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

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
HT is for Higher Tier only

	Term 1	Term 2	Term 3	Portable knowledge	Key terms
Year 7	**Introduction to Working Scientifically** ▪ 1. Lab safety ▪ 2. Risks and hazards ▪ 3. Making observations ▪ 4. Using a Bunsen ▪ 5. Recording data ▪ 6. Interpreting & evaluating data ▪ 7. Command Words **Forces - speed & gravity** ▪ 1. Motion: Speed, velocity & acceleration ▪ 2. Motion: DT graphs	**Energy Costs & Energy transfer** ▪ 3. Energy transfer burning food ▪ 4. Fossil fuels ▪ 5. Renewable energy ▪ 6. Making & paying for electricity **Electricity and circuits** ▪ 1. Static electricity ▪ 2. Describing electrical circuits ▪ 3. Understanding electrical circuits ▪ 4. Resistance ▪ 5. Series circuits ▪ 6. Parallel circuits	**Waves - Sound & Light** ▪ 1. Waves and energy ▪ 2. Using wave properties ▪ 3. Sound systems ▪ 4. Exploring light ▪ 5. How light travels ▪ 6. 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	Force diagram Newtonmeter Resultant Vector Accelerating Decelerating Steady speed Reaction forces Friction Air resistance Mass Weight Gravitational field strength Newtons Kilograms Mass Volume

	▪ 3. Motion: Investigating speed: PRAC ▪ 4. Motion: Investigating speed: Write up ▪ 5. Motion: Relative speed ▪ 6. Forces: effects, types, force diagrams ▪ 7. Forces: balanced & unbalanced ▪ 9. Forces: Investigating unbalanced forces **Energy Costs & Energy transfer** ▪ 1. Energy types & transfers ▪ 2. Energy transfers & effieciency ▪				Displacement Area Speed Velocity Time Stationary Reaction time Conduction Convection Radiation Fossil fuels Energy store Energy transfer Conservation Created Destroyed Joules Degrees Celcius Renewable Non-renewable Kilowatt hours Finite

Year 8	**The Universe** ▪ 1. Stars and galaxies ▪ 2. Effect of Earth's motion ▪ 3. The Universe ▪ 4. Models in Science ▪ 5. Forces: Mass, gravity & weight ▪ 6. Forces: size & effect of gravity, orbits **Contact Forces & Pressure** ▪ 1. Contact and non contact forces ▪ 2. Friction ▪ 3. Contact forces and pressure ▪ 4. Upthrust ▪ 5. Pressure theory ▪ 6. Pressure in liquids ▪ 7. Atmospheric pressure	**Magnestism & Electromagnestism** ▪ 1. Magnets and magnetic materials ▪ 2. Magnetic fields ▪ 3. Earth's magnetic field and navigation ▪ 4. Electromagnets ▪ 5. Using electromagnets **Work, Heating & Cooling** ▪ **1. Work** ▪ 2. Moments ▪ 3. Levers ▪ 4. Conduction ▪ 5. Convection ▪ 6. Radiation ▪ 7. Heating water	**Wave Effects & Wave Properties** ▪ 1. Waves and Energy ▪ 2. Using Wave properties2 ▪ 3. Sound Systems ▪ 4. Exploring Lighet ▪ 5. Light vs sound ▪	• Energy transfers for a range 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	Kinetic Internal Ions Conductors Insulators Emit Absorb Reflect Joules Newtons Rate Watts Thermal conductivity Isotopes Subatomic Relative charge relative mass Atomic number Nucleus Proton Electron neutron Geiger counter Alpha Universe Solar System Star Galaxy Light Year Force Friction Air Resistance Contact force Non-contact force Pressure Upthrust Wave Amplitude Frequency Wavelength Reflection

					Beta Gamma Penetration Background radiation ionising Nuclei Decay Radioactive isotope ionising Attract Repel Field Solenoid Relay Circuit breaker Transverse Longitudinal Wavelength Frequency Translucent Transparent Opaque Refraction Reflection Dispersion Spectrum Convex Concave Transmit Universe Solar System Star Galaxy Light Year Force Friction Air Resistance Pressure Upthrust

Year 9	**Energy** ▪ 1. Energy stores ▪ 2. Energy transfers ▪ 3. Efficiency ▪ 4. GPE ▪ 5. Kinetic energy ▪ 6. EPE ▪ 7. SHC ▪ 8. SHC REQ PRAC ▪ 9. Work ▪ 10. Power ▪ 11. Work and power ▪ 12. Energy resources ▪ 13. Generating electricity ▪ 14. Energy issues ▪ 15. Conduction ▪ Infrared TRIPLE ONLY ▪ Insulation REQ PRAC TRIPLE ONLY ▪ 16. Insulation in buildings	**Electricity** ▪ 1. Circuit types & component symbols ▪ 2. Current & charge ▪ 3. Resistance ▪ 4. Resistance in a wire RPRAC. ▪ 5. RPRAC write up ▪ 6. Ohms law & I-V graphs ▪ 8. RPRAC write up ▪ 9. Current in series & parallel circuits ▪ 10. Potential difference in parallel & series circuits ▪ 11. Resistance in parallel & series circuits ▪ 12. Ohmic and non-ohmic conductors ▪ 15. AC and DC ▪ 16. Plugs and Cables	**Particle model** ▪ 1. Density ▪ 2. Density of regular shapes RPRAC ▪ 3. Density of irregular shapes RPRAC ▪ 4. Density of liquids RPRAC ▪ 5. Change of state ▪ 6. Cooling & heating curves ▪ 8. Specific heat capacity ▪ 9. Specific latent heat ▪ 10. Particle motion of gases ▪ 11. Gas pressure & temperature ▪ 12. Gas pressure & volume ▪	- Energy transfers in particles - Interaction between particles in solids, ;liquids & gases - Effect of heating and cooling on substances - Energy transfers carried by waves -	Electricity: Current Potential Difference Resistance Power Energy Transfer Series circuit Parallel circuit Static Charge National Grid Transformer Energy: Stores Transfers Conservation of energy Work done Gravitational potential energy Elastic potential energy Kinetic energy Dissipation Friction Efficiency Power Conduction Insulation Renewable Non-renewable 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

Year 10	**Atomic Structure** ▪ 1. Structure of atoms ▪ 2. Ions, ionisation & isotopes ▪ 3. Development of atomic model ▪ 4. Radioactive decay - types of radiation & properties ▪ 5. Radiation - dangers (penetration & ionisation) ▪ 6. Nuclear decay equations ▪ 7. Half life (and consolidation assessment) ▪ 8. Half life graphs (& practical) ▪ 9. Hazards and uses of radiation ▪ Radiation in medicine ▪ Nuclear fission ▪ Nuclear fusion ▪ Nuclear issues - HW (also partly covered in fission & fusion)	**Forces** ▪ 1. Scalars and vectors ▪ 2. Forces basics ▪ 3. Resultant forces ▪ 4. Weight and mass ▪ 5. Centre of mass. ▪ 6. Work and energy ▪ 7. Forces and elasticity ▪ 8. REQ PRAC: Hooke's law ▪ 9. Hooke's law RPRAC write up ▪ 10. Parallelogram of forces (HT ONLY) ▪ 11. Resolution of forces (HT ONLY) ▪ Moments and levers ▪ Gears ▪ Pressure in fluids ▪ Effects of depth & density on pressure in fluids ▪ Atmospheric pressure ▪ Upthrust & floatation	**Motion** ▪ 1. Speed and velocity ▪ 2. Distance-time graphs ▪ 3. Acceleration ▪ 4. Accleration RPRAC ▪ 5. Velocity-time graphs ▪ 6. SUVAT equations (HT only) ▪ 7. Motion of falling objects - acceleration & terminal velocity ▪ 8. Newtons 1st Law of motion ▪ 9. Newton's 2nd Law of motion (Inertial mass HT only) ▪ 10. Newtons 3rd Law ▪ 11. Stopping distances ▪ 12. Momentum (HT only) ▪ 13. Conservation of momentum ▪ 14. Force as the rate of change in momentum (impact forces)	▪ Energy transfers carried by waves ▪ Structure of the atom in terms of electric charge and flow ▪ Energy transfers in particles ▪ Interaction between particles in solids, ;liquids & gases ▪ Unbalanced forces cause an object to change its motion ▪ ▪	Atomic structure: Atom Ion Alpha Beta Gamma Unstable Decay Activity Plum pudding Alpha particle scattering Penetrating power Ionising power Half-life *Fission* *Fusion* Forces in action: Vectors Scalars dispacement Acceleration Deceleration inertia Resultant force Terminal velocity Moment Gear Principle of moments Impact forces Equilibrium Balanced forces Unbalanced forces Drag Friction Limit of proportionality Pressure Atmospheric pressure Altitude upthrust

Year 11	**Forces B: Motion** ▪ 1. Speed ▪ 2. Distance-time graphs ▪ 3. Veolcity-time graphs ▪ 4. SUVAT equations (HT only) ▪ 5. Acceleration + REQ PRAC ▪ 6. Acceleration + REQ PRAC cont. ▪ 7. Newton's Laws ▪ 8. Terminal velocity ▪ 9. Stopping distance, reaction time, impact forces & collisions ▪ 10. Momentum ▪	**Waves** ▪ *1. Wave types & properties* ▪ 2. Wave calculations ▪ 3. Waves in fluids & solids. REQ Prac ▪ Reflection & refraction ▪ Sound, imaging, sonar & seismic waves ▪ 4. EM spectrum, dangers & uses ▪ 5. Refraction of (EM) waves ▪ 6. IR Required practical ▪ Radio waves & electrical circuits (HT only) ▪ Concave & convex lenses ▪ Colour vision ▪ Emission & absorption of IR radiation ▪	***Revision for paper 2*** ▪ Forces ▪ Waves ▪ Magnetism & electromagnetism	- Understanding of charges linked to attraction and repulsion - Electricity ad magnetism in terms of forces acting at a distance	Waves: Transverse Longitudinal Oscillation Frequency Wavelength Reflection Refraction Sound waves Electromagnetic waves Transverse Longitudinal Oscillation Frequency Wavelength Reflection Refraction Sound waves *Ultrasound* *Seismic waves* Electromagnetic waves *Light* *Refraction of light* *Reflection of light* Magnetism & Electromagnetism: Magnetic field Induced magnetism Attract Repel Solenoid Electromagnet Relay Motors *Generators* *Transformers*
		Revision for Paper 1 ▪ ***Energy*** ▪ Electricity ▪ Particle model of matter ▪ Atomic structure			

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.

Key Stage 5 Curriculum Overview

Subject: Physics

Year 12

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2	Assessment
Measurements and their errors ▪ SI units and base units ▪ Standard form and prefixes ▪ Limitations of physical measurements Particles & Radiation; Matter and radiation ▪ Inside the atom ▪ Stable and unstable nuclei ▪ Photons ▪ Particles and antiparticles ▪ Particle interactions Particles and radiation; Quarks and leptons ▪ The particle zoo ▪ Particle sorting ▪ Leptons at work ▪ Quarks and antiquarks ▪ Conservation rules	Particles and radiation; ▪ Quantum phenomena ▪ Photoelectric effect ▪ Photoelectricity ▪ Collisions of electrons with atoms ▪ Energy levels in atoms ▪ Energy levels in spectra ▪ Wave-particle duality Waves & Optics; Waves ▪ Waves and vibrations ▪ Measuring waves ▪ Wave properties ▪ Stationary and progressive waves ▪ Waves on strings ▪ Oscilloscopes	Waves & Optics; Optics ▪ Refraction of light ▪ More about refraction ▪ Total internal reflection ▪ Double slit interference ▪ Diffraction ▪ Diffraction gratings Mechanics and materials; ▪ Forces in equilibrium ▪ Vectors and scalars ▪ Balanced forces ▪ Moments ▪ Stability ▪ Equilibrium ▪ Statics calculations	Mechanics and materials; On the move ▪ Speed and velocity ▪ Acceleration ▪ Motion along a straight line ▪ Free fall ▪ Motion graphs ▪ Projectile motion Mechanics and materials; Newton's laws of motion ▪ Force & acceleration ▪ Terminal speed ▪ On the road ▪ Vehicle safety	Mechanics and materials; Force & momentum ▪ Momentum and impulse ▪ Impact forces ▪ Conservation of momentum ▪ Elastic and inelastic collisions ▪ Explosions Work, energy & power ▪ Work and energy ▪ Kinetic energy and potential energy ▪ Power ▪ Energy and efficiency ▪ Mechanics and materials; ▪ Materials ▪ Density ▪ Springs ▪ Deformation of solids ▪ Stress and strain	Electricity; Electric current ▪ Current and charge ▪ Potential difference and power ▪ Resistance ▪ Components and their characteristics Electricity; DC circuits ▪ Circuit rules ▪ More about resistance ▪ EMF and internal resistance ▪ Circuit calculations ▪ Potential dividers Mechanics and materials; Materials ▪ Density ▪ Springs ▪ Deformation of solids ▪ Stress and strain	CPAC Mock assessments End of unit assessment Exam question homework In-class deliberate practice

Key Stage 5 Curriculum Overview

Subject: Physics

Year 13

Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2	Assessment
Further mechanics & thermal physics; Motion in a circle ▪ Uniform circular motion ▪ Centripetal acceleration ▪ On the road ▪ At the fairground Simple harmonic motion ▪ Oscillations ▪ Principles of SHM ▪ Sine waves ▪ Applications of SHM ▪ Forced vibrations & resonance Further mechanics & thermal physics; Thermal physics ▪ Internal energy and temperature ▪ Specific heat capacity ▪ Change of state	Further mechanics & thermal physics; Gases ▪ Experimental gas laws ▪ Ideal gas law ▪ Kinetic theory of gases Fields; Gravitational fields ▪ Gravitational field strength ▪ Gravitational potential ▪ Newton's law of gravitation ▪ Planetary fields ▪ Satellite motion Electric fields ▪ Field patterns ▪ Electric field strength ▪ Electric potential ▪ Coulomb's law ▪ Point charges ▪ Comparing electric & gravitational fields	Fields; Capacitors ▪ Capacitance ▪ Energy stored in a charged capacitor ▪ Charging and discharging a capacitor through a fixed resistor ▪ Dielectrics Magnetic fields ▪ Current-carrying conductors in a magnetic field ▪ Moving charges in a magnetic field ▪ Charged particles in circular orbits Electromagnetic induction ▪ Generating electricity ▪ Laws of electromagnetic induction ▪ AC generator ▪ AC and power	Nuclear physics; Radioactivity ▪ Discovery of the nucleus ▪ α, β, & γ radiation ▪ dangers of radioactivity ▪ radioactive decay ▪ isotopes in use ▪ decay modes ▪ nuclear radius Nuclear physics; Nuclear energy ▪ energy and mass ▪ binding energy ▪ fission ad fusion ▪ thermal nuclear reactor Optional module: Astrophysics	Optional module: Astrophysics Revision		CPAC Mock assessments End of unit assessment Exam question homework In-class deliberate practice