

Curriculum overview: Physics

Key Stage 2

Earth and Space:

- Describe the movement of the Earth, and other planets, relative to the Sun
- Describe the movement of the Moon relative to the Earth
- Use the idea of the Earth's rotation to explain day and night

Forces:

- Explain that unsupported objects fall towards the Earth because of the forces of gravity
- Identify the effects of air and water resistance and friction
- Recognise that some mechanisms (levers, pulleys and gears) allow a smaller force to have a greater effect

Light:

- Recognise that light appears to travel in straight lines
- Explain how we see things
- Explain shadows

Electricity:

- Explain voltage
- Use recognised symbols when representing a simple circuit

Key skills/content requirements at GCSE

Physics content and understanding

Topics students need to have a good understand of

- Energy & Energy transfers in systems
- Energy resources & electricity generation
- Electrical circuits
- Domestic electricity
- Particles in solids, liquids and gases and how they behave under certain conditions
- Structure & development of the atom
- Ionising radiation & its' effects
- Forces & their interactions
- Waves
- Magnetism and electromagnetism
- The solar system and the origin of the universe (triple science only)

Students will need to know appropriate key terminology in order to describe and explain the physics concepts within each topic and how they interrelate with appropriate academic depth.

Students will need to know a range of required practical's. These require a high level of applied practical knowledge.

Scientific skills

Development of scientific thinking

- Understand how scientific methods and theories develop over time.
- Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.
- Appreciate the power and limitations of science and consider any ethical issues which may arise.
- Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.
- Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.
- Recognise the importance of peer review of results and of communicating results to a range of audiences.

Experimental skills and strategies

- Use scientific theories and explanations to develop hypotheses.
- Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.
- Apply a knowledge of a range of techniques, instruments, apparatus, and materials to select those appropriate to the experiment.
- Carry out experiments appropriately having due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.
- Recognise when to apply a knowledge of sampling techniques to ensure any samples collected are representative
- Make and record observations and measurements using a range of apparatus and methods.
- Evaluate methods and suggest possible improvements and further investigations.

Analysis and Evaluation

- Presenting observations and other data using appropriate methods.
- Translating data from one form to another.

The topics studied within GCSE Physics aim to answer some of the questions of how the world around us works. Energy and energy resources makes links between energy transfers and electricity- answering how we are able to use devices at the simple flick of a switch. Electricity is explored on a circuit level as well as the understanding behind domestic electricity in the home. This ties in to knowledge under the atomic structure topic area, with how nuclear decay works explained- linking to a potential future of electricity generation. This all relates back to the fundamentals of particles themselves; and how their interactions cause electrical current, pressure and even magnetism. Contextualising the understanding of energy and energy transfers is how waves are the medium for energy transfers such as light and heat.	- Carrying out and represent mathematical and statistical analysis. - Representing distributions of results and make estimations of uncertainty. - Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions. - Presenting reasoned explanations including relating data to hypotheses. - Being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error. - Communicating the scientific rationale for investigations, methods used, findings and reasoned conclusions through paper-based and electronic reports and presentations using verbal, diagrammatic, graphical, numerical and symbolic forms. Maths skills - Use scientific vocabulary, terminology and definitions. - Recognise the importance of scientific quantities and understand how they are determined. - Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate. - Use prefixes and powers of ten for orders of magnitude (eg tera, giga, mega, kilo, centi, milli, micro and nano). - Interconvert units. - Use an appropriate number of significant figures in calculation. - Standard form - Estimates and significant figures - Averages - Simple probability - Algebra skills - Graph skills The knowledge and skills in this section apply across the specification, including the required practicals.
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Curriculum Overview

Physics content and understanding: Each year students will learn about a range of physical applications to everyday life; such as, electrical circuits, forces between objects and energy transfers and the key content behind these. This portable knowledge is what students are entitled to know if they are to be a well rounded scientist.

Scientific skills: *For each year group specific skills are delivered within topics. Each year skill development will embed and build upon what was learnt in the previous year. Across all year groups, lessons with a practical focus have been integrated into schemes of work to guide students through the process of; selecting apparatus, writing a methodology, working in a systematic manner, analysing data to draw conclusions, making evaluations and improvements.*

Red italics is triple science knowledge only

	Term 1	Term 2	Term 3	Portable knowledge	Key terms
Year 7	<u>Forces and motion</u> - Speed, velocity and acceleration - Distance-time graphs - Investigating speed - Relative speed - Forces effects and types - Force diagrams - Balanced and unbalanced forces - Investigating unbalanced forces	<u>Energy costs and energy transfer</u> - Energy types and transfer - Energy transfers and efficiency - Energy transfer: burning food - Fossil fuels - Renewable energy - Making and paying for electricity <u>Electricity and circuits</u> - Static electricity - Describing electrical	<u>Electricity and circuits cont.</u> - Resistance - Series circuits - Parallel circuits <u>Waves: sound and light</u> - Waves and energy - Using wave properties - Sound systems - Exploring light - How light travels - Light v sound	- Understanding of objects in motion linked to their speed and how easy it is to stop these objects in terms of energy - Energy transfers - Energy sources and how their limitation affects humans - Current flows only in a complete circuit. - Voltage is the energy transferred per unit charge.	Contact force Non-contact force Force diagram Newtonmeter Resultant Vector Accelerating Decelerating Steady speed Reaction forces Friction Air resistance Mass Weight Gravitational field strength

		- circuits - Understanding electrical circuits		- Resistance reduces current. - Series circuits have one pathway; parallel circuits have more than one. - Electrical devices transfer energy from one form to another. - Waves transfer energy, not matter. - Waves have amplitude, wavelength and frequency. - Sound waves are longitudinal. - Light waves are transverse. - Waves can be reflected, refracted, absorbed or transmitted.	Newtons Kilograms Mass Volume Displacement Area Speed Velocity Time Stationary Fossil fuels Electricity Electric charge Static electricity Current Potential Difference) Resistance Circuit Series circuit Parallel circuit Wave Energy transfer Vibration Oscillation Medium Frequency Amplitude Wavelength Wave speed
Year 8	<u>Contact forces and pressure</u> - Contact and non-contact forces - Friction - Contact forces and pressure - Upthrust - Pressure theory - Pressure in liquids - Atmospheric pressure	<u>Magnetism and electromagnetism</u> - Magnets and magnetic materials - Magnetic fields - Earth's magnetic field and navigation - Electromagnets - Using electromagnets <u>Work, Heating and Cooling</u> - Work - Moments - Levers	<u>Work, Heating and Cooling continued</u> - Conduction - Convection - Radiation - Heating water <u>Wave effects and wave properties</u> - Waves and energy - Using wave properties - Sound systems - Exploring light	Forces change motion. Pressure depends on force and area. Energy is transferred when work is done or heating occurs. Electricity is the movement of charge in a complete circuit. Magnetism and electricity are closely linked. Waves transfer energy and interact predictably with materials.	Force Contact force Friction Air resistance Water resistance Drag Normal contact force Tension Upthrust Push Pull Balanced forces Unbalanced forces Weight Mass Gravity Newton (N) Resultant force Speed Velocity

					Acceleration Pressure Force Surface area Pascal (Pa) Density Hydraulic system Compression Pressure difference Vacuum Barometer Force spread Contact area Magnet Magnetic field Magnetic force Pole Pole Attraction Repulsion Permanent magnet Induced magnet Magnetic material Iron Nickel Cobalt Compass Electromagnet Solenoid Coil Iron core Current Electricity Motor Magnetic field lines
Year 9	<u>Energy</u> ▪ Energy transfers ▪ Efficiency ▪ Kinetic energy ▪ Gravitational potential energy ▪ Required practical: Elastic potential energy ▪ Required practical: specific heat capacity ▪ Work done ▪ Power ▪ Non-renewable resources ▪ Renewable resources	<u>Electricity</u> ▪ Circuit symbols ▪ Electric current, resistance and potential difference ▪ Required practical: resistance ▪ Series and parallel circuits ▪ Required practical: current-potential difference graphs ▪ Control circuits, light dependent resistors and thermistors ▪ Alternating current and the plug ▪ National grid ▪ <i>Static electricity</i>	<u>Particle Model of Matter</u> ▪ Density ▪ Required Practical – Density ▪ States of matter and internal energy ▪ Changes of State ▪ Specific latent heat ▪ Pressure in gases ▪ <i>Gas pressure and temperature</i> ▪ <i>Increasing the pressure of a gas</i>	- Energy is conserved and transferred between stores. - Electricity is the movement of charge driven by potential difference. - Matter is composed of particles whose behaviour explains physical properties. -	Energy: Stores Transfers Conservation of energy Work done Gravitational potential energy Elastic potential energy Kinetic energy Dissipation Friction Efficiency Power Conduction <i>Infrared radiation</i> Insulation

		- Power - Energy and power <i>Induced potential and the national grid</i>			Renewable Non-renewable Electricity: <i>Field</i> <i>Static electricity</i> Current Charge Potential difference Resistance Series Parallel Diode LED LDR Thermistor Ohmic Non-ohmic Alternating current Direct current Electrical power Particle model of matter: Density Physical change Chemical change Kinetic theory Conservation of mass Change of state Latent heat Specific latent heat (vaporisation & fusion) Internal energy Specific heat capacity <i>Pressure</i>
Year 10	<u>Atomic Structure</u> - Atoms and isotopes - Development of the model of the atom - Atoms and nuclear radiation - Nuclear equations - Half-life - Radioactive contamination - Hazards and uses of radioactive emissions	<u>Forces</u> - Scalar and vector quantities - Contact and non-contact forces - Resultant forces - Weight, mass and gravity - Centre of mass - Work and energy - Forces and elasticity - Parallelogram of forces	<u>Motion</u> - Speed, distance and time - Distance-time graphs - Velocity and acceleration - Newton's laws - Weight and terminal velocity - Forces and braking		Atomic structure: Atom Ion Alpha Beta Gamma Unstable Decay Activity Plum pudding

	Nuclear fission and fusion	- Resolution of forces - Moments at work - More about levers and gears - Moment and equilibrium - Pressure and surfaces - Pressure in liquids at rest - Atmospheric pressure - Pressure and surfaces - Pressure in liquids at rest - Atmospheric pressure - Upthrust and floatation	- Momentum - Conservation of momentum - Impact forces and safety Waves - The nature and properties of waves - Reflection of waves - Sound waves - Reflection and refraction of light - Sound waves - Uses of ultrasound - Seismic waves		Alpha particle scattering Penetrating power Ionising power Half-life Fission Fusion Waves: Transverse Longitudinal Oscillation Frequency Wavelength Reflection Refraction Sound waves Ultrasound Seismic waves Electromagnetic waves Light Refraction of light Reflection of light Colour of light Lenses Real image Virtual image
Year 11	Waves continued - The electromagnetic spectrum - Infrared radiation - Communications and ultraviolet waves, x-rays and gamma rays - X-rays in medicine and electromagnetic waves - Lenses - Visible light - Black body radiation	Magnetism and Electromagnetism - Magnetism and magnetic forces - Compasses and magnetic fields - The magnetic effect of a solenoid - Flemings left hand rule - Calculating the force on a conductor - Electric motors - Loudspeakers - The generator effect - Loudspeakers and microphones - Transformers	REVISION	- Electromagnetic radiation transfers energy, and differences in wavelength and frequency determine its uses and hazards. - Electric currents and magnetic fields interact, allowing energy to be transferred and electricity to be generated. - Gravitational forces govern the motion of objects in space, and stars drive the formation and evolution of the Universe.	Electromagnetic waves: Electromagnetic wave Electromagnetic spectrum Radiation Wave Energy Frequency Wavelength Wave speed Vacuum Transverse wave Magnetism & Electromagnetism: Magnetic field Induced magnetism Attract Repel Solenoid Electromagnet Relay Motors Generators

					<i>Transformers</i> <i>Space physics:</i> <i>Main sequence</i> <i>Life-cycle (of a star)</i> <i>Satellites</i> <i>Orbits</i> <i>Red-shift</i> <i>Blue-shift</i> <i>Universe</i> <i>The Big Bang</i>
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GCSE External assessment:

Combined science is assessed by six written examinations, each exam lasting 1 hour and 15 minutes. All examinations are taken at the end of Year 11. Two grades are awarded as described in the table.

	Weighting	The qualification will be graded on a 17-point scale: 1 – 1 to 9 – 9, where 9 – 9 is the best grade. This counts as two GCSE grades.
Biology paper 1	16.7%	
Biology paper 2	16.7%	
Chemistry paper 1	16.7%	
Chemistry paper 2	16.7%	
Physics paper 1	16.7%	
Physics paper 2	16.7%	

Students studying the separate sciences will achieve three science GCSEs at the end of Year 11. These will be in the following subjects

- GCSE biology
- GCSE chemistry
- GCSE physics

All content is examined at the end of Year 11. All of the GCSE science courses are split into two units:

	Weighting	
Biology Paper 1	50%	A GCSE grade in Biology from grade 9 to grade 1
Biology Paper 2	50%	
Chemistry Paper 1	50%	A GCSE grade in Chemistry from grade 9 to grade 1
Chemistry Paper 2	50%	
Physics Paper 1	50%	A GCSE grade in Physics from grade 9 to grade 1
Physics Paper 2	50%	

Each examination is available at two tiers. Teachers will use internal class assessments to decide which tier is most appropriate for you.

Tier	Available Grades
Higher	4-9 if studying the separate sciences 4-4 to 9-9 if studying combined science
Foundation	4- 5 if studying the separate sciences 1-1 to 5-5 if studying combined science

In addition to acquiring knowledge and understanding, students learn a range of practical and investigative skills that are assessed in each of the 6 examinations.

SMSC in science:

Spiritual development in science

In the science department we look to maintain a neutral approach as we study issues and ideas which are sometimes a source of tension in our society today. The modern world is full of potential areas for conflict, when scientific and spiritual ideas come together. Students will study topics such as evolution and the universe's origins using an evidence-based approach. This means scientific theories can be introduced then evaluated from an unbiased perspective. From this students often see how it is possible for spiritual and scientific theories to exist alongside each other, and how this may lead to more tolerance of different viewpoints.

Moral development in science

Rapid advances in science have given us the opportunity to influence and change the world in which we live, often with positive outcomes. However, the new powers given to society by science have also led to moral issues arising, and in lots of cases vigorous debate surrounds these ideas, for example with genetically modified organisms. We give students the opportunity to engage with some of the most significant scientific developments and to weigh up the evidence to form their own conclusions on some moral issues facing society today. This is not only a key exam skill, but a vital skill for all students as they develop as young adults.

Social development in science

The impact of science on society is extremely significant. Medical advances in particular are changing the way we live, with a continued increase in global population and longer life expectancy. Students will study the scientific advances that have led to this, the problems caused and possible solutions to them, whilst being encouraged to deepen their own understanding and form and support views using scientific fact. Through this approach students will gain a wider perspective on the changing society that surrounds them.

Cultural development in science

Achievement in the field of science is truly global, and promoting cultural awareness is an intrinsic part of the science curriculum. From the Russian origins of the periodic table to the discovery of radioactivity by the French physicist Henri Becquerel, progress in all areas of scientific study is a consequence of a worldwide commitment to continuing discovery.