IDSALL

SCHOOL

Physics Curriculum Vision

"Energy is liberated matter; matter is energy waiting to happen."

Bill Bryson

Physics is the branch of science that deals with the structure of matter and how the fundamental constituents of the universe interact. In the widest sense, physics is concerned with all facets of nature on both the macroscopic and sub microscopic levels. Its scope of study embraces not only the behaviour of objects under the action of given forces but also the nature and origin of gravitational, electromagnetic, and nuclear force fields. Its ultimate objective is the formulation of a few comprehensive principles that bring together and explain all such disparate phenomena.

The Physics curriculum at Idsall School aims to foster scientific curiosity where students learn through inquiry and hands on learning. We have a strong emphasis on practical skills, which develop not only deep scientific understanding but also key transferable skills such as teamwork, leadership, and organisation. Our students are able to utilise their physics knowledge and understanding to understand important issues that affect our society

Idsall School
Years 7-13 Physics Learning Journey

NEXT

This way to Training, Employment or University

Year 13

Periodic Motion	Gravitational Fields	Electric Fields	Magnetic Fields
Thermal Physics	Radioactivity	Capacitance	Option Topic

Year 12

Measurements and their errors	Mechanics	Progressive and Stationary Waves	Particles	Periodic Motion
Refraction, diffraction and interference	Current Electricity	Materials	Thermal Physics	Quantum Phenomena

Year 11

Forces in Balance	Motion	Forces & Motion	Wave Properties	Electromagnetic Waves	Electromagnetism

Year 10

Molecules & Matter	Radioactivity	Electricity in the home	Electric Circuits	Energy Resources	Energy Transfer by Heating	Conservation & dissipation of Energy

Year 9

Motion & Pressure	Turning points in Physics	Waves

Year 8

Waves - Light	Energy	Electricity & Magnetism

Year 7

Space	Waves - Sound	Forces

Start here

YEAR 7 CURRIUCLUM OVERVIEW - PHYSICS

The Big Picture - Intent*:*

Students will develop broad and balanced knowledge of the key topics of forces, waves, sound and space as the foundation of the physical world matter and energy. The forces topic is a fundamental topic within physics and a good understanding of which most of the physics topics build upon.

Physics has long been regarded as the fundamental science meaning that not only do other branches of science and engineering all stem from foundations in physics but by studying physics, we gain a deeper understanding of the entire universe around us. The physics curriculum is knowledge rich, constantly building upon prior knowledge in order to reinforce understanding at a deeper level. We aim for our students to develop into confident, resilient, and reflective learners who enjoy physics and can understand its context and influence in the modern world.

All students will be able to access the main content of all lessons and all students will be taught to the top with scaffolding, adaptive teaching and stretch and challenge provided where necessary

Implementation:

In Year 7 physics there are 3 units: Forces, Sound and Space

Forces: Students move from concrete explorations of the effects of forces to abstract representations of forces, and an understanding of how contact forces arise as a result of interactions at a microscopic level. They meet the idea of a 'field', which is a fundamental concept in physics as a region where objects experience forces. They develop an understanding of the difference between weight and mass, and how to calculate weight; this is the beginning of quantifying and calculating that will continue throughout physics.

Sound: Students build on their concrete explorations of sound at KS2 by applying a wave model to predict and explain a range of observations; echoes, how sounds of different loudness and pitch are produced, the range of human hearing, ultrasound and infrasound.

Space: Students develop models involving the spinning and orbiting of the Moon about the Earth and the Earth about the Sun to explain the phases of the Moon, eclipses, seasonal changes on different parts of the Earth, and the tides.

Each unit has separate key study skills and these will be fostered through observation, practical and independent practical skills. Students study skills will be developed through in class and independent assessment preparation.
We ensure that we also prepare students in both practical and mathematical skills, for them to fully access the curriculum and explore investigations scientifically.

Key Summative Assessments:

Baseline assessments will take place in the Autumn term.

Formal End of unit tests will take place at the end of each unit.

Cumulative end of Year exams in the summer term.

Retrieval homework.

Live marking and low stakes quizzing

Autumn Term:
Baseline Testing
Forces.

Spring Term:
Waves – Sound.

Summer term:
Space.
Year 7 exam.

Impact:
Students will have increased understanding and confidence in physical substantive and disciplinary knowledge and be able to apply new skills to a variety of new and challenging scientific concepts. Students will know more and remember more. There will be an increase in attainment, evidenced in regular, formal and interleaved assessments. Students will have a firm grounding in the essential knowledge and skills they need to develop their critical thinking and problem-solving skills.

Content	Disciplinary Knowledge (Skills) This is the actions taken within a topic to gain substantive knowledge	Substantive Knowledge This is the specific, factual content for the topic, which is connected into a careful sequence of learning.	Prior Learning KS2	Future Learning
Forces	**Maths:** Substituting values into an equation. Changing the subject of an equation. **Literacy:** Prefixes/ suffixes of words. Correct use of key words Use of tier 2 & 3 scientific language in writing **Sc1 – working scientifically:** Explain what forces do, interaction pairs, differences between contact and non- contact. Use Hooke's Law to identify proportional stretching of a spring and describe in terms of bonds why solid surfaces provide a support force. Explain why drag forces and friction arise. Describe the effect of a field and link features to weight on different planets. Present force arrow drawings to show & explain the speed or direction of motion of objects. Using scales and scientific equipment. Suitably recording and presenting data.	• Types of forces – squashing & stretching, drag forces & friction, balanced & unbalanced • Effects of forces on shape and motion • Effects of magnetic, gravitational and electric fields.	• Identify the effects of air resistance, water resistance and friction, that act between moving surfaces • Recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect • Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object	Motion and pressure
Waves: Sound	**Maths:** Substituting values into an equation. Practice calculations **Literacy:** Prefixes/ suffixes of words. Correct use of key words Use of tier 2 & 3 scientific language in writing **Sc1 – working scientifically:** Estimating values or answers to numerical questions. Using scales and scientific equipment to measure sound Using an oscilloscope to investigate waves.	• Waves • Sound and energy transfer • Loudness and pitch • Detecting sound • Echoes and ultrasound	• Identify how sounds are made, associating some of them with something vibrating • Recognise that vibrations from sounds travel through a medium to the ear • Find patterns between the pitch of a sound and features of the	Energy

	Compare the different types of waves and their features. Describe sound travel in terms of energy transfer in different media and contrast speed with the speed of light. Comparative evaluation of data		object that produced it • Find patterns between the volume of a sound and the strength of the vibrations that produced it • Recognise that sounds get fainter as the distance from the sound source increases	
Space	**Maths:** Interpret data from graphs and plot graphs. **Literacy:** Prefixes/ suffixes of words. Correct use of key words Use of tier 2 & 3 scientific language in writing **Sc1 – working scientifically:** Describe the objects that you can see in the night sky, the structure of the Universe. Name the objects in the Solar System and describe some similarities and differences between the planets of the Solar System and identify patterns in the spacing and diameters of planets. Explain the motion of the Sun, stars, and Moon across the sky, why seasonal changes happen and use data to show the effect of the Earth's tilt on temperature and day - length. Describe and explain the phases of the Moon and why eclipses happen. Students will use models to represent the phases of the moon and eclipses as a way of understanding large objects that are not easy to see.	• The night sky • The solar system • The earth • The moon	• Describe the movement of the Earth and other planets relative to the sun in the solar system • Describe the movement of the moon relative to the Earth • Describe the sun, Earth and moon as approximately spherical bodies • Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky	Waves: Light

YEAR 8 CURRIUCLUM OVERVIEW - Physics

The Big Picture – Intent

Students build upon their prior learning adding challenge and diversity, revisiting and extending previously learnt concepts further developing scientific knowledge, skills and thinking. Students study electricity and magnetism, energy, and waves (light) building upon the key previously learnt key physics fundamentals. The physics curriculum is knowledge rich, building upon prior knowledge in order to reinforce understanding at a deeper level. We aim for our students to develop into confident, resilient, and reflective learners who enjoy Physics and move on and up to be successful at KS3, GCSE, A-Level and beyond.

Physics lessons will focus on the substantive knowledge and content, but in addition teach methods of enquiry and investigation to stimulate creative thought. Pupils will ask questions and further develop an appreciation of the way Physics will affect their future on a personal, national and global level.

All students will be able to access the main content of all lessons and all students will be taught to the top with scaffolding, adaptive teaching and stretch and challenge provided where necessary.

Implementation:

In Year 8 physics there are 3 units:

Electricity and magnetism: Students investigate circuits exploring current and potential difference and the difference between parallel and series circuits. The concept of resistance also emerges from models and can be related to definitions of conductors and insulators. Students also study gravitational, electric, and magnetic fields in this topic including real life applications of electromagnets.

Energy: Modelling of energy introduces the idea of energy stores and transfers. These are systems (one object or a group of objects) where energy can be calculated. Energy transfers are taught in terms of particles, radiation and temperature. Students use calculations to calculate work done & power

Waves: Light: Light can be modelled as rays or waves. The wave nature of light is less obvious to students than that of sound. Refraction is explained using the wave model, as is dispersion. Students learn about spectra; humans detect a small range of frequencies of both light and sound. Light is part of a wider electromagnetic spectrum where waves can be useful, but also damaging. Understanding our perception of colour requires knowledge of frequencies of light and specialized cells in the retina.

Each unit has separate key study skills and these will be fostered through observation, practical and independent practical skills. Students study skills will be developed through in class and independent assessment preparation. We ensure that we also prepare students in both practical and mathematical skills, for them to fully access the curriculum and explore investigations scientifically.

Key Summative Assessments:

Formal End of unit tests will take place at the end of each unit.

Cumulative end of Year exams in the summer term.

Retrieval homework.

Live marking and low stakes quizzing

Autumn Term:
Electricity & Magnetism

Spring Term:
Energy

Summer term:
Waves: Light
Year 8 exam/

Impact: Students will have increased understanding and confidence in physical substantive and disciplinary knowledge and be able to apply new skills to a variety of new and challenging scientific concepts. Students will know more and remember more. There will be an increase in attainment, evidenced in regular, formal and interleaved assessments. Students will continue to develop the essential knowledge and skills they need as they develop their critical thinking and problem-solving skills looking at the physical phenomena and fundamental laws of the world around them. We aim for our students to develop into confident, resilient, and reflective learners who enjoy Physics , are able to place it in context and link it to the other scientific disciplines and to their experience of the world at large

Content	Disciplinary Knowledge (Skills) This is the actions taken within a topic to gain substantive knowledge	Substantive Knowledge This is the specific, factual content for the topic, which is connected into a careful sequence of learning.	Prior Learning (KS2-Y7)	Future Learning (Y9)
Electricity & Magnetism	**Maths:** Substituting values into an equation (e.g. calculate resistance when potential difference and current are known). Changing the subject of an equation. **Literacy:** Key terms & definitions in context. **Sc1:** Building circuits and taking measurements using ammeters and voltmeters (Potential difference, current and resistance).	**Electricity:** Circuits and current • Potential difference • Series and parallel • Resistance • Static electricity **Magnets and magnetic fields** • Electromagnets • A field is a region where there is a force on an object (a mass, charge, or magnetic material). • A field is an abstract concept, represented by physical lines (which are not the field). • Compasses also show a magnetic field around current carrying wires and electromagnets • Our lives have been changed immeasurably by devices with motors.	**KS2: Electricity** • Construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers. • Recognise some common conductors and insulators, and associate metals with being good conductors **KS2: Forces and magnets** • Notice that some forces need contact between two objects, but magnetic forces can act at a distance. • Observe how magnets attract or repel each other and attract some materials and not others. • Describe magnets as having two poles. • Predict whether two magnets will attract or repel each other, depending on which poles are facing. .	Turning points in physics
Energy	**Maths:** Substituting values into and equation (e.g. Work done, power and cost of domestic appliances).	• Energy resources • Energy stores and transfers	• Y7: Sound • Y7: Particles and their behaviour	Motion and Pressure

	calculate energy transferred using the power and time taken Manipulate formulaic relationship between energy and power • Manipulate formulaic relationship of work done and relate to levers and gears Literacy: Key terms & definitions in context. **Sc1:** Using simple gears and levers.	• Energy stores are systems (one object or a group of objects) where energy can be calculated. • Energy stores are kinetic, gravitational potential, elastic potential, thermal, chemical, and nuclear • Light, sound, heating, and electric current are not stores but methods of transferring energy between stores. • Energy • Work done • Power		Turning points in physics.
Waves: Light	**Maths:** Using and measuring angles (acute and obtuse). **Sc1:** Predictions and models to record observations and understand scientific concepts. Drawing ray diagrams with accuracy and precision. **Modelling:** Students will use models to represent colours, light and mixing coloured light to relate these to the properties and wavelengths of light.	• Properties of waves • Properties and behaviour of light. • Reflection • Refraction • How the eye and the camera work • Combining colours, coloured filters and coloured objects.	KS2: Light Recognise that light appears to travel in straight lines. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye. Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes Y7: Sound	Turning points in physics Key concepts: Waves

YEAR 9 CURRIUCLUM OVERVIEW – PHYSICS

The Big Picture – Intent:

In Year 9 students draw together their physics learning in KS3 ready to apply knowledge and understanding to KS4 topics. The application of topic knowledge in Year 7 and 8 demands linking of concepts learnt and an increased demand in terms of conceptual understanding. Students study motion and pressure, turning points in physics and key concepts about waves. This is all explicitly linked to real world application of Physics.

The curriculum encompasses the national curriculum and follows a spiral structure, building upon prior knowledge in order to develop understanding at a deeper level. We aim for our students to develop into confident, resilient, and reflective learners who enjoy science and move on and up to be successful at KS3, GCSE and A-Level.

All students will be able to access the main content of all lessons and all students will be taught to the top with scaffolding, adaptive teaching and stretch and challenge provided where necessary.

Implementation:

In Year 9 physics there are 3 units:

Motion and pressure: Students measure, describe and explain motion using ideas of forces. Students then move on to quantify it with calculations of speed. Using cross curricular graphing skills students interpret distance time graphs and link the shape of the graph to changes in speed & direction. Students links macroscopic phenomena, such as gas pressure, and the motion of particles on a microscopic scale, using ideas about forces. They distinguish between force and pressure, make calculations and carry out experiments.

Turning points in physics: Students apply prior knowledge to explore forces in the solar system on a macro scale, the evidence behind universe expansion and the effect on light. Satellites and spacecraft are put into orbit around the earth and using knowledge of forces and rotation different orbits can be produced. The history of radioactivity is also introduced as well as the three types of radiation before finally looking at the real-world application of electromagnets.

Key concepts: Waves: Students observe and describe the properties of mechanical and electromagnetic waves. Students compare transverse and longitudinal waves examining the relationship between the direction of propagation and the direction of the oscillations. Students analyse wave properties such as wavelength, amplitude, and period leading to the relationships between period, frequency and wave speed, frequency, and wavelength.

Each unit has separate key study skills and these will be fostered through observation, practical and independent practical skills. Students study skills will be developed through in class and independent assessment preparation.

We ensure that we also prepare students in both practical and mathematical skills, for them to fully access the curriculum and explore investigations scientifically.

Key Summative Assessments:

Formal End of unit tests will take place at the end of each unit.

Cumulative end of Year exams in the summer term.

Retrieval homework.

Live marking and low stakes quizzing

Autumn Term:
Motion and pressure

Spring Term:
Turning points in physics

Summer term:
Key concepts: Waves
Year 9 exam.

Impact:

Physics has long been regarded as the fundamental science meaning that not only do other branches of science and engineering all stem from foundations in physics but by studying physics, we gain a deeper understanding of the entire universe around us. Our curriculum and our teaching provide our students with the essential knowledge and skills that they need to develop their critical thinking and problem-solving skills which will enable them not only to pursue a wide range of careers but just as importantly allow them to satisfy their curiosity about the universe whether they simply want to know how a light bulb works or want to know what will happen to our solar system in five billion years.

Students will know more and remember more. There will be an increase in attainment, evidenced in regular, formal and interleaved assessments.

Content	Disciplinary Knowledge (Skills) This is the actions taken within a topic to gain substantive knowledge	Substantive Knowledge This is the specific, factual content for the topic, which is connected into a careful sequence of learning.	Prior Learning (KS2-Y8)	Future Learning (GCSE)
Motion and pressure	**Maths:** Substituting values into an equation e.g. calculating speed, pressure or a moment of a force. Changing the subject of an equation. Drawing and interpreting data graphically. **Literacy:** Key terms & definitions in context. **Sc1:** Volume, depth and temperature in gas and water pressure. Using scientific equipment precisely and safely.	• Speed and distance-time graphs • Pressure in gases and liquids. • Turning forces.	**KS2: Forces** • Notice that some forces need contact between two objects, • Identify the effects of air resistance, water resistance and friction, that act between moving surfaces • Recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect **KS3:** • Types of forces – squashing & stretching, drag forces & friction, balanced & unbalanced • Effects of forces on shape and motion	P8: Forces in balance P9: Motion P10 Force and motion
Turning points in physics	**Maths:** Drawing and interpreting data graphically. **Literacy:** Key terms & definitions in context. **Sc1:** Using scientific equipment precisely and safely. **Modelling:** Objects that are to large or small to be seen.	• Gravitational attraction • The solar system & forces. • Redshift, the big band and universal expansion. • Atomic model & isotopes • Radiation • Electromagnetism	**KS2 Space:** • Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object • Describe the movement of the Earth and other planets relative to the sun in the solar system • Describe the movement of the moon relative to the Earth • Describe the sun, Earth and moon as approximately spherical bodies • Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky	P7 Radioactivity P13 Electromagnetism

			Electricity and magnetism: • Notice that some forces need contact between two objects, but magnetic forces can act at a distance. • Observe how magnets attract or repel each other and attract some materials and not others. • Describe magnets as having two poles. • Predict whether two magnets will attract or repel each other, depending on which poles are facing. **KS3 Electromagnets:** • A field is a region where there is a force on an object (a mass, charge, or magnetic material). • A field is an abstract concept, represented by physical lines (which are not the field). • Compasses also show a magnetic field around current carrying wires and electromagnets. • Our lives have been changed immeasurably by devices with motors.	
Waves	**Maths:** Substituting values into an equation. Changing the subject of an equation. Drawing and interpreting data graphically. **Literacy:** Key terms & definitions in context. **Sc1:** Using scientific equipment precisely and safely. **Modelling:** Appropriate models to explain waves.	• Longitudinal and transverse waves. • Properties of waves. • Waves can transfer energy • Wave speed. • Reflection and refraction. • The electromagnetic spectrum. • Uses of the different wavelengths in the electromagnetic spectrum.	**KS2 Sound:** • Identify how sounds are made, associating some of them with something vibrating • Recognise that vibrations from sounds travel through a medium to the ear • Find patterns between the pitch of a sound and features of the object that produced it • Find patterns between the volume of a sound and the strength of the vibrations that produced it • Recognise that sounds get fainter as the distance from the sound source increases **KS3 Sound:** • Using scales and scientific equipment to measure sound • Using an oscilloscope to investigate waves. • Compare the different types of waves and their features. Describe sound travel in terms of energy transfer in • different media and contrast speed with the speed of	P11 Wave properties P12 Electromagnetic waves

			• light. • Waves • Sound and energy transfer • Loudness and pitch • Detecting sound • Echoes and ultrasound **KS2 Light:** • Recognise that light appears to travel in straight lines. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye. • Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes **KS3 Waves:** • Properties of waves • Properties and behaviour of light. • Reflection • Refraction • How the eye and the camera work • Combining colours, coloured filters and coloured objects.	

YEAR 10 CURRICULUM OVERVIEW: Physics Combined

The Big Picture – Intent:

Physics has long been regarded as the fundamental science meaning that not only do other branches of science and engineering all stem from foundations in physics but by studying physics, we gain a deeper understanding of the entire universe around us. Our curriculum and our teaching provide our students with the essential knowledge and skills that they need to develop their critical thinking and problem-solving skills which will enable them not only to pursue a wide range of careers.

The Physics papers cover the following topics:

Paper 1 – (Topics 18–21): Energy; Electricity; Particle model of matter; and Atomic structure.

Paper 2 – (Topics 22–24): Forces; Waves; and Magnetism and electromagnetism

All students will be able to access the main content of all lessons and all students will be taught to the top with scaffolding, adaptive teaching and stretch and challenge provided where necessary.

Implementation:

Students undertaking combined science have 10 science lessons a fortnight.

The units taught in Year 10 Physics are: *Energy; Electricity; Particle model of matter; and Atomic structure.*

At Key Stage 4 most students follow AQA GCSE Combined Science Trilogy. The specification covers Biology, Chemistry and Physics. This is a linear course with all the examinations at the end of year 11. Students will sit six examinations, two in Biology, two in Chemistry and two in Physics. Each examination is one hour and fifteen minutes in length and worth 16.7% of the final grade. Students can be entered at either Foundation or Higher tier and will attain the equivalent of two GCSEs at 9-1 grades. There are six papers: two biology, two chemistry and two physics. Students are exposed to a knowledge-rich, spiralised curriculum, with the introduction of aspirational career pathways embedded in all units, ranging from pathologists to electrical engineers. Additionally, students are given the opportunity to discuss 'big questions' around the moral, social and ethical implications of many areas of science

Students learn about science through purposeful practical activities as part of day-to-day teaching and learning. Students will also undertake required practicals in class in order to deepen their understanding of scientific concepts and develop their skills of investigating, observing, experimenting and testing the validity of scientific concepts ideas.

Key Summative Assessments:

All units include:

- Retrieval homework
- Live marking
- Low stake quizzing
- End of Unit Tests

Required practical tasks:

- Specific heat capacity
- Resistance
- IV characteristics
- Density
- Force and extension
- Force & acceleration
- Waves
- Radiation and absorption

Autumn Term:
Physics: Energy & energy resources.

Spring Term:
Physics: Particles at work: electricity.

Summer term:
Physics: Particles at work: radioactivity.

Impact: By the end of Year 10 students will be confident with the fundamental and more complex principles, knowledge and application of this knowledge in Physics.

They will be able to apply their Physics knowledge and skills to both familiar and unfamiliar situations using the analytical, questioning and critical thinking skills that they will have developed during their study of Physics in year 10.

Prior Knowledge

KS2: Forces

- Notice that some forces need contact between two objects,
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces
- Recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect

KS2: Space:

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- Describe the movement of the Earth and other planets relative to the sun in the solar system
- Describe the movement of the moon relative to the Earth
- Describe the sun, Earth and moon as approximately spherical bodies
- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky

KS2: Electricity and magnetism:

- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.
- Describe magnets as having two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

KS2: Sound:

- Identify how sounds are made, associating some of them with something vibrating
- Recognise that vibrations from sounds travel through a medium to the ear
- Find patterns between the pitch of a sound and features of the object that produced it
- Find patterns between the volume of a sound and the strength of the vibrations that produced it
- Recognise that sounds get fainter as the distance from the sound source increases

KS2 Light:

- Recognise that light appears to travel in straight lines. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes

KS3 Motion and pressure:

- Speed and distance-time graphs
- Pressure in gases and liquids.
- Turning forces

KS3 Forces:

- Types of forces – squashing & stretching, drag forces & friction, balanced & unbalanced

- Effects of forces on shape and motion

KS3 Turning points in physics:

- Gravitational attraction
- The solar system & forces.
- Redshift, the big band and universal expansion.
- Atomic model & isotopes
- Radiation
- Electromagnetism

KS3 Electromagnets:

- A field is a region where there is a force on an object (a mass, charge, or magnetic material).
- A field is an abstract concept, represented by physical lines (which are not the field).
- Compasses also show a magnetic field around current carrying wires and electromagnets.
- Our lives have been changed immeasurably by devices with motors.

KS3 Waves:

- Longitudinal and transverse waves.
- Properties of waves.
- Waves can transfer energy
- Wave speed.
- Reflection and refraction.
- The electromagnetic spectrum.
- Uses of the different wavelengths in the electromagnetic spectrum.

KS3 Sound:

- Using scales and scientific equipment to measure sound
- Using an oscilloscope to investigate waves.
- Compare the different types of waves and their features. Describe sound travel in terms of energy transfer in
- different media and contrast speed with the speed of
- light.
- Waves
- Sound and energy transfer
- Loudness and pitch
- Detecting sound
- Echoes and ultrasound

KS3 Waves:

- Properties of waves
- Properties and behaviour of light.
- Reflection
- Refraction
- How the eye and the camera work
- Combining colours, coloured filters and coloured objects.

Content	**Disciplinary Knowledge (Skills)** This is the actions taken within a topic to gain substantive knowledge	**Substantive Knowledge** This is the specific, factual content for the topic, which is connected into a careful sequence of learning.
Conservation and Dissipation of Energy	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Use the formulae KE=1/2mv2 and E=1/2ke2 to solve problems • Use the formula GPE=mgh to solve problems • Use P=E/t to calculate power, Link power to useful and wasted energy • Use the formula W=Fs to calculate work • Use the formula to calculate efficiency **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions **Sc1:** • Identify energy stores • Describe how energy can be transferred, and apply the law of conservation of energy • Explain how work is done to overcome friction • Suggest how machines could be made more efficient • State what happens to wasted energy • Discuss whether energy is ever really "lost" • Identify useful and waste energy types in electrical transfers	• Energy stores and systems • Energy transfers in a system – conservation of energy • Energy and work • Changes in energy – GPE • Changes in energy – kinetic & elastic • Energy change sin systems – dissipation of energy • Efficiency • Electrical appliances • Energy & power

Energy Transfer by Heating	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Use the formula E=mcθ to solve problems • Work out U values • Use the specific heat equation **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define "Conductors" and "Insulators" and give examples • Define "Specific Heat Capacity" **Sc1:** • Use the particle model to explain how conduction works • State and explain what factors affect the rate of conduction • Model how global warming is caused in terms of infrared radiation • Identify methods to reduce heat loss • State factors that affect the rate of infrared transfer • Explain how each method works in terms of conduction, convection, and radiation • Explain what is meant by black body radiation • Explain how the rate of infrared transfer affects temperature,	• Conduction • Heating & insulating buildings • Energy changes in systems – specific heat capacity • Change of heat – specific heat capacity

Energy Resources	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • **C**alculate the energy efficiency of different fuels **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define "Supply" and "Demand • Define "Renewable Energy **Sc1:** • Identify which fuels are used to generate electricity • Compare uses of different fuels, • Identify different types of power plant • Describe how a power plant produces electricity • Identify advantages and disadvantages of power plants • Identify the main causes of environmental • concern when producing electricity • Describe how nuclear powerplants work • Compare power stations to one another in terms of advantages and disadvantages for the environment • Identify how best to use different power stations to adapt to changes in demand • Give examples of renewable sources of energy • Identify advantages and disadvantages of renewable sources of energy	• National & global energy resources - energy demands • National & global energy resources - wind & water • National & global energy resources - sun & geothermal • National & global energy resources - energy & environment

Electricity	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Use the formula Q=It to solve problems • Measure potential difference in a circuit • Calculate the resistance of the components from the graphs • Sketch IV graphs for an ohmic resistor, a filament lamp, and a diode • Explain the shapes of these graphs, **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define an electric field • Define what is meant by current • Define what is meant by potential difference • Define "Series Circuit" • Define "Parallel Circuits" **Sc1:** • State how charges affect one another, • Describe how a static charge is formed and • discharged • Explain the relationship between current and charge • State how current and potential difference changes in series circuits • State and explain what happens when you place resistors in series, • State what happens to current and potential difference in parallel circuits • State and explain what happens to resistors • in parallel **Perform a series of scientific investigations to investigate:** • How resistance changes with length • The current and pd of a component • Resistors in series • Resistors in parallel	• Circuit diagrams • Current & charge • PD & resistance • Component characteristics - resistors diodes, LDR's & thermistors • Series circuits • Parallel circuits

Mains Electricity	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Calculate the current drawn by a device from its power rating, • Use the formula Q=It and P=IV to solve problems • Relate energy transfer to potential difference using E=QV • Calculate the total energy supplied using P=IV and E=Pt • Calculate the useful and wasted energy from an appliance's efficiency **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define AC and DC **Sc1:** • State what is meant by the live wire and neutral wire in mains electricity • Describe the national grid and explain how it works • Identify the wires in a UK cable • Identify which fuse should be used in a device from its power rating • Explain the function of the earth pin • Describe the parts of a UK plug and explain the materials used • Compare different appliances based on their efficiencies • Describe energy transfers through a resistor • Describe the energy transfer in a circuit • Describe how to use an oscilloscope to measure frequency and peak pd	• ACDC & national grid • Cables & plugs • Elec Power & PD • Currents & energy transfer • Appliances & efficiency

Molecules and Matter	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Use density equation to calculate mass or volume • Determine melting or boiling point from temp/time graph • Use specific latent heat in calculations • Measure specific latent heat of ice and Water • Use pV = constant in calculations **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define density including units • Define melting and boiling point • Define latent heat, specific latent heat of fusion and of vaporisation **Sc1:** • State properties of solids, liquids and gases, • Describe particle arrangement of solids, liquids and gases • Describe requirements to melt solids or boil liquids • Explain how temperature changes affect internal energy, explain properties of solid, liquid and gas • Describe how particle energy changes with heating • Explain why mass stays the same after state changes • Explain difference between boiling and Evaporation • Measure density of solids and liquids • Determine from density whether object will float • Explain why gases are less dense in terms of energy and bonds • Explain how gases exert pressure on a surface • Explain gas pressure in terms of particles • Describe observable evidence of random motion • Explain why changing gas volume changes Pressure • Explain why gas temperature increases when compressed rapidly • Relate gas pressure to temperature • Relate changes in gas pressure to changes in volume	• Changes of state – *including recap of states of matter* • Internal energy • Specific heat capacity recap • Specific latent heat • Particle motion in gases

Radioactivity	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Represent alpha/beta emission as a diagram • Calculate count rate after given number of half lives • Use nuclear equations **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define isotope • Define half-life and count rate • Define nuclear fission • Define chain reaction • Define nuclear fusion **Sc1:** • Describe an isotope and explain how they are formed • Understand the difference between a stable and unstable isotope and be able to name some • Describe how alpha/beta emission changes nucleus • State how far each type of radiation travels in air • State how materials absorb alpha/beta/gamma radiation • State ionising power of radiation, • Explain why ionising radiation is dangerous • Explain types of nuclear radiation used in medical imaging • Explain how to use radioactivity to destroy cancer cells • Choose appropriate radioisotope for a job, • Discuss how safe nuclear reactors are • Describe effect of radioactive decay on count rate • Describe use of radioisotopes in medicine • Describe radon gas, how it is formed and the dangers it can present • Describe difference between spontaneous and induced fission • Explain how chain reaction is controlled in a reactor • Describe how nuclei can be fused	• Atoms & radiation -including recap of structure of the atom • Discovery of the nucleus - in common with chem • Isotopes • Radioactivity • Nuclear equations • Half life & decay • Radioactive contamination

	• Explain where the sun's energy comes from • Explain why fusion reactors are difficult to make • Explain: why radon gas is dangerous, why nuclear waste is dangerous, what happens to nuclear waste	

YEAR 11 CURRICULUM OVERVIEW: Combined Physics

The Big Picture – Intent:

Physics has long been regarded as the fundamental science meaning that not only do other branches of science and engineering all stem from foundations in physics but by studying physics, we gain a deeper understanding of the entire universe around us. Our curriculum and our teaching provide our students with the essential knowledge and skills that they need to develop their critical thinking and problem-solving skills which will enable them not only to pursue a wide range of careers.

The Physics papers cover the following topics:

Paper 1 – (Topics 18–21): Energy; Electricity; Particle model of matter; and Atomic structure.

Paper 2 – (Topics 22–24): Forces; Waves; and Magnetism and electromagnetism and Space Physics

All students will be able to access the main content of all lessons and all students will be taught to the top with scaffolding, adaptive teaching and stretch and challenge provided where necessary.

Implementation:

Students undertaking Combined Physics have 10 science lessons a fortnight.

The units taught in Year 11 Physics are*: Forces; Waves; and Magnetism and Electromagnetism*

At Key Stage 4 most students follow AQA GCSE Combined Science Trilogy. The specification covers Biology, Chemistry and Physics. This is a linear course with all the examinations at the end of year 11. Students will sit six examinations, two in Biology, two in Chemistry and two in Physics. Each examination is one hour and fifteen minutes in length and worth 16.7% of the final grade. Students can be entered at either Foundation or Higher tier and will attain the equivalent of two GCSEs at 9-1 grades. There are six papers: two biology, two chemistry and two physics. Students are exposed to a knowledge-rich, spiralised curriculum, with the introduction of aspirational career pathways embedded in all units, ranging from pathologists to electrical engineers. Additionally, students are given the opportunity to discuss 'big questions' around the moral, social and ethical implications of many areas of science

Students learn about science through purposeful practical activities as part of day-to-day teaching and learning. Students will also undertake required practicals in class in order to deepen their understanding of scientific concepts and develop their skills of investigating, observing, experimenting and testing the validity of scientific concepts ideas.

Key Summative Assessments:

All units include:

- Retrieval homework
- Live marking
- Low stake quizzing
- Memory recall tasks
- End of Unit Tests

Required practical tasks:

- Specific heat capacity
- Resistance
- IV characteristics
- Density
- Force and extension
- Force & acceleration
- Waves
- Radiation and absorption

Autumn Term:
Forces. Waves

Spring Term:

- Magnetism and electromagnetism

Summer term:
GCSE Exams

Impact: By the end of Year 11 students will be confident with the fundamental and more complex principles, knowledge, and application of this knowledge in physics. Their practical skills will have developed both in discussing variables and describing methods but also analysing data, interpreting results, and suggesting improvements. It is also hoped that links can be made between other sciences as they develop as complete physicists.

Prior Knowledge

KS2: Forces

- Notice that some forces need contact between two objects,
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces
- Recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect

KS2: Space:

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- Describe the movement of the Earth and other planets relative to the sun in the solar system
- Describe the movement of the moon relative to the Earth
- Describe the sun, Earth and moon as approximately spherical bodies
- Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky

KS2: Electricity and magnetism:

- Notice that some forces need contact between two objects, but magnetic forces can act at a distance.
- Observe how magnets attract or repel each other and attract some materials and not others.
- Describe magnets as having two poles.
- Predict whether two magnets will attract or repel each other, depending on which poles are facing.

KS2: Sound:

- Identify how sounds are made, associating some of them with something vibrating
- Recognise that vibrations from sounds travel through a medium to the ear
- Find patterns between the pitch of a sound and features of the object that produced it
- Find patterns between the volume of a sound and the strength of the vibrations that produced it
- Recognise that sounds get fainter as the distance from the sound source increases

KS2 Light:

- Recognise that light appears to travel in straight lines. Use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye.
- Explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes

KS3 Motion and pressure:

- Speed and distance-time graphs
- Pressure in gases and liquids.
- Turning forces.

KS3 Forces:

- Types of forces – squashing & stretching, drag forces & friction, balanced & unbalanced
- Effects of forces on shape and motion

KS3 Turning points in physics:

- Gravitational attraction
- The solar system & forces.
- Redshift, the big band and universal expansion.
- Atomic model & isotopes
- Radiation
- Electromagnetism

KS3 Electromagnets:

- A field is a region where there is a force on an object (a mass, charge, or magnetic material).
- A field is an abstract concept, represented by physical lines (which are not the field).
- Compasses also show a magnetic field around current carrying wires and electromagnets.
- Our lives have been changed immeasurably by devices with motors.

KS3 Waves:

- Longitudinal and transverse waves.
- Properties of waves.
- Waves can transfer energy
- Wave speed.
- Reflection and refraction.
- The electromagnetic spectrum.
- Uses of the different wavelengths in the electromagnetic spectrum.

KS3 Sound:

- Using scales and scientific equipment to measure sound
- Using an oscilloscope to investigate waves.
- Compare the different types of waves and their features. Describe sound travel in terms of energy transfer in
- different media and contrast speed with the speed of
- light.
- Waves
- Sound and energy transfer
- Loudness and pitch
- Detecting sound
- Echoes and ultrasound

KS3 Waves:

- Properties of waves
- Properties and behaviour of light.
- Reflection
- Refraction
- How the eye and the camera work
- Combining colours, coloured filters and coloured objects.

Content	**Disciplinary Knowledge (Skills)** This is the actions taken within a topic to gain substantive knowledge	**Substantive Knowledge** This is the specific, factual content for the topic, which is connected into a careful sequence of learning.
Forces in Balance	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Work out the magnitude of a vector quantity • Use scale diagrams • Find a resultant vector for parallel and perpendicular vectors • State the unit of forces • Use Newton's laws to explain motion • Use F=ma formula to solve problems • Calculate resultant force • Use the parallelogram of forces to calculate a resultant force • Find vertical and horizontal components of forces at an angle • Combine two vectors that are not at right angles • Use SOHCAHTOA and graphical methods to find solutions to vector problems **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define "scalar" and "vector • Define "Resultant Force" • Define "centre of mass"	• Vectors and scalars • Forces between objects • Resultant Forces • Centre of mass • The parallelogram of forces • Resolution of forces

	• Define "counterweight" **Sc1:** • Describe what is meant by a vector quantity • Describe what is meant by a scalar quantity • Give examples of scalars and vectors • Describe displacement • Describe what is meant by a contact force • State what happens to an object when resultant force is zero or not zero • Use the idea of centre of mass and moments to explain stability/toppling over • State Newton's Laws of Motion • Describe and carry out a practical to determine the centre of mass of a 2D shape • Draw a parallelogram of forces	
Motion	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Plot and distance-time graphs • Calculate speed from the graph • Use the formula a=(v-u)t/2 to solve problems • Plot speed-time graphs • Plot a speed-time graph from a distance-time graph • Calculate acceleration and distance travelled from the graph • Make reference to key calculated values **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define acceleration • Define displacement	• Speed distance time • Velocity and acceleration • Velocity time graphs • Analysing motion graphs

	• Define distance • Define speed • Define velocity **Sc1:** • Describe an objects motion from its motion graph • Explain the meaning of negative acceleration • Describe an object's motion from its motion graph • Interpret motion graphs to find meaningful values from gradients or areas • Use motion time graphs to accurately describe an object's journey	
Forces and Motion	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Calculate resultant force from acceleration and mass • Calculate momentum including units • Measure extension of a stretched object **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define inertia • Define terminal velocity • Define momentum • Define elasticity • Define limit of proportionality **Sc1:** • Relate acceleration to force and mass • Describe motion of a falling object	• Force and acceleration • Weight and terminal velocity • Forces and braking • Momentum • Forces and elasticity

	• Describe resultant force for terminal velocity • State difference between mass and weight • State forces opposing forward motion of a vehicle • Solve problems involving the conservation of momentum • Describe and explain factors affecting stopping distance • Explain why increasing the impact time reduces the force • Explain: why helmets and cushioned surfaces reduce impact forces, why • seatbelts and airbags reduce force in an accident, how side impact bars and crumple zones work; work out if a car in a collision was speeding • State factors that affect impact force, • Describe how spring extension relates to force applies	
Wave Properties	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Relate wave speed to frequency and wavelength • Use the formula v=fλ **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define ultrasound • Define seismic waves **Sc1:** • Identify types of waves • Label key features of waves • Give examples of uses of waves • Investigate waves propagating on a string • Describe reflection and refraction	• The nature of waves • Properties of waves • Reflection and refraction • Sound waves

	• State when reflection and refraction of plane waves will happen • Explain why reflection and refraction occur • Describe sound waves • Describe how the loudness and pitch of a soundwave are affected • State limits of human hearing • Identify sound waves from oscilloscope traces	
Electromagnetic Waves	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Relate wave speed to frequency and wavelength • Use the formula v=fλ **Literacy:** • Key terms & definitions in context. • Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define white light • Define ionising radiation **Sc1:** • Identify parts of the EM spectrum • State why some EM waves are dangerous • Identify wavelengths of visible light • Identify different radio waves for different purposes • Describe fibre optics • State which materials will absorb X-Rays	• The electromagnetic spectrum • Light, infrared, microwaves and radio waves • Communications • Ultraviolet waves, X-rays and gamma rays • X-rays in medicine
Electromagnetism	**Maths:** Multiple equations and mathematical processes that students will need to employ. This makes up 30% of the marks available in the physics papers • Relate the ratio of coil numbers to ratio of potential differences **Literacy:** • Key terms & definitions in context.	• Magnetic fields • Magnetic fields of electric currents • Electromagnets in devices • The motor effects • The generator effects • The alternating current generator • Transformers • Transformers in action

	• Use and understanding of GSCE command words • Literacy through the use of GCSE exam questions • Define an electromagnet and label a diagram • Define the motor effect • Define the generator effect **Sc1:** • State the force rule for magnets near each other • Draw field lines around a fixed magnet • Draw magnetic field lines around a current carrying wire • State devices that use electromagnets • Explain induced magnetism • Explain how electromagnets allow their devices to work • Use the Left Hand Rule to determine the force on a wire in a magnetic field • Use induced potential to explain how current can be induced in a wire and state • what affects its size and direction • Label a diagram of a generator and explain how it works • Relate the ratio of coil numbers to ratio of potential differences • Discuss transformer efficiency • State how the strength and direction of the field can be varied • Label a diagram of a simple motor and explain how it works • Explain what is meant by induced potential • Describe a transformer and what it does • State where transformers are used • Explain how transformers work • Use the transformer formula to solve problems • Explain why high voltages are used in overhead power cables	