A Level Physics
Curriculum Overview

We have designed a Physics curriculum to offer students the opportunity to develop understanding and awareness of the physics around them and to evaluate critically how science and technology changes their society. We aim to inspire them to become fascinated with the subject and as a result become life-long learners. They will learn how physics has developed over time, building on the understanding and research of others, and the importance of scientists working as a community. We aim for them to be able to hold their own point of view about developments in the world of Physics and articulate advantages and disadvantages, broadening their awareness through critical thinking, research, debate and discussion.

Through careful planning of taught content and independent tasks we will help the students to develop teamwork skills, apply numeracy and learn to effectively communicate their knowledge. Through scientific enquiry they will learn to ask scientific questions and use the laboratory resources and equipment to provide data to come to conclusions. This will allow them to make connections between the scientific principles and theory they learn and motivated to apply to the applications in everyday life. Students will also be encouraged to make connections between technology and the world around us and how physics has forwarded our understanding of the Universe. We endeavour to show the varied occupations that are available to them using Physics, and specific Physics and Engineering careers. Throughout the course they will be given the opportunity to apply their understanding of physics principles to the constantly changing world around them and how it can be used to positively impact the future. We do this using quality first teaching which ensures students understand underlying physics principles and can apply them in a variety of familiar and unfamiliar, challenging contexts.

Whilst we want students to achieve the very best exam results possible, we believe our curriculum needs to go beyond what is examinable and we have designed it to support learners for a changing world. We have coherently planned the curriculum to be ambitious, broad and yet balanced for all students with sequencing which allows for skills to be developed at each stage. We believe that it is important to both allow for bridging from KS4 to KS5 whilst stretching the most able and allowing learners to finish the course prepared to study physics at a higher level. We aim to use both teacher and peer modelling to promote high standards whilst developing respect, tolerance and courtesy. Through cross curriculum links, discussion of careers and physics in the wider world we reflect learners places in their wider community. From a seamless transition from KS4 to KS5 to a curriculum with extensive breadth and depth we encourage personal development which inspires drive, passion and commitment.

Collaborative, detailed and thorough curriculum planning lies at the heart of what we do in the department. We use all available resources and teaching strategies to ensure that students have a comprehensive knowledge of the specifications and are capable of going beyond what is taught in lessons. To complement the schemes of work students also engage in activities that allow students to gain valuable insight into the subject and the demands of the examination. The order in which we teach has been carefully planned to include opportunities for students to

demonstrate their developing skills whilst building their knowledge. We have chosen topics to teach in parallel with each other which complement each other in terms of transferable skills and building up the level of knowledge and understanding required.

Practical work forms a key part of our planning. Students need to be able to independently plan investigations to answer scientific questions using appropriate equipment and explaining their choices and the rationale behind their ideas. As well the practical work the students are required to do, investigations are planned in as often as possible and where relevant. This allows students to see physics in action, to apply the theory and laws they are learning and analyse data to draw conclusions, supported by evidence. Students will have the opportunity to work independently with equipment and planning but also collaboratively with their peers to share ideas and understand the importance of working in a team as scientists. We aim for students to finish the course being able to both plan and evaluate their own results and analyse the results of others.

To complement the curriculum and what is visible in lessons we also provide guidance for all students with their learning through drop in sessions and setting up peer support groups. We provide feedback in a variety of ways such as self-assessment to encourage pupils to use and understand mark schemes plus verbal and detailed written feedback. We help to prepare and enter students for the Senior Physics Challenge competition. We encourage students to attend free lectures at local Universities such as guest lecturer series at Keele University. We have supported students in completing extra-curricular challenges such as Oxnet summer schools. We also provide personalised support for Physics and engineering related degree courses and apprenticeships including preparation for the PAT and BMAT.

Physics - encourages the development of fundamental physics knowledge and understanding through opportunities of working scientifically. A level study in physics builds on the foundations for understanding the physical world developed during study of GCSE Physics. Physics understanding is changing our lives and is vital to the world's future prosperity, and all students should be taught essential aspects of the knowledge, methods, processes, and uses of this field. Physics helps students to develop curiosity about the natural world, gives them insight into how science works, and provides an appreciation of its relevance to their everyday lives. The scope and nature of such study is broad, coherent, practical and satisfying, and thereby encourages students to be inspired, motivated and challenged by the subject and its achievements. Students are helped to appreciate how the complex and diverse phenomena of the physical world can be described in terms of a small number of key ideas which are inter-linked and are of universal application. Physics is fundamentally an experimental subject. This curriculum provide numerous opportunities to use practical experiences to link theory to reality, and equip students with the essential practical skills they need. Required practicals allow students the opportunity to develop knowledge and understanding of key skills for future learning and careers.

Trips and Visits

Possible trip to see working nuclear facilities (tasks include study of light and lasers) and to Christie hospital to support uses of nuclear radiation topics

Assessment

Assessment will be covered lesson by lesson using practical work and exam style questions (multiple choice and longer questions), assessed homework and end of unit and topic assessments.

Exam style questions set up with specified content tested in each of the first two papers at A-level to help students prepare for their exams Short answer, longer answer questions and a variety of assessment styles within each paper so students can confidently engage with the questions

Multiple choice questions are included to allow for a wide breadth of Physics from the specifications to be tested.
Assessments will cover one or two chapters of content.

In Year 1 students will take two mock exams after completing the Year 1 content. In Year 2 students will complete an assessment at the start of the year to cover content covered in Year 1, they will then take three mock exams after all content has been covered.

Homework

Each lesson students must complete self -assessed summary work, fortnightly they will complete an assessed piece of homework, weekly they will complete an exam style questions relevant to the content.

Clubs and/or intervention

Twice weekly drops in in Year 1, twice weekly registered intervention in Year 2. Students will also be invited to assist with KS3 science club and KS4 revision.

Parental/Carer support

VLE resources, Bromcom communication, parent fact sheet, and email communication.

Helpful sources of information

VLE, AQA website, A Level Physics online, Kerboodle.com, and Seneca learning.

Connections to future pathways:

Careers: accelerator operator, acoustic consultant, aeronautical engineer, aerospace engineer, architect, astronomer, astrophysicist, auto electrician Broadcast engineer, broadcast technician, CERN, communication equipment operator , construction, control and instrumentation engineer, cosmologist, data communication analyst, design engineer, drilling engineer, electrical engineer, electronics engineer, electrician, electronic engineer, energy engineer, engineering geologist, fibre optic engineer, field service engineer, functional safety engineer, generator technician, generator engineer, geochemist, geoscientist, green construction manager, heating engineer, hydrographic surveyor, instrument field engineer / technician, laser engineer, laser/optical physicist, mechanic, mechanical engineer, medical scientist, medicine, meteorologist, mining engineer, mudlogger, network systems analyst, nuclear medicine, nuclear physicist, nuclear technician, optical engineer, optician, optoelectonics, optometrist, particle physicist, power plant operator, physicist, programmer radio dispatcher, prosthetics, radar operator, radiographer, renewable energy consultant, research physicist, research scientist, renewable energy sales representative, rocket scientist, satellite engineer, ship builder, signals intelligence analyst, solar project manager, technical manager, theoretical physicist, vehicle crash engineer, vehicle safety engineer, wind farm site manager.

Future learning: Physics degree, engineering degree, mathematics degree, engineering apprenticeships

Year 12 Overview

<table>
<tr><th>Term</th><th>Knowledge</th><th>Assessment</th><th>Connections to learning</th></tr>
<tr><td rowspan="2">Autumn 1</td><td colspan="3">Big Ideas:
1 Measurements and their errors
A working knowledge of the specified fundamental (base) units of measurement is vital. Likewise, practical work in the subject needs to be underpinned by an awareness of the nature of measurement errors and of their numerical treatment. The knowledge developed through this topic will enable them to make accurate estimations and this is required throughout the course and beyond.
Big Questions: Why is the importance of accurate and precise measurements important? Space travel – include the ethics of funding eg James Webb space telescope

2 Waves and Optics
Knowledge of wave phenomena developed at KS3 and 4 is extended through a development of knowledge of the characteristics, properties, and applications of travelling waves and stationary waves. Topics treated include refraction, diffraction, superposition and interference. Students are able to apply their current understanding to new and more challenging examples as well as underpinning the new ideas (superposition) and future concepts (quantum phenomena).
Big Questions: should we be able to fund treatment of eye conditions through the NHS? Electron diffraction analysing drugs used for future medicines

3 Mechanics
Vectors and their treatment are introduced followed by development of the student’s knowledge and understanding of forces, energy and momentum. This section and also the following section Electricity would provide a good starting point for students who prefer to begin by consolidating work but also provides new ideas for those who require additional challenge of new mathematical processes.
Big Questions: do we have a responsibility to ensure safety on the roads? Should cars have a maximum speed? Are the UK speed limits appropriate?</td></tr>
<tr><td><u>Measurements and their errors</u>
➢ Uncertainty
➢ Making careful measurements
➢ Everyday physics instruments
➢ Analysis and evaluation
➢ Data handling
➢ Trigonometry and algebra</td><td>➢ GCSE exam paper
➢ Transition booklet (practical tasks and self-assessed examples)
➢ Assessed homework (exam style questions based on</td><td>➢ KS3 the development of scientific thinking
➢ KS4 experimental skills and strategies, analysis and evaluation, vocabulary and units
➢ KS5 knowledge and measurements and their</td></tr>
</table>

	➢ Graphs and their gradients ➢ Split into both conceptual and procedural disciplinary knowledge of speci equipment (eg micrometer, venier calliper, digital and analogue meters)	measurements and errors	errors is essential for all aspects of KS5 course Personal development – careful measurements, following instructions
	<u>Matter and Radiation</u> • Inside the atom • Stable and unstable nuclei • Photons • Particles and antiparticles • Particle interactions <u>Quarks and leptons</u> • The particle zoo • Particle sorting • Leptons at work • Quarks and antiquarks Conservation rules	• Assessed homework (matter matters) • Assessed homework (specific charge) • Exam style questions lesson by lesson (on powerpoint) End of unit assessment (in spring term)	• KS4 Physics, atomic structure and the structure of matter • KS4 chemistry atoms, elements and compounds • KS3 states of matter KS5 fundamental forces and SI units Future A level units such as mass and energy, nuclear radiation Moral development – investing in particle physics Spiritual development
	<u>Forces in Equilibrium</u> ➢ Vectors and scalars ➢ Balanced forces ➢ The principle of moments ➢ More on moments ➢ Stability ➢ Equilibrium rules ➢ Statics calculations	➢ Stretch and challenge homework (‘putting ones foot down’) ➢ Moments questions homework (exam style questions ➢ Assessed homework ➢ Exam style question (on powerpoint lesson by lesson)	➢ KS3 motion and forces (describing forces, types of force, balanced forces, forces and motion) ➢ KS4 forces and forces in motion ➢ KS5 materials, Newtons law, work, energy and momentum Social development – including big questions on speed limits / cars

	<u>On the Move</u> ➢ Speed and velocity ➢ Acceleration ➢ Motion along a straight line at constant acceleration ➢ Free fall ➢ Motion Graphs ➢ Motion Calculations ➢ Projectile Motion	➢ Stretch and challenge homework (‘rockets’) ➢ Practical – acceleration down an inclined slope ➢ Exam style questions on powerpoint (lesson by lesson)	➢ KS3 describing motion ➢ KS4 Forces and motion ➢ speed of sound, estimating speeds and accelerations in everyday contexts ➢ interpreting quantitatively graphs of distance, time, and speed ➢ KS5 forces in equilibrium ➢ Future A level units such as Newtons laws and energy and momentum Social development – including big questions on speed limits / cars
Autumn 2	**Big Ideas:** **1 Optics (continued from Autumn 1)** Knowledge of wave phenomena developed at KS3 and 4 is extended through a development of knowledge of the characteristics, properties, and applications of travelling waves and stationary waves. Topics treated include refraction, diffraction, superposition and interference. Students are able to apply their current understanding to new and more challenging examples as well as underpinning the new ideas (superposition) and future concepts (quantum phenomena). *Big Questions: should we be able to fund treatment of eye conditions through the NHS? Electron diffraction analysing drugs used for future medicines* **2 Newton’s Law of Motion, Force and Momentum** Vectors and their treatment are introduced followed by development of the student’s knowledge and understanding of forces, energy and momentum. This topic consolidates and extends prior knowledge from both KS3 and 4. It utilises skills developed in complimentary subjects such as maths and engineering with more complex mathematical problems (using vectors and resolving forces). *Big Questions: do we have a responsibility to ensure safety on the roads? Should cars have a maximum speed? Are the UK speed limits appropriate?* **3 Matter and Radiation** This section introduces students both to the fundamental properties of matter, and to electromagnetic radiation and quantum phenomena. Teaching this topic at this point provides a new interest and knowledge dimension beyond GCSE but also requires use of essential skills developed in Autumn 1. Through a study of these topics, students become aware of the way ideas develop and		

	evolve in physics. They will appreciate the importance of international collaboration in the development of new experiments and theories in this area of fundamental research. *Big Questions: how much do British scientists contribute to international research (historically and currently)?*		
	<u>Optics</u> ➢ Refraction of light ➢ More about refraction ➢ Total internal reflection ➢ Double slit interference ➢ More about interference ➢ Diffraction ➢ The diffraction grating ➢ Disciplinary knowledge of procedural use of signal generator and vernier calliper	➢ Waves and optics exam style questions ➢ All chapter summary questions ➢ End of chapter exam style questions ➢ In lesson retrieval quiz and multiple choice hinge questions (on powerpoint lesson by lesson) ➢ End of unit assessment (Chapters 4 and 5) ➢ Required practical – diffraction grating, single slit interference	➢ KS3 Waves (observed waves, sound waves, energy and waves, light waves) ➢ KS4 Waves (observed waves, sound waves, energy and waves, light waves) ➢ KS5 optics and turning points (option module) ➢ KS5 measurements and their errors ➢ KS5 Theoretical physics, electromagnetism ➢ KS5 Turning points unit 1 – personal development (skills)
	<u>On the Move</u> ➢ Speed and velocity ➢ Acceleration ➢ Motion along a straight line at constant acceleration ➢ Free fall (disciplinary knowledge of different types of timer / light gates, comparison and advantages) ➢ Motion Graphs ➢ Motion Calculations ➢ Projectile Motion	➢ Exam style questions on powerpoint (lesson by lesson) ➢ End of chapter assessment – chapter 7 (on the move)	➢ KS3 describing motion ➢ KS4 Forces and motion ➢ speed of sound, estimating speeds and accelerations in everyday contexts ➢ interpreting quantitatively graphs of distance, time, and speed ➢ KS5 forces in equilibrium ➢ KS5 Newton's laws and energy and momentum

			Social development – including big questions on speed limits / cars
	<u>Newtons Law of Motion</u> ➢ Force and acceleration ➢ Using F=ma ➢ Terminal speed ➢ On the road ➢ Vehicle safety	➢ Exam style questions on powerpoint (lesson by lesson) ➢ Practical observations – trolleys and masses, pulleys and ramps ➢ End of unit exam (later in spring term)	➢ KS3 describing motion ➢ KS4 Forces and motion ➢ KS5 forces in equilibrium ➢ KS5 energy and momentum Social development – including big questions on speed limits / cars
	<u>Waves</u> ➢ Waves and vibrations ➢ Measuring waves ➢ Wave properties 1 ➢ Wave properties 2 ➢ Stationary and progressive waves ➢ More about stationary waves on a string ➢ Using an oscilloscope ➢ Disciplinary knowledge of procedural use of signal generator and vernier calliper	➢ Waves and optics exam style questions ➢ All chapter summary questions ➢ End of chapter exam style questions ➢ In lesson retrieval quiz and multiple choice hinge questions (on powerpoint lesson by lesson) ➢ End of unit assessment (Chapters 4 and 5) ➢ Required practical – stationary waves	➢ KS3 Waves (observed waves, sound waves, energy and waves, light waves) ➢ KS4 Waves (observed waves, sound waves, energy and waves, light waves) ➢ KS5 optics and turning points (option module) ➢ KS5 measurements and their errors 1 – personal development (skills)

	<u>Matter and Radiation</u> ➢ Inside the atom ➢ Stable and unstable nuclei ➢ Photons ➢ Particles and antiparticles ➢ Particles interactions ➢ Particle zoo ➢ Particle sorting ➢ Leptons at Work ➢ Quarks and antiquarks ➢ Conservation rules	➢ Matter and radiation exam style questions ➢ All chapter summary questions ➢ End of chapter exam style questions ➢ In lesson retrieval quiz and multiple choice hinge questions (on powerpoint lesson by lesson)	➢ KS3 Atomic structure ➢ KS4 atomic structure, periodic table ➢ KS5 optics and turning points (option module) ➢ KS5 measurements and their errors 4/5 - spiritual and moral development – particle accelerators
Spring 1	**Big Ideas:** **1 Force and momentum, work energy and power** Vectors and their treatment are introduced followed by development of the student's knowledge and understanding of forces, energy and momentum. The section continues with a study of materials considered in terms of their bulk properties and tensile strength. As with earlier topics, this section and also the following section Electricity would provide a good starting point for students who prefer to begin by consolidating work. *Big Question – what changes could be made to materials to allow the UK to cope better with extreme weathers?* **2 Quantum Phenomena** This section introduces students both to the fundamental properties of matter, and to electromagnetic radiation and quantum phenomena. Teachers may wish to begin with this topic to provide a new interest and knowledge dimension beyond GCSE. Through a study of these topics, students become aware of the way ideas develop and evolve in physics. They will appreciate the importance of international collaboration in the development of new experiments and theories in this area of fundamental research. *Big Question – is investment in quantum technology worth it? STM, TEM, MR and SQUIDs* **3 Electric current** This section builds on and develops earlier study of these phenomena from GCSE. It provides opportunities for the development of practical skills at an early stage in the course and lays the groundwork for later study of the many electrical applications that are important to society.		

	Big Question – should we be finding alternative ways to provide electricity to our homes given the global warming crisis and rising cost of living?		
	<u>Force and Momentum</u> ➢ Momentum and impulse ➢ Impact forces ➢ Conservation of momentum ➢ Elastic and inelastic collision ➢ Explosions	➢ Testing conservation of momentum (practical) ➢ Momentum exam question ➢ Multiple choice and exam style questions (lesson by lesson) ➢ Assessed homework – force and momentum exam style questions ➢ Assessment covering force, momentum and newton's laws of motion	➢ KS4 Physics momentum and conservation of momentum ➢ KS3 science forces and magnets ➢ KS5 matter, work and energy, mass and energy in nuclear reactions (conservation of momentum)
	<u>Work and Energy</u> ➢ Calculating work and energy ➢ Kinetic energy ➢ Potential energy ➢ Power ➢ Energy and efficiency	➢ Multiple choice and exam style questions (lesson by lesson) ➢ Practical – investigating GPE of a tennis ball ➢ End of chapter summary questions and exam style questions	➢ KS4 Physics energy changes and transfers, changes in systems ➢ KS3 science types of energy ➢ KS5 force and momentum, waves, particles and quantum phenomena

	<u>Quantum Phenomena</u> ➢ The photoelectric effect ➢ More about photo electricity ➢ Collisions of electrons with atoms ➢ Energy levels in atoms ➢ Energy levels and spectra ➢ Wave-particle duality	➢ Energy levels assessed homework ➢ Photo electricity assessed homework ➢ Multiple choice and exam style questions (lesson by lesson) ➢ End of unit assessment – exam style questions and past paper questions	➢ KS4 Physics – nuclear radiation ➢ KS4 Chemistry – structure and bonding ➢ KS5 Physics – Nuclear radiation, mass and energy
	<u>Electric Current</u> ➢ Current and charge ➢ Potential difference and power ➢ Resistance ➢ Components and characteristics	➢ Practical – Measuring current in a circuit ➢ Practical -Measuring potential difference ➢ Practical – Calculating resistance in a circuit ➢ Assessed homework – electric circuits	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric fields, capacitors, magnetic fields ➢ KS3 science – electric circuits and electrical energy ➢ KS5 nuclear radiation, electric fields, capacitance, ➢ KS5 electronics
Spring 2	**Big Ideas** **Electric Current (continued from spring 1), DC Circuits** This section builds on and develops earlier study of these phenomena from GCSE. It provides opportunities for the development of practical skills at an early stage in the course and lays the groundwork for later study of the many electrical applications that are important to society. DC Circuits will follow electric current once students have built their knowledge and understanding of the fundamental ideas. This begins to build on earlier learning (circuit rules) and develop knowledge and understanding which will link into Year 2 (emf and internal resistance) *Big Question – should we be finding alternative ways to provide electricity to our homes given the global warming crisis and rising cost of living?* **Big Idea: Materials** The teaching will follow mechanics and begins with a study of materials considered in terms of their bulk properties and tensile strength. This will build on basic concepts studied at GCSE (such as Hooke's Law) and introduce more complex concepts such as		

	Youngs Modulus. Teaching this concept at this point allows students to have developed their practical skills to a point where they can tackle difficult required practicals. Exam questions also tend to link in with work and energy and so it is useful to teach these ideas relatively closely. *Big Question – what changes could be made to materials to allow the UK to cope better with extreme weathers?*		
	<u>Electric Current</u> ➢ Current and charge ➢ Potential difference and power ➢ Resistance ➢ Components and characteristics	➢ Practical – Measuring current in a circuit ➢ Practical -Measuring potential difference ➢ Practical – Calculating resistance in a circuit ➢ Assessed homework – electric circuits ➢ Practical – LDRs, components ➢ End of unit exam style questions	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric fields, capacitors, magnetic fields ➢ KS3 science – electric circuits and electrical energy ➢ KS5 electronics
	<u>DC Circuits</u> ➢ Circuit rules ➢ More about resistance ➢ Emf and internal resistance ➢ More about circuit calculation ➢ Potential divider	➢ Assessed homework – resistors in series and parallel ➢ Practical – emf and internal resistance ➢ End of unit assessment – exam style questions on electric current and DC circuits	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric fields, capacitors, magnetic fields ➢ KS5 Nuclear radiation, Electric fields, Capacitance ➢ KS3 science – electric circuits and electrical energy ➢ KS5 electronics

	<u>Materials</u> ➢ Density ➢ Springs ➢ Deformation of solids ➢ More about stress and strain	➢ Practical – calculating density of regular and irregular objects ➢ Practical – investigating Hooke's Law ➢ Required Practical – Young's Modulus ➢ Assessed Homework – Materials ➢ Exam style questions (lesson by lesson, powerpoint) ➢ End of unit exam (exam style questions)	➢ KS3 science – forces ➢ KS4 Physics – forces, Hooke's Law, density ➢ KS5 Physics – work and energy ➢ KS5 - engineering
Summer 1	**Big Idea: Circular Motion, simple harmonic motion** The earlier study of mechanics is further advanced through a consideration of circular motion and simple harmonic motion (the harmonic oscillator). Students will need to recall their earlier learning of mechanics, work and energy and apply this to new and more complex concepts. This is content which is in Year 2 of the course and so teaching this at this point in the year will encourage students to both recall prior learning and develop skills required for the following year, as this builds upon Year 1 work they should be able to more easily access the content. *Big Question – what is at the centre of our Universe?*		
	<u>Circular Motion</u> ➢ Uniform circular motion ➢ Centripetal acceleration ➢ On the road ➢ At the fairground	➢ Practical – investigating circular motion ➢ Assessed homework – circular motion ➢ End of chapter assessment – exam style questions	➢ KS3 science – forces, scientific skills ➢ KS4 Physics – energy types and transfers ➢ KS5 Physics – work and energy, Newton's laws of motion ➢ KS5 – maths ➢ KS5 simple harmonic motion

	<u>Simple Harmonic Motion</u> ➢ Oscillations ➢ The principle of SHM ➢ More about sine waves ➢ Applications of SHM ➢ Energy and SHM ➢ Forced vibrations and resonance	➢ Assessed practical – investigating oscillations ➢ Required practical – oscillations of a loaded spring ➢ Exam style questions – simple harmonic motion (lesson by lesson on powerpoint)	➢ KS3 science – forces, scientific skills ➢ KS4 Physics – energy types and transfers ➢ KS5 Physics – work and energy, Newton's laws of motion ➢ KS5 - maths ➢ KS5 Year 1 units energy and work
Summer 2	**Big Idea: Simple harmonic motion** The earlier study of mechanics is further advanced through a consideration of circular motion and simple harmonic motion (the harmonic oscillator). Students will need to recall their earlier learning of mechanics, work and energy and apply this to new and more complex concepts. This is content which is in Year 2 of the course and so teaching this at this point in the year will encourage students to both recall prior learning and develop skills required for the following year, as this builds upon Year 1 work they should be able to more easily access the content. *Big Idea – the millennium bridge started to move with large oscillations due to a large footfall – how can we carefully design monuments?* **Big Idea: Thermal Physics** Another Year 2 topic taught at this point is the thermal properties of materials, the properties and nature of ideal gases, and the molecular kinetic theory to be studied in depth. This links nicely to GCSE content but also KS5 Chemistry content (which many students study alongside A Level Physics). *Big Idea – new homes are being built to be more energy efficient – how can we use ideas about specific heat capacity to design future proof homes?*		
	<u>Simple Harmonic Motion</u> ➢ Oscillations ➢ The principle of SHM ➢ More about sine waves ➢ Applications of SHM ➢ Energy and SHM ➢ Forced vibrations and resonance	➢ Assessed practical – investigating oscillations ➢ Required practical – oscillations of a loaded spring ➢ Exam style questions – simple harmonic motion (lesson by	➢ KS3 science – forces, scientific skills ➢ KS4 Physics – energy types and transfers ➢ KS5 Physics – work and energy, Newton's laws of motion ➢ KS5 – maths

		lesson on powerpoint) ➢ End of unit assessment covering all Year 2 content (circular motion, SHM and thermal physics)	➢ KS5 circular motion, Year 1 units energy and work
	<u>Thermal Physics</u> ➢ Internal energy and temperature ➢ Specific heat capacity ➢ Change of state	➢ Assessed practical – investigating latent heat and specific heat capacity ➢ Required practical – Charles law and Boyles Law ➢ End of unit assessment – exam style questions	➢ KS3 science – solids, liquids and gases ➢ KS4 Physics – pressure, forces ➢ KS5 Physics – work and energy ➢ KS5 Chemistry – specific heat capacity and latent heat ➢ KS5 gas laws, Year 1 units energy and work

Year 13 Overview

Term	Knowledge	Assessment	Connections to learning
Autumn 1	**Big Ideas:** **Recap of Circular Motion, SHM and thermal physics (taught in Year 1)** The earlier study of mechanics is further advanced through a consideration of circular motion and simple harmonic motion (the harmonic oscillator). Students will need to recall their earlier learning of mechanics, work and energy and apply this to new and more complex concepts. This is content which is in Year 2 of the course and so teaching this at this point in the year will encourage students to both recall prior learning and develop skills required for the following year, as this builds upon Year 1 work they should be able to more easily access the content. Another Year 2 topic taught at this point is the thermal properties of materials, the properties and nature of ideal gases, and the molecular kinetic theory to be studied in depth. This links nicely to GCSE content but also KS5 Chemistry content (which many students study alongside A Level Physics). **Big Idea: Gravitational Fields, Electric Fields**		

	The concept of field is one of the great unifying ideas in physics. The ideas of gravitation, electrostatics and magnetic field theory are developed within the topic to emphasise this unification. Practical applications considered include: planetary and satellite orbits, capacitance and capacitors, their charge and discharge through resistors, and electromagnetic induction. These topics have considerable impact on modern society. Teaching fields at the beginning of Year 2 will allow us to continue to revisit these difficult concepts throughout the year and will create a foundation upon which to build understanding of other types of field (magnetic and electrical). *Big Question – use of satellites during conflict* **Big Idea: Nuclear Radiation** This section builds on the work of Particles and radiation to link the properties of the nucleus to the production of nuclear power through the characteristics of the nucleus, the properties of unstable nuclei, and the link between energy and mass. Students should become aware of the physics that underpins nuclear energy production and also of the impact that it can have on society. *Big Question – nuclear power, nuclear weapons – moral issues*		
	<u>Gravitational Fields</u> ➢ Gravitational field strength ➢ Gravitational potential ➢ Newton's Law of Gravitation ➢ Planetary Field ➢ Satellite Motion	➢ Assessed homework – measuring the mass of the earth ➢ Exam style questions (lesson by lesson, on powerpoint) ➢ Gravitational fields end of chapter exam style questions ➢ Gravitational fields multiple choice Qs	➢ KS3 science – forces ➢ KS4 Physics – forces, motion, work and energy ➢ KS5 Physics – electric fields, magnetic fields, work and energy, newtons laws of motion
	<u>Electric Fields</u> ➢ Field patterns ➢ Electric field strength ➢ Electric potential ➢ Coulomb's Law ➢ Point charges ➢ Comparing electric and gravitational fields	➢ Field patterns with EHT practical ➢ Assessed homework – electric fields ➢ Exam style questions (lesson by lesson on power point – multiple choice and written)	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric current, DC circuits, capacitors, magnetic fields ➢ KS3 science – electric circuits and electrical energy

	➢ Nuclear Radiation ➢ The discovery of the nucleus ➢ The properties of alpha, beta and gamma radiation ➢ The dangers of radioactivity ➢ Radioactive decay ➢ Theory of radioactive decay ➢ Radioactive isotopes in use ➢ Decay modes ➢ Nuclear radius	➢ Practical – properties of alpha, beta and gamma ➢ Practical – protactinium generator ➢ Assessed homework – radioactivity exam style questions ➢ End of unit assessment (exam style questions)	➢ KS4 Physics – nuclear radiation ➢ KS4 Chemistry – structure and bonding ➢ KS5 Chemistry – structure and bonding, mass and moles ➢ KS5 Physics – Nuclear radiation, mass and energy in nuclear reactions (conservation of momentum), materials physics, nuclear radiation
Autumn 2	**Big Idea:** **Electric fields (continued from Autumn 1), Magnetic fields** The concept of field is one of the great unifying ideas in physics. The ideas of gravitation, electrostatics and magnetic field theory are developed within the topic to emphasise this unification. Practical applications considered include: planetary and satellite orbits, capacitance and capacitors, their charge and discharge through resistors, and electromagnetic induction. These topics have considerable impact on modern society. Teaching electric fields to follow on from gravitational fields allows for comparison with gravitational fields and for future knowledge of magnetic fields. *Big Question- use of electric and magnetic fields in medical treatment – how do British scientists contribute?* **Big Idea: Nuclear Radiation, Nuclear Energy** This section builds on the work of Particles and radiation to link the properties of the nucleus to the production of nuclear power through the characteristics of the nucleus, the properties of unstable nuclei, and the link between energy and mass. Students should become aware of the physics that underpins nuclear energy production and also of the impact that it can have on society. *Big Question – nuclear power, nuclear weapons – moral issues* **Big Idea: Capacitors** Many ideas from mechanics and electricity from earlier in the course support the learning of capacitors and are further developed. Practical applications considered include: capacitance and capacitors in terms of current and voltage, their charge and discharge through resistors and energy stored *Big question – British scientists were contributors to understanding of capacitors (Cavendish and Faraday), why does one get the unit named after him and not the other?*		

	<u>Electric Fields</u> ➢ Field patterns ➢ Electric field strength ➢ Electric potential ➢ Coulomb's Law ➢ Point charges ➢ Comparing electric and gravitational fields	➢ Field patterns with EHT practical ➢ Assessed homework – electric fields ➢ Exam style questions (lesson by lesson on power point – multiple choice and written)	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric current, DC circuits, capacitors, magnetic fields ➢ KS3 science – electric circuits and electrical energy Future Learning ➢ Nuclear radiation ➢ Electric fields ➢ Capacitance ➢ Physics degree ➢ Engineering degree
	➢ <u>Nuclear Radiation</u> ➢ The discovery of the nucleus ➢ The properties of alpha, beta and gamma radiation ➢ The dangers of radioactivity ➢ Radioactive decay ➢ Theory of radioactive decay ➢ Radioactive isotopes in use ➢ Decay modes ➢ Nuclear radius	➢ Practical – properties of alpha, beta and gamma ➢ Practical – protactinium generator ➢ Assessed homework – radioactivity exam style questions ➢ End of unit assessment (exam style questions)	➢ KS4 Physics – nuclear radiation ➢ KS4 Chemistry – structure and bonding ➢ KS5 Chemistry – structure and bonding, mass and moles ➢ KS5 Physics – mass and energy Future Learning ➢ Mass and energy in nuclear reactions (conservation of momentum) ➢ Physics degree, engineering degree ➢ Materials physics ➢ Nuclear radiation
	➢ <u>Nuclear Energy</u> ➢ Energy and mass ➢ Binding energy	➢ End of unit assessment (exam	➢ KS4 Physics – nuclear radiation

	➢ Fission and fusion ➢ The thermal nuclear reactor	style questions) with nuclear radiation ➢ Assessed homework – fission and fusion ➢ Lesson by lesson exam style questions (on powerpoint)	➢ KS4 Chemistry – structure and bonding ➢ KS5 Chemistry – structure and bonding, mass and moles ➢ KS5 Physics – Nuclear radiation, quantum phenomena, matter and radiation Future Learning ➢ Mass and energy in nuclear reactions (conservation of momentum) ➢ Materials physics ➢ Nuclear radiation
	➢ <u>Capacitors</u> ➢ Capacitance ➢ Energy stored in a charged capacitor ➢ Charging and discharging a capacitor through a fixed resistor ➢ Dielectrics	➢ Practical – charging a capacitor through a fixed resistor ➢ Assessed homework – capacitor exam style questions ➢ Capacitor practical follow up questions ➢ Lesson by lesson exam style questions (on powerpoint)	➢ KS3 science – electrical circuits, types of energy ➢ KS4 Physics – electrical circuits, work and energy ➢ KS5 Physics – DC circuits, electrical current, work and energy ➢ KS5 Electronics Future Learning ➢ Nuclear radiation ➢ Electric fields ➢ Capacitance
	➢ <u>Magnetic Fields</u> ➢ Current carrying conductors in a magnetic field ➢ Moving charges in a magnetic field ➢ Charged particles in a circular orbit	➢ Practical – motor kits ➢ Lesson by lesson exam style questions (on powerpoints)	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric current, DC circuits, capacitors, magnetic fields ➢ KS3 science – electric circuits and electrical energy Future Learning ➢ Nuclear radiation

			➢ Electric fields ➢ Capacitance
Spring 1	**Big Idea:** **Magnetic fields (continued from Autumn 2)** The concept of field is one of the great unifying ideas in physics. The ideas of gravitation, electrostatics and magnetic field theory are developed within the topic to emphasise this unification. Practical applications considered include: planetary and satellite orbits, capacitance and capacitors, their charge and discharge through resistors, and electromagnetic induction. These topics have considerable impact on modern society. Teaching electric fields to follow on from gravitational fields allows for comparison with gravitational fields and for future knowledge of magnetic fields. *Big Question- use of electric and magnetic fields in medical treatment – how do British scientists contribute?* **Nuclear Energy and mass** This section builds on the work of Particles and radiation to link the properties of the nucleus to the production of nuclear power through the characteristics of the nucleus, the properties of unstable nuclei, and the link between energy and mass. Students should become aware of the physics that underpins nuclear energy production and also of the impact that it can have on society. *Big Question – nuclear power, nuclear weapons – moral issues*		
	<u>Electromagnetic Induction</u> ➢ Generating Electricity ➢ The laws of electromagnetic induction ➢ The alternating current generator ➢ Alternating current and power ➢ Transformers	➢ Assessed homework – magnetic fields ➢ Assessed homework – Flemings Law and Lenz's Law ➢ End of unit assessments (exam style questions on magnetic fields and motion in a circle)	➢ KS4 Physics – current electricity, mains electricity ➢ KS5 Physics – electric current, DC circuits, capacitors, magnetic fields ➢ KS3 science – electric circuits and electrical energy ➢ Future Learning ➢ Nuclear radiation ➢ Electric fields

			➢ Capacitance
	<u>Nuclear Energy</u> ➢ Energy and mass ➢ Binding energy ➢ Fission and fusion ➢ The thermal nuclear reactor	➢ End of unit assessment (exam style questions) with nuclear radiation ➢ Assessed homework – fission and fusion ➢ Lesson by lesson exam style questions (on powerpoint)	➢ KS4 Physics – nuclear radiation ➢ KS4 Chemistry – structure and bonding ➢ KS5 Chemistry – structure and bonding, mass and moles ➢ KS5 Physics – Nuclear radiation, quantum phenomena, matter and radiation, mass and energy in nuclear reactions (conservation of momentum), materials physics, nuclear radiation
Spring 2	**Big Idea: Turning Points** This option is intended to enable key concepts and developments in physics to be studied in greater depth than in the core content. Students will be able to appreciate, from historical and conceptual viewpoints, the significance of major paradigm shifts for the subject in the perspectives of experimentation and understanding. Many present-day technological industries are the consequence of these key developments and the topics in the option illustrate how unforeseen technologies can develop from new discoveries. *Big Question – the turning points topics covers key scientific discoveries, throughout the teaching of this topic we ask the question of how British scientists contributed to these developments* **Revision/exam preparation**		

	<u>Turning Points</u> ➢ The discovery of the electron ➢ Wave-particle duality ➢ Special relativity	➢ Assessed homework – turning points 1, 2 and 3 (exam style questions) ➢ End of unit assessment (turning points option module 2018)	➢ KS4 Physics – nuclear radiation ➢ KS4 Chemistry – structure and bonding ➢ KS5 Chemistry – structure and bonding, mass and moles ➢ KS5 Physics – mass and energy
	<u>Revision / exam preparation</u> ➢ All year 1 and 2 content	➢ Paper 1, 2 and 3 2019 as mock exams ➢ Exam style questions covering all content	➢ All content in KS5
Summer 1	**Big Idea: revision /exam preparation** Rationale:		