GCSE Triple Science - Physics

Curriculum Overview 2023-2024

Triple Physics - encourages the development of fundamental physics knowledge and understanding through opportunities of working scientifically. GCSE study in physics provides the foundations for understanding the physical world. 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.

Science has changed our lives and is vital to the world's future prosperity in such a technological age. Our students learn the essential knowledge, methods, processes and uses of science in order to be prepared for life in the modern world. Through building up a body of key knowledge and concepts, pupils will be encouraged to recognise the power of rational explanation and to inspire curiosity and a sense of excitement about natural phenomena. They will be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes. Students be used to challenge, and will become future prepared, critical thinkers. We aim to inspire and produce motivated, highly skilled scientists who are independent life- long learners and who can accurately relate complex concepts to local and world- wide contexts.

At Brine Leas School we provide a balanced science curriculum with breadth and depth in order to help students achieve. Science does not stand alone and many of the concepts taught will help support a student's understanding of other subjects such as PE, Geography, History, Psychology, engineering and Maths. At KS4 we follow the national curriculum using Kerboodle as a starting point for our lessons. This is an excellent, resource rich scheme, which we adapt to suit our students and our local context. Each lesson has a lesson ppts adapted for the group which is shared on Teams. Each powerpoint provides carefully selected activities, model answers, and opportunities for academic reading. Relevant clips to review content and show practicals and the principles of scientific enquiry are embedded into each, where the covid risk assessment has not safely allowed practical to take place. Students are provided with a booklet containing a glossary of tier 3 vocabulary and lesson resources. Students are also given knowledge organisers to use in lessons and at home for self-testing, review and revision. In order to provide further breadth and depth, all students care encouraged to opt for Triple Science should they wish.

Periodic review and evaluation of the Science schemes of work continue to develop and respond to our intent to develop and embed challenge, metacognition, long-term retention and scientific literacy into our curriculum. The course aims to equip our young learners with the independent study skills they need to develop to be successful in their future pathways. Lesson powerpoints provide the basis for consistent of delivery of our curriculum and structured homeworks are set to support students in their independent learning to foster a culture of hard work that leads to achievement and encourages life-long learning. Knowledge organisers and glossaries are provided at the start of topics to embed third tier vocabulary and to provide clarity of learning intent.

The main aim of our curriculum is to provide students with the key knowledge and skills to achieve well and become good scientists, with a clear understanding of the importance of science as a STEM subject in the modern world. Science is also vital for the personal development of well-rounded, informed, healthy individuals. Our curriculum supports students social, moral, spiritual and cultural development by facilitating a sense of enjoyment and fascination in learning about themselves, others and the world around them, use of imagination and creativity in their learning and encouraging a willingness to reflect on their experiences. Many topics such as genetic screening, human impact on the world, our changing atmosphere, generating electricity etc. provide the opportunity to create an interest in investigating and offering reasoned views about moral and ethical issues, and being able to understand and appreciate the viewpoints of others on these issues. Students are also encouraged to develop and use a range of social skills particularly during practical activities and project work. Science provides a platform to teach the fundamentally important biological knowledge that contributes to relationship and sex education and health and well-being. Throughout ks3 and 4 we explore key ideas address topics such as physical health and fitness, the effect of drugs, tobacco and alcohol, healthy eating, prevention of disease and adolescent bodies, sexual relationships, sexual health and contraception.

A significant focus is placed upon developing our students as accomplished practical scientists. Using the core principles of good investigative techniques and the associated maths skills. Students will experience what makes a strong and valid investigation and know how to develop their own method and carry out an investigation safely and efficiently. Building these practical skills throughout the course will enable all students to progress to A- level or science apprenticeships with a well-developed knowledge and wide experience of working scientifically. In addition to planning and carrying out an investigation the students will have to learn how to interpret and use the data or observations that they have generated. The skills that the students acquire in data analysis are invaluable as a transferable life skill. Also the ability to use calculations and determine the validity and significance of the data are wider skills that could be employed across many employment sectors. In the process of analysis they will learn to spot patterns and link that to scientific theory, again these skills are very transferable beyond a science setting.

Science at Brine Leas should be challenging, fascinating, and provide the knowledge and transferrable skills that are invaluable in preparing students for their life ahead. We aim for a large proportion of students to go on to study science further and to have science- based careers.

Assessment

Termly exams in physics consist of a mixture of long and short answer questions as well as multiple choice questions- 15% of questions relate to practical skills, 20% of the marks available will test maths skills.

Homework

Exam style questions, creation of knowledge organisers and revision cards, practical write ups, and webquests.

Clubs and/or intervention

Revision sessions and homework support.

Parental/Carer support

Teams resources, Knowledge organisers, and email communication.

Helpful sources of information
Teams, AQA website, GCSE Bitesize, Kerboodle.com, and Seneca learning. Oak National Academy lessons

Connections to future pathways:
Careers: accelerator operator, acoustic consultant, aerospace engineer, astronomer, auto electrician Broadcast engineer, broadcast technician, 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, field service engineer, functional safety engineer, generator technician, generator engineer, geochemist, geoscientist, green construction manager, hydrographic surveyor, laser engineer, mechanic, meteorologist, mining engineer, mudlogger, network systems analyst, nuclear technician, optical engineer, optician, power plant operator, programmer radio dispatcher, prosthetics, radar operator, radiographer, renewable energy consultant, 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 A level, engineering A level or equivalent, Physics degree, engineering apprenticeships

Year 10 Overview

Term	Knowledge	Assessment	Connections to learning
Autumn 1&2	**Energy Resources & Particles at work** Energy Resources - The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage. Particles at work - Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. The fundamentals of electromagnetism were worked out by scientists of the 19th century. However, power stations, like all machines, have a limited lifetime. *Big Question- If we all continue to demand more electricity this means building new power stations in every generation – but what mix of power stations can promise a sustainable future?*		

	➢ <u>Energy</u> ➢ Conduction ➢ Convection ➢ Radiation ➢ Specific Heat capacity ➢ Reducing energy losses in the home ➢ <u>Energy Resources</u> ➢ Energy demands ➢ Energy from wind and water ➢ Power from the sun and earth ➢ Energy and the environment ➢ Big energy issues	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Energy resources and electricity in year 7 and 9. <u>5 - The Moral Development of pupils</u>
	➢ <u>Electrical circuits and electricity in the home</u> ➢ Electric fields ➢ Current and charge ➢ Potential difference ➢ Component characteristics ➢ Series circuits ➢ Parallel circuits ➢ Alternating current ➢ Cables and plugs ➢ Electrical power and potential difference ➢ Electrical currents and energy transfer ➢ Appliances and efficiency	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ In lesson retrieval quiz and multiple choice hinge questions ➢ Required practicals (3)	➢ Circuits and energy at KS3
Spring 1	**Particle model of matter** The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain! *Big Question – George Mallory (a British explorer from Cheshire) died on Everest – what were his achievements? How is the particle model relevant to his expeditions?*		

	➢ <u>Molecules and matter</u> ➢ Density ➢ States of matter ➢ Changes of state ➢ Internal energy ➢ Specific latent heat ➢ Gas pressure and temperature ➢ Gas pressure and volume	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ In lesson retrieval quiz and multiple-choice hinge questions ➢ Required practical	➢ KS3 atoms, elements and molecules, maths skills lessons, chemical reactions.
Spring 2	**Atomic structure** Ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation *Big Question – many discoveries related to atomic structure took place at the University of Manchester (eg Rutherford Scattering) - how important are the discoveries made in our local area?*		
	➢ <u>Radioactivity</u> ➢ Atoms and radiation ➢ The discovery of the nucleus ➢ Changes in the nucleus ➢ Alpha, beta and gamma radiation ➢ Activity and half life ➢ Radiation in medicine ➢ Fission & Fusion ➢ Nuclear Issues	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ quiz and multiple choice hinge questions	➢ KS3 atom and elements, particles ➢ KS4 particle model of matter, atomic structure,
Summer 1	**Forces in action** Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible. *Big Question – should cars be designed with a maximum power engine? Should roads have a maximum speed limit?*		

	➢ <u>Forces in balance</u> ➢ Vectors and scalars ➢ Forces between objects ➢ Resultant forces ➢ Levers & Gears ➢ Centre of mass ➢ Moments ➢ The parallelogram of forces ➢ Resolution of forces	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / hinge questions/ retrieval quiz, required practical sheets ➢ NOTE: Specifically chapter 9 but you may choose to address in this chapter ➢ NOTE: Specifically chapter 9 but you may choose to address in this chapter	➢ KS4 motion ➢ KS3- forces and motion
Summer 2	**Forces in action** Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible. *Big Question – the law continually changes with regards to our roads – should factors which affect our reaction time carry greater penalties?*		
	➢ <u>Motion</u> ➢ Speed-distance time graphs ➢ Velocity and acceleration ➢ Velocity- time graphs ➢ Analysing motion graphs	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3- forces and motion ➢ KS4 – forces in balance

Year 11 Overview

Term	Knowledge	Assessment	Connections to learning

<table>
<tr><td rowspan="2">Autumn 1</td><td colspan="3">Forces

Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible.
Big Question – should cars be designed with a maximum power engine? Should roads have a maximum speed limit?</td></tr>
<tr><td>➢ Forces and acceleration
➢ Weight and terminal velocity
➢ Forces and braking
➢ Momentum
➢ Impact forces
➢ Safety first
➢ Forces and elasticity
➢ Pressure and surfaces
➢ Pressure in a liquid
➢ Atmospheric pressure
➢ Upthrust & flotation</td><td>➢ Exam style questions (Multiple choice, structured, closed short answer, and open response)
➢ Required practical</td><td>➢ KS3 forces, floating and sinking, fluids</td></tr>
<tr><td rowspan="2">Autumn 2</td><td colspan="3">Waves

Wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves.
Big Question – what life changing ways can we use medical physics? How many of these developments have taken place in the UK (eg CT scanner)?</td></tr>
<tr><td>➢ <u>Waves</u>
➢ The nature of waves
➢ Properties of waves
➢ Reflection and refraction
➢ More about waves
➢ Sound waves
➢ The uses of ultrasound
➢ Seismic waves</td><td>➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper exam/ hinge questions/ retrieval quiz, required practical sheets
➢ Required practical</td><td>➢ KS3- light, sound
➢ KS4 - energy</td></tr>
</table>

	➢ The electromagnetic spectrum ➢ Light, infrared, microwaves and radio waves ➢ Communications ➢ Ultraviolet waves, x-rays and gamma rays. ➢ X -rays in medicine		
Spring 1	**Waves and EM induction** Wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves. The study of magnetic fields is essential to the understanding of generating electricity. The topic starts with recall of KS3 magnetic fields and builds up to linking magnetic fields to the generation of alternating currents. Pupils then apply this learning to the understanding of transformers. Pupils can link to earlier topics such as electricity in the home but also begin to look forward to the more in depth study of the effects of magnetic fields at A Level. *Big Question – how effective is regenerative braking? Should all cars have this?*		
	➢ Reflection of light ➢ Refraction of light ➢ Light and colour ➢ Lenses ➢ Using lenses ➢ Magnetic fields ➢ Magnetic fields of electric currents ➢ Electromagnets in devices ➢ The motor effect ➢ The generator effect ➢ The AC generator ➢ Transformers ➢ Transformers in action	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practicals (2)	➢ KS3 magnets and electromagnets, forces. ➢ KS4 electricity, energy resources.

Spring 2	**Space** The study of space is one that fascinates physicists. This topic links together prior topics such as electromagnetic waves and nuclear radiation to develop an understanding of the fundamental ideas that explain the way in which the Universe works. Pupils will begin with the Solar System and work outwards, studying stars and planets before the Universe as a whole. This topic also plants the seed for more in depth understanding of many topics studied at a A level, using satellites and orbits to begin thinking about gravitational fields and circular motion. This topic is linked to the wider scientific world using the study of different types of telescopes, again linking to electromagnetic waves. *Big Question – what is the future of the Universe?*		
	<u>Space</u> ➢ Formation of the Solar System ➢ The life history of a star ➢ Planets, satellites, and orbits ➢ The expanding universe ➢ The beginning and future of the Universe	➢ Mock paper	➢ KS3 Space (studied in Year 8, planets, solar system, orbits, stars and constellations)