Physics Year 10 Triple Science

Curriculum Intent

Physics is the study of energy and matter and their interactions. The GCSE Physics course provides an interesting and challenging experience to link key physical ideas and understand how they relate to each other.

The course aims for all students to: ·
develop essential knowledge, understanding and application of different areas of the subject and how they relate to each other understand how society makes decisions about scientific issues and how Physics contributes to the success of the economy and society develop competence and confidence in a variety of practical, mathematical and problem solving skills develop and demonstrate a deep appreciation of the skills, knowledge and understanding of scientific methods promote students' interest in and enthusiasm for the subject, including an interest in further study and careers associated with the subject.

Autumn Term | Energy & Atomic Structure

Students will learn:-

Energy stores and systems
Energy changes
Power
Conservation and dissipation of energy
Efficiency
National and global energy resource
The structure of an atom
Mass number, atomic number and isotopes
Development of the model of the atom
Radioactive decay and nuclear radiation
Nuclear equations
Half life
Radioactive contamination
Hazards and uses of background radiation
Nuclear fission and fusion

What does excellence look like?

be able to calculate the changes in energy involved when a system is changed by:
• heating
• work done by forces
• work done when a current flows
Can recall and manipulate equations for kinetic energy and gravitational potential energy in order to calculate energy transfers in a variety of situations.
Can critically evaluate the limitations of the practical methods used to determine specific heat capacity
Able to give examples that illustrate the definition of power.

Explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation.

Able to recall and manipulate the equations for efficiency and apply them to novel contexts

Describe the environmental impact arising from the use of different energy resources

Explain patterns and trends in the use of energy resources.

Explain why atoms have no overall electrical charge
relate differences between isotopes to differences in conventional representations of their identities, charges and masses.
Apply knowledge to the uses of radiation and evaluate the best sources of radiation to use in a given situation.
Calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives.
Describe the factors that could affect the background radiation in a given place
Explain why the hazards associated with radioactive material differ according to the half-life involved.

Knowledge, understanding & Skills

Be able to describe all the changes involved in the way energy is stored when a system changes, for common situations. For example:
• an object projected upwards
• a moving object hitting an obstacle
• an object accelerated by a constant force
• a vehicle slowing down
• bringing water to a boil in an electric kettle.
How to use the equations for kinetic energy, gravitational potential energy and elastic potential energy
Determine the specific heat capacity of one or materials experimentally and using the equation for specific heat capacity
Definition of power and equations to calculate mechanical or electrical power in a variety of contexts
Describe with examples where there are energy transfers in a closed system, that there is no net change to the total energy.
Describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways.

Investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.

Efficiency expressed as a fraction or a percentage

Describe the main energy sources available
Distinguish between energy resources that are renewable and energy resources that are non-renewable
Compare ways that different energy resources are used, the uses to include transport, electricity generation and heating
Understand why some energy resources are more reliable than others

Describe the structure of an atom and the arrangement of protons, neutrons and electrons within it

Use mass number and atomic number to determine the number of neutrons in different isotopes
The electron arrangements may change with the absorption of electromagnetic radiation or by the emission of electromagnetic radiation
Describe why evidence from the Rutherford scattering experiment lead to a change in the model of the atom
Describe the difference between the Plum Pudding model and the nuclear model of an atom
Describe the properties of alpha particles, beta particles and gamma rays is limited to their penetration through materials, their range in air and ionising power.
Use the names and symbols of common nuclei and particles to write balanced equations that show single alpha (α) and beta (β) decay.
Explain the concept of half-life and how it is related to the random nature of radioactive decay.
Determine the half-life of a radioactive isotope from given information.
Students should be able to compare the hazards associated with contamination and irradiation and suggest appropriate precautions

Describe background radiation and its sources
Describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue
Evaluate the perceived risks of using nuclear radiations in relation to given data and consequences.
Describe the process of fission and fusion and their applications
Interpret diagrams representing nuclear fission and how a chain reaction may occur.

How is homework used to enhance learning?

AQA website https://www.aqa.org.uk/subjects/science/gcse/physics-8463/specification-at-a-glance
BBC bitesize https://www.bbc.co.uk/bitesize/examspecs/zsc9rdm
Grade gorilla https://gradegorilla.com/
Isaac Physics https://isaacphysics.org/
Physics tube http://physicstube.org/
Minute physics https://www.youtube.com/user/minutephysics
Hyperphysics http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Suggested homework tasks

- Learn definitions of key terms.
- Group and independent research projects
- Past examination questions practice

Practical activity preparation, simulations and follow-up.

How will we assess impact?

- Peer and self-assessment
- Previous lesson recap quiz
- Land mark tasks
- End of topic test

Spring | Electricity

Students will learn:-

Current
Potential Difference
Resistance
Electrical Charge
Current-voltage characteristics
Series and Parallel Circuits
Energy transfers and power
The National Grid
Static Electricity

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BBC bitesize https://www.bbc.co.uk/bitesize/examspecs/zsc9rdm
Grade gorilla https://gradegorilla.com/
Isaac Physics https://isaacphysics.org/
Physics tube http://physicstube.org/
Minute physics https://www.youtube.com/user/minutephysics
Hyperphysics http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

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Knowledge, understanding & Skills

Standard circuit symbols
The equation linking current, charge and time
The equation linking voltage, current and resistance
The applications of thermistors in circuits eg a thermostat

The application of LDRs in circuits eg switching lights on when it gets dark.

Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature.

Use circuit diagrams to construct and check series and parallel circuits that include a variety of common circuit components
Describe the difference between series and parallel circuits
Calculate the currents, potential differences and resistances in dc series circuits
Solve problems for circuits which include resistors in series using the concept of equivalent resistance.
Describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices.
Describe the use of transformers in the National Grid

Describe the production of static electricity, and sparking, by rubbing surfaces
Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact
Draw the electric field pattern for an isolated charged sphere
Explain the concept of an electric field

What does excellence look like?

Students should be able to draw and interpret circuit diagrams.
Explain the design and use of a circuit to measure the resistance of a component

Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance
Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to the energy changes over time.
Explain why the National Grid system is an efficient way to transfer energy.
Explain how the transfer of electrons between objects can explain the phenomena of static electricity.
Explain how the concept of an electric field helps to explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking.

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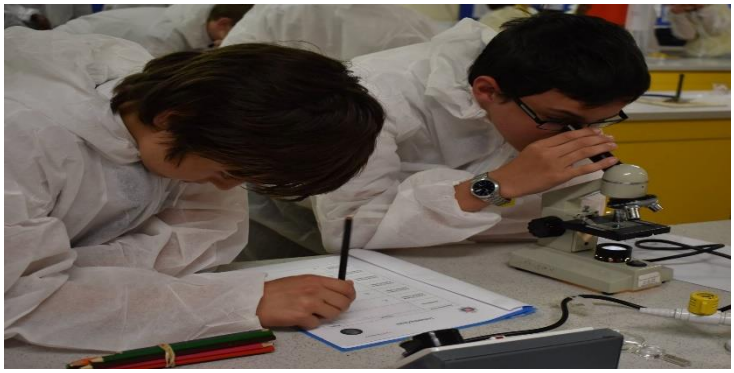
Summer | Forces

Students will learn:-

Scalar and vector quantities
Contact and non-contact forces
Gravity
Resultant forces
Work done and energy transfer
Forces and elasticity
Moments, levers and gears
Pressure and pressure differences in fluids
Atmospheric pressure
Describing motion
Newton's laws
Forces and braking
Momentum



What does excellence look like?

Able to describe the interaction between pairs of objects which produce a force on each object.
Describe examples of the forces acting on an isolated objector system
Resolve a single force into two components acting at right angles to each other.
Able to use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction
Able to convert between newton-metres and joules.
Explain how work done against the frictional forces acting on an object causes arise in the temperature of the object.
Determine the spring constant from a force-extension graph
Explain why, in a liquid, pressure at a point increases with the height of the column of liquid above that point and with the density of the liquid.
Explain why atmospheric pressure varies with height above a surface.
Explain qualitatively, with examples, that motion in a circle involves constant speed but changing velocity.
Determine the speed of an object from a distance time graph
Determine the acceleration of an object from its velocity-time graph
Estimate the magnitude of every day accelerations
Explain how different factors that affect stopping distance either affect thinking distance or braking distance
Explain methods used to measure human reaction times and recall typical results
Estimate the forces involved in the deceleration of road vehicles in typical situations on a public road.
Use the idea of conservation of momentum to calculate momentum changes for two interacting objects

Knowledge, understanding & Skills

Scale drawings of vectors
Determining resultant force by use of scale drawings
Examples of contact forces include friction, air resistance, tension and normal contact force.
Examples of non-contact forces are gravitational force, electrostatic force and magnetic force.
Measure the weight of objects using a spring balance
Use of the equation linking mass, gravitational force and field strength
Understand how an object can be considered to act a point called the centre of mass
Determine the centre of mass of regular and irregular objects experimentally

Use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object, including balanced forces when the resultant force is zero.

Give examples of the forces involved in stretching, bending or compressing an object
Describe the difference between elastic deformation

Investigate the relationship between applied load and extension of a spring

Describe examples in which forces cause rotation.
Calculate the size of a force, or its distance from a pivot, acting on an object that is balanced.
Describe how a simple lever and a simple gear system can both be used to transmit the rotational effects of forces.
Calculate the differences in pressure at different depths in a liquid.
Describe the factors which influence floating and sinking.
Describe a simple model of the Earth's atmosphere and of atmospheric pressure
Measuring and calculating distance, displacement, speed, velocity and acceleration
Recall typical values of speed for a person walking, running and cycling as well as the typical values of speed for different types of transportation systems.
Apply Newton's First Law to explain the motion of objects moving with a uniform velocity and objects where the speed and/or direction changes.
Recall and use the equation for Newton's second law
Apply Newton's third law to equilibrium situations
Describe stopping distance and the factors that affect it
Explain the dangers caused by large decelerations
Calculate linear momentum
Describe and explain examples of momentum in an event, such as a collision

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BBC bitesize https://www.bbc.co.uk/bitesize/examspecs/zsc9rdm
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International Opportunities

Visits Programmes

- Glass bottom boat tour
- Astronomy workshop in school.
- Technik Museum Speyer - incl. Blue Planet IMAX movie
- Shanghai, Oriental Pearl Tower
- Yuyuan Garden

Within the curriculum

The GCSE Physics curriculum is designed to deepen understanding and appreciation of how the International scientific society collaborates and makes decisions about world scientific issues.
Students are encouraged to research each theme beyond lessons, exploring topical international scientific examples. Classwork and homework is designed to ensure that they can draw upon a worldwide knowledge of skills, techniques and theoretical understanding required for their examinations and the potential further study of Physics at an International level at global universities.