GCSE Physics Energy

West Kirby Grammar School

*Learning about **energy** is important because:* Energy is needed for all processes on Earth. Understanding how energy is stored, transferred and conserved helps us explain how machines work, how electricity is generated, and how we can reduce energy waste. Engineers use their knowledge of energy to design efficient vehicles, buildings, power stations and renewable energy technologies.

This builds on: In Key Stage 3 you learnt that energy can be transferred between different forms and that energy cannot be created or destroyed. You studied heating, electricity, movement and simple energy changes in everyday situations.

This leads to: Later in GCSE Physics you will apply energy concepts to electricity, particle models, heating systems, power generation and efficiency. Understanding energy transfers is also important in engineering, environmental science and many careers involving technology.

We will learn:

1. about the different energy stores and how energy is transferred.
2. that energy is conserved and cannot be created or destroyed.
3. how to interpret and draw Sankey diagrams.
4. how to calculate energy changes in systems.
5. about gravitational potential energy and kinetic energy.
6. how energy is stored in elastic objects.
7. how to calculate power and understand efficiency.
8. how energy resources are used to generate electricity.
9. the advantages and disadvantages of renewable and non-renewable energy resources.
10. the environmental impacts of different methods of generating electricity.

We will develop/practise skills including:

- interpreting energy transfer diagrams.
- drawing and analysing Sankey diagrams.
- selecting and rearranging equations.
- evaluating different energy resources.
- calculating energy transfers, efficiency and power.
- explaining how energy is stored and transferred in real-world situations.

We will develop/practise maths skills by:

- changing the subject of equations.
- substituting numerical values into equations using correct units.
- converting between standard form units.
- calculating percentages for efficiency.
- interpreting graphical and numerical data.
- using ratios and proportions.

Some of the vocabulary that we will use includes:
energy store – a way in which energy is held by an object or system.
kinetic energy store – energy stored by a moving object.
gravitational potential energy store – energy stored due to an object's position in a gravitational field.

You could learn more about this topic by:
Do this quiz: AQA GCSE Physics Energy topic questions on Physics & Maths Tutor.
Read and watch: Energy stores and transfers – AQA GCSE Physics Revision on BBC Bitesize.

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elastic potential energy store – energy stored when an object is stretched or compressed. **thermal energy store** – internal energy stored in particles due to temperature. **chemical energy store** – energy stored in fuels, food and batteries. **magnetic energy store** – energy stored due to magnetic fields. **electrostatic energy store** – energy stored due to electric charges. **nuclear energy store** – energy stored within atomic nuclei. **energy transfer** – movement of energy from one store to another by: • mechanical work • electrical work • heating • radiation **conservation of energy** – energy cannot be created or destroyed; it can only be transferred between stores. **useful energy transfer** – energy transferred to the desired store. **wasted energy transfer** – energy transferred to unwanted stores, usually thermal energy. **efficiency** – a measure of how much useful energy or power is produced compared with the total supplied. **power** – the rate at which energy is transferred or work is done. **renewable energy resource** – an energy resource that is naturally replenished. **non-renewable energy resource** – an energy resource that will eventually run out. **fossil fuels** – coal, oil and natural gas formed from ancient organic matter. **biofuel** – fuel produced from recently living organisms. **Sankey diagram** – a diagram showing energy transfers where arrow width represents the amount of energy transferred.	**Practice calculations:** Isaac Physics Energy and Power questions.

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:

GCSE Physics Energy

- Energy stores and transfers exam questions.
- Power and efficiency calculations.
- Evaluation of energy resources.
- End of topic assessment on Energy.

GCSE Physics Electricity

West Kirby Grammar School

*Learning about **electricity** is important because:* Electricity powers almost every aspect of modern life, from mobile phones and computers to hospitals and transport systems. Understanding how electric circuits work enables engineers and scientists to design safe electrical systems, improve renewable energy technologies and develop the electronic devices we rely on every day.

This builds on: In Key Stage 3 you learnt that electric current flows around complete circuits. You investigated series and parallel circuits, learnt the roles of cells, bulbs, switches and motors, and explored conductors, insulators and static electricity.

This leads to: Later in GCSE Physics you will study electromagnetism, mains electricity, transformers, generators and motors. Knowledge of electricity is essential for careers in engineering, electronics, renewable energy, computing and telecommunications.

We will learn:

- about electrical charge and current.
- the relationship between current, potential difference and resistance.
- how series and parallel circuits behave.
- how resistance changes with different components.
- about domestic electricity and mains supply.
- how electrical power and energy are calculated.
- how appliances transfer energy.
- how to investigate current, potential difference and resistance (Required Practical).
- how to explain the behaviour of electrical components.

We will develop/practise skills including:

- drawing and interpreting circuit diagrams using standard symbols.
- constructing series and parallel circuits safely.
- measuring current, potential difference and resistance.
- plotting and interpreting current–potential difference graphs.
- identifying patterns in data.
- calculating electrical quantities using equations.
- evaluating practical methods and experimental results.

We will develop/practise maths skills by:

- changing the subject of equations.
- substituting values into equations using SI units.
- converting prefixes (milli, kilo etc.).
- plotting and interpreting graphs.
- calculating gradients.
- calculating percentages and efficiencies where appropriate.

Some of the vocabulary that we will use includes:

electric charge – the property of matter that causes electrical forces; measured in coulombs (C).

current – the rate of flow of electric charge; measured in amperes (A).

You could learn more about this topic by:

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

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

Practice calculations: Isaac Physics – Electric Circuits and Resistance.

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potential difference (voltage) – the energy transferred per unit charge; measured in volts (V). **resistance** – a measure of how difficult it is for current to flow through a component; measured in ohms (Ω). **series circuit** – a circuit with only one path for current. **parallel circuit** – a circuit with more than one path for current. **cell** – provides potential difference to move charge around a circuit. **battery** – two or more cells connected together. **conductor** – a material that allows electric charge to flow easily. **insulator** – a material that resists the flow of electric charge. **diode** – allows current to flow in only one direction. **light-dependent resistor (LDR)** – resistance decreases as light intensity increases. **thermistor** – resistance decreases as temperature increases. **static electricity** – the build-up of electric charge on an object's surface. **earth wire** – a safety wire that prevents electric shock if a fault occurs. **live wire** – carries alternating potential difference from the mains supply. **neutral wire** – completes the circuit by carrying current away from the appliance. **fuse** – safety device that melts if current becomes too large.	

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.

- Required Practical: Investigating current and potential difference.
- Circuit construction and fault-finding activities.
- Current–potential difference graph analysis.
- Electrical power and energy calculations.
- End of topic assessment on Electricity (AQA 4.2).

GCSE Physics Particle Model of Matter

West Kirby Grammar School

*Learning about the **particle model of matter** is important because:* Everything around us is made of particles. Understanding how particles behave helps explain changes of state, temperature, pressure and density. Scientists and engineers use the particle model when designing engines, refrigerators, buildings and materials, and when predicting weather and studying Earth's atmosphere.

This builds on: In Key Stage 3 you learnt that solids, liquids and gases are made of particles. You explored changes of state, diffusion and simple heating and cooling. You also learnt that heating causes particles to gain energy and move more quickly.

This leads to: Later in GCSE Physics you will apply the particle model to gas pressure, internal energy, thermal insulation and radioactive decay. Knowledge of particle behaviour is also essential in chemistry, engineering, meteorology and environmental science.

We will learn:

- about the arrangement and movement of particles in solids, liquids and gases.
- how substances change state by heating and cooling.
- about internal energy and how it changes.
- the difference between specific heat capacity and specific latent heat.
- how to calculate energy transferred when heating substances.
- how pressure in gases is related to particle motion.
- how changes in temperature affect gas pressure.
- about density and how to calculate it.
- how to investigate the density of regular and irregular objects (Required Practical).

We will develop/practise skills including:

- describing particle behaviour in different states of matter.
- explaining changes of state using the particle model.
- measuring mass and volume accurately.
- calculating density.
- carrying out heating calculations.
- interpreting graphs involving heating and cooling.
- evaluating experimental methods and data.

We will develop/practise maths skills by:

- rearranging equations.
- substituting values into equations using correct units.
- converting between cm^3 and m^3.
- converting between grams and kilograms.
- interpreting graphs.
- using ratios and proportional reasoning.

Some of the vocabulary that we will use includes:
particle model – a model which explains the properties of solids, liquids and gases using tiny particles.
solid – particles vibrate about fixed positions and are closely packed.
liquid – particles are close together but can move past one another.

You could learn more about this topic by:
Do this quiz: Physics & Maths Tutor – AQA GCSE Particle Model of Matter Topic Questions.
Read and watch: BBC Bitesize – Particle Model of Matter (AQA GCSE Physics).

GCSE Physics Particle Model of Matter

West Kirby Grammar School

gas – particles are widely spaced and move rapidly in random directions. **density** – the mass of a substance per unit volume. **mass** – the amount of matter in an object; measured in kilograms (kg). **volume** – the amount of space occupied by an object; measured in cubic metres (m^3) or cubic centimetres (cm^3). **internal energy** – the total kinetic and potential energy of the particles in a system. **specific heat capacity** – the energy required to raise the temperature of 1 kg of a substance by 1°C (or 1 K). **specific latent heat** – the energy required to change the state of 1 kg of a substance without changing its temperature. **melting** – change from solid to liquid. **freezing** – change from liquid to solid. **boiling** – change from liquid to gas throughout the liquid. **evaporation** – change from liquid to gas at the surface. **condensation** – change from gas to liquid. **sublimation** – direct change between solid and gas without becoming liquid. **pressure** – force acting per unit area; in gases it is caused by particles colliding with the walls of their container. **absolute zero** – the lowest possible temperature (-273°C), where particles have minimum kinetic energy.	**Practice calculations:** Isaac Physics – Density, Specific Heat Capacity and Specific Latent Heat.

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 density.
- Density calculations.
- Specific heat capacity and latent heat calculations.
- Particle model explanation questions.
- Gas pressure and temperature investigations.
- End of topic assessment on Particle Model of Matter.

GCSE Physics - Atomic Structure

West Kirby Grammar School

*Learning about the **Atomic Structure** is important because:* Everything in the Universe is made of atoms. Understanding atomic structure explains the behaviour of elements, the discovery of radioactivity, and the uses of nuclear radiation in medicine, industry and scientific research. It also helps us understand how the Earth was formed and how radioactive materials can be used safely.

This builds on: In Key Stage 3 you learnt that all matter is made of atoms. You learnt about elements, compounds and mixtures, and that atoms contain protons, neutrons and electrons. You were also introduced to the idea that some atoms are radioactive.

This leads to: Later in GCSE Physics you will study nuclear fission, nuclear fusion, radiation hazards and the uses of radioactivity. Knowledge of atomic structure is essential for careers in medicine, engineering, nuclear science, archaeology, environmental science and space exploration.

We will learn:

- about the structure of atoms.
- about isotopes and how they differ.
- how scientific models of the atom have changed over time.
- about radioactive decay and the three main types of nuclear radiation.
- the properties and penetration of alpha, beta and gamma radiation.
- about nuclear equations.
- how radioactive contamination differs from irradiation.
- about half-life and radioactive decay.
- the uses and dangers of radioactive materials.
- about nuclear fission and nuclear fusion.

We will develop/practise skills including:

- interpreting atomic diagrams.
- writing and balancing nuclear equations.
- comparing the properties of different types of radiation.
- interpreting decay and half-life graphs.
- explaining scientific discoveries using evidence.
- evaluating the risks and benefits of radioactive materials.

We will develop/practise maths skills by:

- calculating half-life.
- interpreting graphs and decay curves.
- using ratios and percentages.
- recognising exponential relationships.
- calculating changes in count rate and activity.
- interpreting scientific data.

Some of the vocabulary that we will use includes:
atom – the smallest particle of an element that can exist.
nucleus – the dense centre of an atom containing protons and neutrons.
proton – a positively charged particle found in the nucleus.
neutron – an uncharged particle found in the nucleus.

You could learn more about this topic by:

Do this quiz: Physics & Maths Tutor – AQA GCSE Atomic Structure Topic Questions.
Read and watch: BBC Bitesize – Atomic Structure (AQA GCSE Physics).
Practice questions: Isaac Physics – Radioactivity and Nuclear Physics.

GCSE Physics - Atomic Structure

West Kirby Grammar School

electron – a negatively charged particle that moves around the nucleus in energy levels (shells). **atomic number** – the number of protons in the nucleus of an atom. **mass number** – the total number of protons and neutrons in the nucleus. **isotope** – atoms of the same element with the same number of protons but different numbers of neutrons. **radioactive decay** – the random emission of radiation from an unstable nucleus. **unstable nucleus** – a nucleus that loses energy by emitting radiation. **alpha particle (α)** – consists of two protons and two neutrons (a helium nucleus); highly ionising but least penetrating. **beta particle (β)** – a fast-moving electron emitted from the nucleus; moderately ionising and moderately penetrating. **gamma ray (γ)** – high-energy electromagnetic radiation emitted from the nucleus; weakly ionising but highly penetrating. **ionisation** – the process of removing electrons from atoms to form ions. **background radiation** – low levels of radiation that are always present in the environment. **irradiation** – exposing an object to radiation without making it radioactive. **contamination** – unwanted radioactive material on or inside an object. **activity** – the rate at which a radioactive source decays; measured in becquerels (Bq). **half-life** – the time taken for the activity or number of undecayed nuclei in a radioactive sample to halve. **nuclear fission** – the splitting of a large unstable nucleus into two smaller nuclei, releasing energy. **chain reaction** – a series of fission reactions triggered by released neutrons. **nuclear fusion** – the joining of two small nuclei to form a larger nucleus, releasing large amounts of energy.	

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:

GCSE Physics - Atomic Structure

West Kirby Grammar School

- Atomic structure and isotope questions.
- Nuclear equation practice.
- Radioactive decay and half-life calculations.
- Interpreting decay graphs.
- Evaluating the uses and risks of radiation.
- End of topic assessment on Atomic Structure.