GCSE Physics – Forces

West Kirby Grammar School

<table>
<tr><td colspan="2">Learning about forces is important because: Engineers analyse forces when designing a great variety of machines and instruments, from road 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.</td></tr>
<tr><td colspan="2">This builds on: In Key Stage 3 we introduced the concept of forces and their effect on motion. You learnt the names of some of the forces and what they can do. You will also have looked at those forces in more detail and considered describing motion including distance-time graphs. You learnt that the weight of an object depends on its mass and the gravitational field strength. and friction and weight.</td></tr>
<tr><td colspan="2">This leads to: In Yr 11 we will do further work on Newton's Laws of Motion and the part forces play in changing the way things move. We will link this to momentum and applications of vehicle safety features, including seat belts, crumple zones and air bags.</td></tr>
<tr><td>We will learn:
1. about scalar and vector quantities.
2. how vector quantities, especially forces, are represented in diagrams.
3. about contact and non-contact forces.
4. about the link between mass and weight, including calculations.
5. about resultant forces and how to find the magnitude and direction of the resultant force acting on an object.
6. how to resolve a force into two perpendicular components.
7. work done and energy transfer.
8. stretching springs and Hooke's Law.
9. moments, levers and gears.</td><td>We will develop/practise skills including:
• drawing scale diagrams.
• recognising or describing patterns and trends in data presented in a variety of tabular, graphical and other forms.
• drawing conclusions from given observations.

We will develop/practise maths skills by:
• changing the subject of an equation.
• substituting numerical values into algebraic equations using appropriate units for physical quantities.
• translating information between graphical and numeric form.</td></tr>
<tr><td>Some of the vocabulary that we will use includes:
scalar - measurable quantity that has only a magnitude, not a direction (e.g. energy)
vector – measurable quantity that has both a magnitude and a direction (e.g. force)
mass – the amount of matter in an object; symbol m, unit kilogram, kg
weight – the force of gravity on an object; unit newton, N
gravitational field strength – quantity that measures the 'pull' of the force of gravity on each kilogram of mass; symbol g, unit newtons per kilogram, N/kg
centre of mass – a single point where the weight of an object can be considered to act.
free body diagram - a diagram showing all the forces acting on a single object.
resultant force – the single force that would have the same effect on an object as all the forces that are acting on the object</td><td>You could learn more about this topic by:
Do this quiz: Flashcards - Topic 5.3 Forces and Elasticity - AQA Physics GCSE - PMT (physicsandmathstutor.com)
Read and watch the video at: Change of shape - Forces and elasticity - AQA - GCSE Physics (Single Science) Revision - AQA - BBC Bitesize
Practice calculations using Isaac Physics Chapter 3: Energy and balance Remote Concept Lessons: GCSE — Isaac Physics</td></tr>
</table>

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resolution – the smallest interval or change in a quantity being measured that causes a perceptible change in the instrument's reading. e.g. the resolution of a standard 1-metre ruler is 1 mm. **repeatable -** where repetition, under the same conditions by the same investigator, gives similar results **work done** - the transfer of energy from one energy store to another **range -** the set of minimum and maximum values for an independent or dependent variable in an experiment (e.g., 10 cm to 50 cm). It also refers to the mathematical spread of a data set, calculated by subtracting the smallest value from the largest value. **uncertainty –** half the range **elastic deformation** - this occurs when an object changes shape when forces are applied, then returns to its original shape when the forces are removed. **extension** - the increase in length of a material when stretched, measured in metres (m) **limit of proportionality** - the point beyond which Hooke's law is no longer true when stretching a material **spring constant** - a measure of the stiffness of a spring, measured in newtons per metre (N/m) **moment –** turning effect of a force; increased by increasing the force or the perpendicular distance between the line of action of the force and the pivot; symbol M, unit newton-metre, Nm	
Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion, setting EduCake quizzes and giving you feedback in lots of different ways. The key pieces of work in this topic are: **Exam questions on Forces and elasticity and the Required Practical 6.**	

GCSE Physics - Waves

West Kirby Grammar School

*Learning about the **Waves** is important because:* Waves allow energy to be transferred without transferring matter. They are used in communication, medicine, entertainment and scientific research. Understanding waves helps explain how we hear sound, see light, communicate using radio signals and diagnose illnesses using ultrasound and X-rays.

This builds on: In Key Stage 3 you learnt that sound, light and water waves transfer energy. You investigated reflection, refraction and simple wave properties, and explored how light and sound behave in different materials.

This leads to: Later in GCSE Physics you will apply your understanding of waves to electromagnetism, communication technologies and astronomy. Knowledge of waves is also important in careers involving medicine, engineering, telecommunications, geology and acoustics.

We will learn:

1. about transverse and longitudinal waves.
2. the properties of waves including amplitude, wavelength and frequency.
3. how wave speed, frequency and wavelength are related.
4. about reflection, refraction and diffraction.
5. how sound waves are produced and detected.
6. about the electromagnetic spectrum and its uses.
7. how visible light behaves, including colour and reflection.
8. how lenses form images.
9. about black body radiation (Higher Tier only).
10. how to investigate waves using the Required Practical.

We will develop/practise skills including:

- drawing and labelling wave diagrams.
- measuring wavelength and amplitude.
- calculating wave speed.
- interpreting wave diagrams and graphs.
- describing the behaviour of waves.
- evaluating practical investigations.
- explaining applications of electromagnetic waves.

We will develop/practise maths skills by:

- rearranging equations.
- substituting values into equations using correct units.
- converting units (Hz, m, s).
- interpreting graphs.
- using standard form for electromagnetic wavelengths.
- calculating wave speed and frequency.

Some of the vocabulary that we will use includes:

wave – a disturbance that transfers energy from one place to another without transferring matter.

transverse wave – a wave in which vibrations are perpendicular to the direction of travel.

You could learn more about this topic by:

Do this quiz: Physics & Maths Tutor – AQA GCSE Waves Topic Questions.

Read and watch: BBC Bitesize – Waves (AQA GCSE Physics).

GCSE Physics - Waves

West Kirby Grammar School

longitudinal wave – a wave in which vibrations are parallel to the direction of travel. **wavelength (λ)** – the distance between two corresponding points on consecutive waves; measured in metres (m). **frequency (f)** – the number of waves passing a point each second; measured in hertz (Hz). **amplitude** – the maximum displacement from the rest position. **wave speed (v)** – the distance travelled by a wave each second. **period (T)** – the time taken for one complete wave. **compression** – region where particles are close together in a longitudinal wave. **rarefaction** – region where particles are spread further apart in a longitudinal wave. **reflection** – when a wave bounces off a surface. **refraction** – the change in direction of a wave when it enters a different medium. **diffraction** – the spreading out of waves after passing through a gap or around an obstacle. **electromagnetic wave** – a transverse wave that can travel through a vacuum. **ultrasound** – sound waves with frequencies greater than 20 000 Hz. **echo** – reflected sound wave. **convex lens** – a lens that converges light rays. **concave lens** – a lens that diverges light rays (not required in detail for AQA GCSE). **black body radiator** – an object that absorbs and emits all wavelengths of electromagnetic radiation.	**Practice calculations:** Isaac Physics – Waves and the Electromagnetic Spectrum.

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion, setting EduCake quizzes and giving you feedback in lots of different ways.

The key pieces of work in this topic are:

- Required Practical: Measuring wave speed.
- Wave calculations using speed, frequency and wavelength.
- Electromagnetic spectrum comparison questions.
- Reflection and refraction ray diagrams.
- Sound wave investigations.
- End of topic assessment on Waves

GCSE Physics - Electromagnetism

West Kirby Grammar School

*Learning about the **Electromagnetism** is important because:* Electromagnetism is one of the most important ideas in modern physics. It explains how electricity and magnetism interact and underpins technologies such as electric motors, generators, loudspeakers, transformers, MRI scanners and renewable energy systems. Understanding electromagnetism helps engineers design many of the electrical devices we use every day.	
This builds on: In Key Stage 3 you learnt that magnets have north and south poles, unlike poles attract and like poles repel. You also learnt about magnetic fields, simple electromagnets and electric circuits. In GCSE Electricity you studied current, potential difference and resistance, which are essential for understanding electromagnetism.	
This leads to: Later in GCSE Physics you will apply electromagnetism to motors, generators and transformers. Knowledge of electromagnetism is essential in careers involving electrical engineering, renewable energy, electronics, medicine, robotics and telecommunications.	
We will learn: 1. about permanent and induced magnets. 2. how magnetic fields are produced and represented. 3. about the magnetic field around current-carrying wires and solenoids. 4. how electromagnets work and the factors affecting their strength. 5. the motor effect and Fleming's Left-Hand Rule (Higher Tier). 6. how electric motors work. 7. how electromagnetic induction generates electricity. 8. how alternating current is produced. 9. how transformers change potential difference. 10. how the National Grid transfers electricity efficiently.	We will develop/practise skills including: • drawing magnetic field patterns. • interpreting magnetic field diagrams. • predicting the direction of forces using Fleming's Left-Hand Rule (Higher Tier). • explaining electromagnetic induction. • comparing AC and DC supplies. • calculating transformer potential differences. • evaluating practical investigations involving magnets and electromagnets. We will develop/practise maths skills by: • rearranging equations. • substituting values into equations using correct units. • interpreting proportional relationships. • analysing graphical data. • calculating transformer ratios. • using standard form where appropriate.
Some of the vocabulary that we will use includes: **magnetic field** – the region around a magnet where magnetic forces act. **magnetic field line** – an imaginary line showing the direction and strength of a magnetic field. **permanent magnet** – a magnet that produces its own magnetic field.	You could learn more about this topic by: **Do this quiz:** Physics & Maths Tutor – AQA GCSE Electromagnetism Topic Questions. **Read and watch:** BBC Bitesize – Electromagnetism (AQA GCSE Physics).

GCSE Physics - Electromagnetism

West Kirby Grammar School

induced magnet – a material that becomes magnetic when placed in a magnetic field. **magnetic flux** – the magnetic field passing through an area. **electromagnet** – a temporary magnet produced by passing current through a coil. **solenoid** – a long coil of insulated wire that produces a magnetic field when current flows. **motor effect** – the force experienced by a current-carrying conductor placed in a magnetic field. **motor** – a device that converts electrical energy into kinetic energy. **generator** – a device that converts kinetic energy into electrical energy. **electromagnetic induction** – the generation of a potential difference when a conductor cuts magnetic field lines. **alternating current (AC)** – current that continually changes direction. **direct current (DC)** – current that flows in one direction only. **transformer** – a device that changes the potential difference of an alternating current. **primary coil** – the input coil of a transformer. **secondary coil** – the output coil of a transformer. **National Grid** – the network of cables and transformers used to distribute electricity across the UK.	**Practice questions:** Isaac Physics – Electromagnetism and Motors.

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion, setting EduCake quizzes and giving you feedback in lots of different ways.

The key pieces of work in this topic are:

- Magnetic field drawing exercises.
- Electromagnet investigation.
- Motor effect and Fleming's Left-Hand Rule questions (Higher Tier).
- Electromagnetic induction investigations.
- Transformer ratio calculations.
- National Grid evaluation questions.
- End of topic assessment on Electromagnetism (AQA 4.7).

GCSE Physics - Space

West Kirby Grammar School

*Learning about the **Space** is important because:* Space Physics helps us understand the Universe, from the formation of planets and stars to the evolution of galaxies. It explains how gravity shapes the Solar System and how astronomers gather evidence about distant objects. Space exploration has also led to many technological advances, including satellite communications, weather forecasting and GPS.	
This builds on: In Key Stage 3 you learnt about the Solar System, the movement of the Earth, Moon and Sun, gravity and day and night. You also explored the planets and considered how scientific ideas about the Universe have changed over time.	
This leads to: Later studies in astronomy, astrophysics and engineering build upon these ideas. Knowledge of Space Physics is important for careers in astronomy, aerospace engineering, satellite communications, climate science, geophysics and space exploration.	
We will learn: • about the structure of our Solar System. • the life cycle of stars. • how orbits are maintained by gravity. • about natural and artificial satellites. • how red-shift provides evidence for the expanding Universe. • about the origin and future of the Universe. • how scientists gather evidence about objects in space. • how theories of the Universe have developed over time.	We will develop/practise skills including: • interpreting diagrams of the Solar System. • comparing planets and other celestial bodies. • describing the stages of a star's life cycle. • explaining how gravity affects orbits. • interpreting astronomical evidence. • evaluating scientific theories using evidence. • analysing data from space observations. We will develop/practise maths skills by: • interpreting graphs and data. • using standard form for very large distances. • comparing relative sizes and masses. • recognising proportional relationships. • interpreting scientific models. • analysing trends in astronomical observations.
Some of the vocabulary that we will use includes: **astronomical unit (AU)** – the average distance between the Earth and the Sun (approximately 150 million km). **light year** – the distance travelled by light in one year (approximately $9.46 \times 10159.46 \backslash times\ 10\hat{}\{15\}$9.46×1015 m). **planet** – a large object that orbits a star.	You could learn more about this topic by: **Do this quiz:** Physics & Maths Tutor – AQA GCSE Space Physics Topic Questions. **Read and watch:** BBC Bitesize – Space Physics (AQA GCSE Physics). **Explore further:** NASA, ESA and the Royal Observatory educational resources for astronomy and space exploration.

GCSE Physics - Space

dwarf planet – a body that orbits the Sun but has not cleared its orbital path. **natural satellite** – an object, such as the Moon, that orbits a planet. **artificial satellite** – a human-made object placed into orbit around the Earth or another celestial body. **orbit** – the curved path followed by an object moving under the influence of gravity. **gravity** – the force of attraction between masses. **star** – a massive ball of hot gas that produces energy by nuclear fusion. **nebula** – a cloud of gas and dust where stars are formed. **protostar** – a young developing star. **main sequence star** – the stable stage of a star's life where hydrogen is fused into helium. **red giant** – the stage where a low-mass star expands after hydrogen is used up. **red supergiant** – the equivalent stage for high-mass stars. **white dwarf** – the hot, dense core left after a low-mass star dies. **neutron star** – the extremely dense remnant of a massive star. **black hole** – an object with such strong gravity that not even light can escape. **supernova** – the explosion of a massive star. **galaxy** – a collection of billions of stars held together by gravity. **Universe** – all matter, energy, space and time. **red-shift** – an increase in the wavelength of light from distant galaxies caused by them moving away from us. **Big Bang Theory** – the theory that the Universe began from an extremely hot, dense state approximately 13.8 billion years ago.	

Your teacher will assess your knowledge & understanding throughout the topic by looking at your work, questioning, discussion, setting EduCake quizzes and giving you feedback in lots of different ways. The key pieces of work in this topic are:

- Solar System and orbital motion questions.
- Life cycle of stars diagrams.
- Red-shift and Big Bang explanation questions.
- Interpreting astronomical data.
- End of topic assessment on Space Physics.