gravity and that objects of greater mass have higher gravity. • Can categorise organisms by according to anatomy, taxonomic relationship and diet. • Can describe energy resources as either renewable or non-renewable. Disciplinary knowledge: Students... <ul style="list-style-type: none"> • Can write a method for a simple practical. • Can use data in tables and can draw bar

			4. Effects of exercise 5. Effects of smoking		4. Groups on the Periodic Table 5. Polymers, ceramics & composites		charts. <ul style="list-style-type: none"> • Can plot data on a line graph with pre-drawn axes. • Can identify common lab hazards and suggest simple counter measures. • Can identify variables in the context of a practical and describe them as independent, dependent or control variables.
Direct Vocab Instruction	Hazard, property, metamorphosis, orbit	Particle, dissolve, concentration, mass, pressure, cell, specialise, function, mineral, organism, structure, system, satellite, light-year,	Material, property, substance, volume, conduct, ductile, malleable, pure, range, distil, component, respire, exchange, circulate, rate, addictive	Menstruate, fertilise, foetal, contraction, mineral, sediment, erupt, subduction, axis, luminous, lunar, eclipse.	Trait, species, vertebrate, devour, deciduous, microorganism, transfer, velocity, variable, deform, classify, conduct, indicate, bond, react.	Atmosphere, potable, adapt, produce, consume, predator, prey, pollination, finite, renewable, fossil, fuel, decay	

Year 8	Term 1		Term 2		Term 3	End points
	Action & reaction	Key concepts	Sustainability	Senses	Energy	
	15 Lessons	15 Lessons	15 Lessons	15 Lessons	15 Lessons	
Theme	How do things change?	Discoveries that changed the world	How do humans impact the world?	Sensing the world around us	What makes things work?	
Content	<u>Forces:</u> 1. Types of forces 2. Weight, lift & upthrust 3. Thrust & friction 4. Air resistance 5. Travelling in Space <u>Chemical reactions:</u> 1. Simple reactions 2. Neutralisation 3. Thermal decomposition 4. Combustion 5. Displacement <u>Inheritance, adaptation & natural selection:</u> 1. Inheritance & selective breeding 2. Variation 3. Adaptation 4. Natural selection 5. Evolution: fossil evidence	<u>DNA:</u> 1. Discovering DNA 2. The structure of DNA 3. Cell division 4. Gametes & reproduction 5. Genetics <u>The atom:</u> 1. Discovering the Periodic Table 2. Developing the atomic model 3. The structure of the atom 4. Molecules 5. Compounds <u>Electricity:</u> 1. How electricity changed the world 2. Circuits & electrical components 3. Current & resistance 4. Parallel v. Series circuits 5. Energy transfers in a circuit	<u>Global warming</u> 1. History of Earth's Climate 2. Global warming 3. Effects of global warming 4. Carbon footprints 5. Reducing carbon emissions <u>Impact on biodiversity</u> 1. What is biodiversity 2. Deforestation 3. Over-fishing 4. Agriculture & pesticides 5. Conservation & seed banks <u>Generating electricity</u> 1. Power stations 2. The National Grid 3. Large scale renewables 4. Small scale renewables 5. Insulating homes	<u>Sight:</u> 1. Light 2. Reflection 3. Refraction 4. Colour 5. The human eye <u>Hearing:</u> 1. Sound waves 2. Speed of sound 3. Pitch (frequency) 4. Loudness (amplitude) 5. The human ear <u>Smell, taste & touch:</u> 1. Taste & the tongue 2. Smell 3. Nerves and receptors 4. The nervous system 5. Reflexes	<u>Energy transfers:</u> 1. Types of energy transfer 2. Energy efficiency 3. Conduction 4. Convection 5. Radiation <u>Energy changes during reactions:</u> 1. Measuring temperature changes 2. Exothermic or endothermic? 3. Using exothermic reactions 4. Using endothermic reactions 5. Reversible reactions <u>Photosynthesis & respiration:</u> 1. Photosynthesis & chloroplasts 2. Factors affecting photosynthesis 3. Aerobic respiration & mitochondria 4. Exercise 5. Anaerobic respiration	<u>Substantive Knowledge:</u> Students... <ul style="list-style-type: none"> • Can describe substances as elements, compounds or mixtures. • Can describe simple chemical reactions using word equations. • Can explain in simple terms how the eye, the ear and the nervous system works. • Can describe simple transfers of energy seen in heating, electric currents and chemical reactions. • Can describe common forces and understand how balanced and unbalanced forces affect motion. • Can describe the structure of DNA and explain, in simple terms, its role in inheritance. • Can explain why biodiversity is important and describe ways that humans negatively affect biodiversity. • Understand that global warming is caused by the release of greenhouse gases and can describe renewable ways of generating power. <u>Disciplinary Knowledge:</u> Students... <ul style="list-style-type: none"> • Can evaluate a method and suggest improvements. • Can plot data on a line graph and draw a line of best fit. • Can calculate mean values unaided. • Can describe simple trends shown on a line graph. • Can identify hazards specific to particular pieces of lab equipment and can suggest counter measures. • Can make sensible predictions and can suggest ways to test these predictions.
Direct Vocab Instruction						

Year 9 Biology	Term 1		Term 2		Term 3	End points
	Cells Tissues and Organs	Human Anatomy	Human Health	Genetics & Inheritance	Ecology	
	5 lessons	5 lessons	5 lessons	5 lessons	5 lessons	
Content	<ol style="list-style-type: none"> 1. Specialised cells 2. Animal tissues, organs, organs systems 3. Plant tissues, organs, organ systems 4. Stem cells and differentiation 5. Stem cell research 	<ol style="list-style-type: none"> 1. The heart & circulatory system 2. The lungs & gas exchange 3. The digestive system 4. Muscular skeletal system 5. Reproductive systems 	<ol style="list-style-type: none"> 1. Disease 2. Hygiene 3. Vaccines 4. Exercise & Fitness 5. Smoking and drugs 	<ol style="list-style-type: none"> 1. Mitosis & asexual reproduction 2. Meiosis & gametes 3. DNA and Genes 4. Family trees 5. Environmental vs Genetic variation 	<ol style="list-style-type: none"> 1. Communities 2. Intraspecies competition 3. Interspecies competition 4. Factors affecting population growth 5. Sampling techniques 	<p><u>Substantive Knowledge:</u> Students...</p> <ul style="list-style-type: none"> • Can state the function of specialised cells and describe their roles in human organ systems. • Can explain how organ systems are affected by positive and negative health effects. • Can describe mitosis and meiosis. • Can explain how genetic information is inherited. <p><u>Disciplinary Knowledge:</u> Students...</p> <ul style="list-style-type: none"> • Can plan methods that give valid results. • Can construct axes with appropriate scales when plotting line graphs. • Can identify anomalous data points. • Can describe changes in trends shown in line graphs. • Understand the importance of repeatability and reproducibility of investigations.
Feedback Points	Specialised cells	November exam	Hygiene	DNA & Genes	Intraspecies competition	
Direct Vocab Instruction	Specialise, function, differentiate,	Circulate, reproduce	Pathogen, contagious, exercise, diffuse, immune			

Year 9 Chemistry	Term 1		Term 2		Term 3	End points
	Atoms, elements & compounds	Reducing the carbon footprint	Trends on the Periodic Table	Reactions of Acids	Energetics	
	5 lessons	5 lessons	5 lessons	5 lessons	5 lessons	
Content	<ol style="list-style-type: none"> 1. Atomic structure 2. Elements & compounds 3. Electronic structure 4. Atoms & the Periodic Table 5. Covalent bonds and molecules 	<ol style="list-style-type: none"> 1. Effects of global warming 2. Calculating carbon footprints 3. Reduce, reuse, recycle 4. Life cycle assessments 5. Evaluating products 	<ol style="list-style-type: none"> 1. Ions and ionic charge 2. Alkali metals 3. Halogens 4. Noble Gases 5. Boiling/melting points 	<ol style="list-style-type: none"> 1. Acids with metals 2. Acids with oxides 3. Acids with hydroxides 4. Acids with carbonates 5. Concentration 	<ol style="list-style-type: none"> 1. Exothermic/ endothermic 2. Investigating temp changes 3. Calculating energy transfer 4. Energy change diagrams 5. Reversible reactions 	<p><u>Substantive Knowledge:</u> Students...</p> <ul style="list-style-type: none"> • Can describe the structure of the atom. • Understand that atomic structure determines how chemicals react. • Can describe energy changes in chemical reactions. • Can calculate a simple carbon footprint and suggest ways to reduce it. <p><u>Disciplinary Knowledge:</u> Students...</p>
Feedback Points	Electronic structure	November exam	Alkali metals	Acids with hydroxides	Calculating Energy transfer	
Direct Vocab Instruction	Atom, bond, property					

						<ul style="list-style-type: none"> • Can plan methods that give valid results. • Can construct axes with appropriate scales when plotting line graphs. • Can identify anomalous data points. • Can describe changes in trends shown in line graphs. • Understand the importance of repeatability and reproducibility of investigations.
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Year 9 Physics	Term 1		Term 2		Term 3	End Points
	Waves	Forces	Electric fields	Particle Model	Our place in the Universe	
	5 lessons	5 lessons	5 lessons	5 lessons	5 lessons	
Content	1. Waves in water 2. Sound waves 3. Light waves 4. Reflection 5. Refraction	1. Newton's Laws of Motion 2. Distance-time graphs 3. Acceleration 4. Deceleration 5. Stopping distance	1. Charge, currents & circuits 2. Current v potential difference 3. Resistance 4. Magnetism 5. Electromagnetism	1. Developing the atomic model 2. Forces between particles 3. Diffusion 4. Gas pressure 5. Hydraulic pressure	1. The Solar System 2. The speed of light 3. Doppler effect and red shift 4. The Big Bang Theory 5. Life cycle of a star	<u>Substantive Knowledge:</u> Students... <ul style="list-style-type: none"> • Can describe the properties of waves and explain the difference between longitudinal and transvers waves, using sound and light as examples. • Can describe the relationship between current and potential difference in circuits. • Can describe changes in the motion of objects and explain why these changes occur in terms of Newton's Laws of Motion.
Feedback Points	Angle of refraction	November exam	Current v potential difference	Diffusion	Doppler effect & red shift	<u>Disciplinary Knowledge:</u> Students... <ul style="list-style-type: none"> • Can plan methods that give valid results. • Can construct axes with appropriate scales when plotting line graphs. • Can identify anomalous data points. • Can describe changes in trends shown in line graphs.
Direct Vocab Instruction	Oscillate	Accelerate, decelerate,	Component, current			

						<ul style="list-style-type: none">• Understand the importance of repeatability and reproducibility of investigations.
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GCSE Biology	Y10 Term 1	Y10 Term 2	Y10 Term 3	Y11 Term 1	Y11 Term 2	Y11 Term 3
	Looking at Cells Organisation in Humans	Communicable diseases Plants	Cell division Digestion	B7: Ecology B5: Homeostasis	B5: Homeostasis B6: Genetics & Reproduction	Revision and exam preparation
	12 lessons			13 lessons	12 lessons	
Content	Looking at Cells: 1. Types of Cell 2. Cells and Tissues 3. Microscopes 4. Microscopy Required Practical Organisation in Humans: 1. Metabolism 2. Aerobic and anaerobic respiration 3. Blood 4. The Heart and blood vessels 5. Diffusion in the lungs 6. The body's response to exercise 7. Health issues and lifestyle 8. Coronary Heart Disease (CHD)	<i>Under construction</i>	<i>Under construction</i>	B7.3 Competition in plants & animals B7.4 Adaptations in plants & animals B7.5 Feeding relationships B7.6 Materials cycling B7.7 The Carbon cycle B7.8 Human population explosion B7.9 Pollution B7.10 Deforestation & Peat destruction B7.11 Global warming B7.12 Maintaining biodiversity B5.1 Principles of homeostasis B5.2 The nervous system B5.3 Reflex actions	B5.4 The endocrine system B5.5 Controlling blood sugar B5.6 Reproductive hormones B5.7 Contraception & fertility treatments B6.1 Types of reproduction B6.2 DNA and the genome B6.3 Meiosis B6.4 Inheritance & genetics B6.5 Inherited disorders B6.6 Evolution & Natural selection B6.7 Selective breeding & genetic engineering B6.8 Genetics and ethics	B6.9 Fossils & extinction B6.10 Classification Revision
Required Practicals	Microscopy	Photosynthesis	Osmosis Food tests Enzymes	Field investigations Reaction Time		
Direct Vocab Instruction	Eukaryotic, prokaryotic, tissue, component, metabolism,			Variation, adaptation, predator, prey, peat, biodiversity, optimal, stimulus, reflex	Secrete, hormone, menstruate, ovulate, fertile, inherit, evolve, ethics	

GCSE Chemistry	Y10 Term 1	Y10 Term 2	Y10 Term 3	Y11 Term 1	Y11 Term 2	Y11 Term 3
	Energy Changes Periodic Table and atoms	Bonding and Structure Acids and Alkalis	Metals Electrolysis	C6 Rates of Reaction C7 Fuels C8 Chemical Analysis	C9 Atmosphere C10 Using Resources	Revision & exam prep

	11 lessons			13 lessons	12 lessons	
Content	Energy Changes: 1. Exothermic and Endothermic 2. Energy transfers during chemical reactions 3. Reaction profiles 4. Bond energies 5. Energy Changes Required practical Periodic table and atoms: 1. Development of the Periodic Table. 2. The Modern Periodic Table 3. Atoms, elements and compounds. 4. Mixtures and separation techniques 5. Electronic structure 6. Group 0 (Noble Gases)	<i>Under construction</i>	<i>Under construction</i>	C6.4 Investigating rate of reaction C6.5 Reversible reactions C6.6 Dynamic equilibrium C7.1 Hydrocarbons C7.2 Fractional distillation C7.3 Burning hydrocarbons C7.4 Cracking hydrocarbons C8.1 Pure & impure substances C8.2 Chromatography C8.3 Rf Values C8.4 Testing for gases C9.1 History of Earth's atmosphere C9.2 Greenhouse gases	C9.3 Global climate change C9.4 Atmospheric pollutants C10.1 Finite & renewable resources C10.2 Potable water C10.3 Investigating potable water C10.4 Treating waste water C10.5 Phytomining & bioleaching C10.6 Life Cycle Assessment C10.7 Reduce, reuse, recycle	Revision
Required practicals	Temperature changes	Making salts	Electrolysis	Rates of reaction Chromatography	Water purification	
Direct Vocab Instruction				Dynamic, equilibrium, viscous,		

GCSE Physics	Y10 Term 1	Y10 Term 2	Y10 Term 3	Y11 Term 1	Y11 Term 2	Y11 Term 3
	Materials Atomic structure and radioactivity	Energy Powering the home	Circuits, current and potential difference	P5 Forces	P6 Waves P7 Magnetism & electromagnetism	Revision & exam prep
	13 lessons			13 lessons	12 lessons	
Content	Materials: 1. Density of materials 2. Density required prac 3. Internal energy and changes of state 4. Specific latent heat 5. Specific heat capacity 6. SHC required prac Atomic structure &	<i>Under construction</i>	<i>Under construction</i>	P5.6 Forces Recap P5.7 Parallelogram of forces P5.8 Speed, distance & time P5.9 Velocity & acceleration P5.10 Velocity-time graphs P5.11 Analysing motion graphs P5.12 Force & acceleration P5.13 Weight and terminal velocity	P6.1 Types of wave P6.2 Wave speed P6.3 Properties of waves P6.4 Reflection & refraction P6.5 E-M Spectrum P6.6 IR absorption & emission P6.7 Sound P7.1 Magnetic fields P7.2 Magnetic fields &	Revision

	radioactivity: <ol style="list-style-type: none"> 1. Structure of the atom 2. Development of the atomic model 3. Isotopes 4. Radioactive decay & nuclear radiation 5. Nuclear equations 6. Half-lives 7. Radioactive contamination 			P5.14 Forces & braking P5.15 Stopping distance P5.16 Momentum P5.17 Hooke's Law P5.18 Newton's Laws	electric currents P7.3 The Motor Effect	
Required Practicals	Density Specific heat capacity		Resistance IV characteristics	Force and extension Acceleration	Waves Radiation and absorption	