Curriculum overview: Physics

Content studied during 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

1. Energy & Energy transfers in systems
2. Energy resources & electricity generation
3. Electrical circuits
4. Domestic electricity
5. Particles in solids, liquids and gases and how they behave under certain conditions
6. Structure & development of the atom
7. Ionising radiation & its' effects
8. Forces & their interactions
9. Waves
10. Magnetism and electromagnetism
11. 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.

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 though 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	**Forces and motion** ▪ Balanced and unbalanced forces (to include contact & non-contact) ▪ Explaining forces (to include forces & fields) ▪ Upthrust ▪ Friction (to include air resistance) ▪ Weight, mass, gravity (and Isaac Newton) ▪ Density ▪ Pressure (crushing can) ▪ Speed	**Earth and beyond** ▪ Solar system- order of planets, data & patterns, groupings of planets etc. ▪ Earth & planets- seasons, day/night, years ▪ The moon –tides, eclipses, phases ▪ Orbits (Comets & Satellites) ▪ The Sun & stars ▪ The big bang **Sound** ▪ Sound waves ▪ The Ear	**Electricity** ▪ Symbols & making circuits ▪ Current, Charge Voltage (energy) ▪ Series circuits ▪ Parallel circuits ▪ Resistance ▪ Ohm's law ▪ Static electricity	▪ How objects move and how their movement can be affected ▪ Understanding of objects in motion linked to their speed and how easy it is to stop these objects in terms of energy ▪ Waves transfer energy and can come in different forms such as light, sound ▪ How fast the speed of sound actually is, ▪ Basic circuit construction ▪ Circuit symbols	Contact force Non-contact force Force diagram Newtonmeter Resultant Vector Accelerating Decelerating Steady speed Buoyancy Reaction forces Friction Air resistance Mass Weight	Year Hemishpere Waxing Waning Geostationary Low polar Orbit length Orbit speed Elliptical Fusion Main sequence Expand Contract Red shift Blue shift Series

	▪ Thinking, stopping, braking distances ▪ D-T graphs	▪ Speed of Sound		▪ Series and parallel circuits	Gravitational field strength Newtons Kilograms Mass Volume Displacement Area Pascals Speed Velocity Time Stationary Reaction time Planet Universe Solar System Diameter Tilt Axis Day Month	Parallel Coulomb Electron Energy transferred Conductor Charge Current Potential difference Ohms Electrons Ohmic Non-ohmic Insulator Vibration Medium Amplitude Wavelength Frequency Pitch Loudness
Year 8	**<u>Energy</u>** ▪ Energy stores and transfers ▪ Efficiency ▪ Heat and temperature ▪ Conduction ▪ Convection & infrared Radiation ▪ Work done ▪ Energy and power ▪ Cost of energy & payback time ▪ Energy resources ▪ Insulation **<u>Nuclear physics</u>** ▪ Atoms ▪ Alpha, beta, gamma ▪ Half life ▪ Nuclear power and radiation uses ▪ Nuclear safety and issues	**<u>Magnetism</u>** ▪ Magnetic fields- magnetic/non, shape of bar magnet field, compass & iron filings, Earth's magnetic field ▪ Electromagnets- making, testing, uses (electric bell) ▪ Relays and circuit breakers (reed switch) ▪ Motors- demo making motors/viewing motors in context, how you make it, what can affect direction/speed	**<u>Waves</u>** ▪ Types of waves (Transverse and longitudinal, light Vs. sound) ▪ Light (translucent, transparent, shadows, opaque etc.) ▪ Reflection ▪ Refraction ▪ Dispersion (and EM spectrum) ▪ The eye ▪ Lenses ▪ Filters & colour	As Yr 7 plus: ▪ Energy transfers for a rnage of different scenarios ▪ Understanding of the law of conservation of energy ▪ Efficiency as a ratio of energy usefully transferred ▪ Atoms and particle interactions such as pressure and changes of state ▪ Ionising radiation; alpha, beta and gamma in terms of their penetrating and ionising power ▪ Magnets and magnetic fields ▪ Transverse and longitudinal waves with examples	Energy store Energy transfer Conservation Created Destroyed Sankey diagram Joules Degrees Celcius Kinetic Internal Kinetic Ions Conductors Insulators Emit Absorb Reflect Joules Newtons Gravitational forces Rate Watts Kilowatt hours Renewable Non-renewable Transformer	neutron Geiger counter Alpha Beta Gamma Penetration Background radiation ionising Count rate Nuclei Decay Radioactive isotope Irradiated Contaminated ionising Attract Repel Field Solenoid Relay Circuit breaker Transverse Longitudinal Wavelength Frequency Translucent

					Finite Thermal conductivity Isotopes Subatomic Relative charge relative mass Atomic number Nucleus Proton Electron	Transparent Opaque Refraction Reflection Dispersion Spectrum Convex Concave Transmit Absorb
Year 9	**<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 ▪ *Gas pressure and temperature* ▪ *Increasing the pressure of a gas*	**<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 ▪ *Nuclear fission and fusion*	**<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	▪ Energy transfers carried by waves ▪ Structure of the atom in terms of electric charge and flow ▪ Understanding of charges linked to attraction and repulsion	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 *Pressure* Atomic structure: Atom Ion Alpha Beta Gamma Unstable Decay	Penetrating power Ionising power Half-life *Fission* *Fusion* Energy: Stores Transfers Conservation of energy Work done Gravitational potential energy Elastic potential energy Kinetic energy Dissipation Friction Efficiency Power Conduction *Infrared radiation* Insulation Renewable Non-renewable

					Activity Plum pudding Alpha particle scattering	
Year 10	**<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 ▪ *Static electricity* ▪ Power ▪ Energy and power	**<u>Waves</u>** ▪ The nature and properties of waves ▪ Reflection of waves ▪ Sound waves ▪ *Reflection and refraction of light* ▪ 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*	**<u>Magnetism and Electromagnetism</u>** ▪ 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* ▪ *Induced potential and the national grid*	▪ Electricity ad magnetism in terms of forces acting at a distance	Electricity: *Field* *Static electricity* Current Charge Potential difference Resistance Series Parallel Diode LED LDR Thermistor Ohmic Non-ohmic Alternating current Direct current Electrical power 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* Magnetism & Electromagnetism: Magnetic field Induced magnetism Attract Repel Solenoid Electromagnet Relay Motors *Generators* *Transformers*
Year 11	**<u>Forces</u>** ▪ Forces and their interactions ▪ Weight ▪ Resultant forces ▪ Free body diagrams ▪ Free fall body diagrams ▪ Vector diagrams ▪ Work done and energy transfer ▪ Forces and elasticity ▪ *Moments, levers, and gears* ▪ *Pressure, and pressure differences in fluids* ▪ Forces and motion ▪ Distance, displacement, speed and velocity ▪ Distance-time graphs				Forces: Contact Non-contact Scalar Vector Magnitude Newton's laws (1^{st}, 2^{nd}, 3^{rd}) Friction Resultant *Moments* *Levers* *Gears* Parallelogram of forces Resolution of forces Velocity	Terminal velocity Momentum *Conservation of momentum* Elasticity Pressure in solids *Pressure in liquids* *Atmospheric pressure* *Upthrust* *Space physics:* *Main sequence* *Life-cycle (of a star)* *Satellites*

	▪ Speed-time graphs ▪ Required practical: acceleration ▪ Uniform motion ▪ Terminal velocity ▪ Newton's laws ▪ Stopping and braking distances ▪ Momentum ▪ *Changes in momentum* ***Space physics*** ▪ *Our solar system* ▪ *Life cycle of a star* ▪ *Orbital motion and natural and artificial satellites* ▪ *Red shift*				Acceleration Stationary Steady speed Weight	*Orbits* *Red-shift* *Blue-shift* *Universe* *The Big Bang*

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	
Biology paper 1	16.7%	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 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.