Cornwallis Academy
Ambitions for All

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Year 11 GCSE Physics

P1 Energy

Learning Objectives

- Define energy and its units (Joules).
- Identify types of energy (kinetic, gravitational, chemical, thermal, etc.).
- Explain energy transfers and conservation.
- Calculate work done, power, and efficiency.
- Understand renewable vs non-renewable energy sources.

What previous knowledge is required?

- Basic mathematics (algebra, units, calculations).
- Understanding of forces and motion (basic level).
- Familiarity with graphs and tables.

How will this topic content help with future learning?

- Foundation for **P2 Electricity** (energy transfer in circuits).
- Supports **P3 Particle Model** (thermal energy).
- Essential for understanding **P6 Forces and motion** (work and power).
- Links to environmental physics and sustainable energy studies.

Common Misconceptions

- Energy is "used up" → energy is transferred, not destroyed.
- All energy is the same → different forms exist with specific uses.
- Efficiency can exceed 100% → impossible due to conservation of energy.
- Fossil fuels are unlimited → they are finite resources.

National Curriculum / Specification

- KS4 Physics: "Energy stores, transfers, conservation, and efficiency."
- AQA 8463 P1: Energy.
- Practical: measuring efficiency of devices, investigating energy transfer.

P2 Electricity

Learning Objectives

- Describe current, potential difference, and resistance.
- Use Ohm's Law and calculate electrical quantities.
- Understand series and parallel circuits.
- Explain domestic electricity (mains supply, fuses, safety).
- Understand energy transfer in electrical appliances.

What previous knowledge is required?

- P1 Energy: work and power concepts.
- Basic atoms and electrons (C1 from Chemistry helpful).
- Simple circuit diagrams and symbols.

How will this topic content help with future learning?

- Foundation for **P5 Waves and EM spectrum** (electromagnetic devices).
- Supports **P6 Forces and motion** (electrical energy powering devices).
- Essential for understanding **renewable energy and electricity generation**.

Common Misconceptions

- Current is "used up" → current is the flow of charge, same everywhere in a series.
- Voltage is "energy itself" → it is **energy per unit charge**.
- Batteries only supply energy once → they convert stored chemical energy continuously.

- Resistance is only present in wires → all components have resistance.

National Curriculum / Specification

- KS4 Physics: "Electricity: current, voltage, resistance, circuits, power, energy transfer."
- AQA 8463 P2: Electricity.
- Practical: measuring current, voltage, resistance; series vs parallel investigations.

P3 Particle Model of Matter

Learning Objectives

- Describe solids, liquids, and gases in terms of particles.
- Explain density, pressure, and internal energy.
- Understand changes of state (melting, boiling, condensation, freezing, sublimation).
- Calculate pressure and density.
- Explain gas pressure and temperature relationships.

What previous knowledge is required?

- Basic mathematics (density, area, volume).
- Energy and work (P1).
- Atomic structure (C1 Chemistry).

How will this topic content help with future learning?

- Supports **P4 Atomic Structure** (particles and energy).
- Foundation for **P6 Forces and motion** (pressure, density, buoyancy).
- Helps explain **P5 Waves and energy transfer** in gases and solids.

Common Misconceptions

- Particles are "floating freely in solids" → they vibrate in fixed positions.
- Temperature = heat → temperature measures particle kinetic energy, not total energy.
- Particles in liquids are the same as gases → liquid particles are closer and less free-moving.
- Pressure only depends on force → also depends on area and particle collisions.

National Curriculum / Specification

- KS4 Physics: "Particle model, density, pressure, changes of state, gas laws."
- AQA 8463 P3: Particle Model of Matter.
- Practical: measuring density, investigating pressure and temperature relationships.

P4 Atomic Structure

Learning Objectives

- Describe structure of atom: protons, neutrons, electrons.
- Explain isotopes and relative atomic mass.
- Describe nuclear radiation: alpha, beta, gamma.
- Explain half-life and radioactive decay.
- Understand uses and dangers of radiation.

What previous knowledge is required?

- Atomic structure (C1 Chemistry).
- Energy (P1) and particle model (P3).
- Basic safety knowledge for handling radiation.

How will this topic content help with future learning?

- Links to **P6 Forces and motion** (nuclear energy).
- Supports understanding of **C9 Chemistry of the Atmosphere** and environmental physics.
- Foundation for **medicine, nuclear power, and radioactivity applications**.

Common Misconceptions

- Radiation is always dangerous → depends on type, exposure, and shielding.

- Radiation changes atoms into entirely new elements → only nuclear decay changes the nucleus.
- Alpha particles can penetrate the body easily → alpha is stopped by paper or skin.
- Half-life means all atoms decay → it is the **time for half the nuclei to decay**.

National Curriculum / Specification

- KS4 Physics: "Atomic structure, radiation, isotopes, nuclear energy."
- AQA 8463 P4: Atomic Structure.
- Practical: detecting radiation, measuring half-life with safe sources.

P5 Forces

Learning Objectives

- Describe contact and non-contact forces.
- Understand Newton's laws of motion.
- Calculate resultant forces, moments, and pressure.
- Explain work done, energy transfer, and Hooke's Law.
- Understand momentum and stopping distances.

What previous knowledge is required?

- Energy (P1).
- Particle model (P3) for understanding material stretching.
- Basic mathematics (forces, algebra, vectors).

How will this topic content help with future learning?

- Essential for **P5 Motion** (forces cause acceleration).
- Supports understanding of **P6 Waves** (force and tension in media).
- Foundation for **P7 Magnetism and P6 EM** (forces on charged particles).

Common Misconceptions

- Weight and mass are the same → weight = mass × gravitational field strength.
- Acceleration is "caused by force alone" → depends on mass (F=ma).
- Springs always obey Hooke's Law → only within elastic limit.
- Momentum is "lost" → momentum is conserved in closed systems.

National Curriculum / Specification

- KS4 Physics: "Forces, motion, elasticity, moments, pressure, work, momentum."
- AQA 8463 P5: Forces.
- Practical: investigating Hooke's Law, measuring forces and extension.

P6 Waves

Learning Objectives

- Describe longitudinal and transverse waves.
- Calculate wave speed, frequency, and wavelength.
- Explain reflection, refraction, diffraction, and absorption.
- Understand the electromagnetic spectrum and uses of EM waves.
- Explain energy transfer by waves.

What previous knowledge is required?

- Energy (P1) and particle model (P3).
- Basic algebra and measurement.
- Light and sound in everyday life.

How will this topic content help with future learning?

- Foundation for **P7 Magnetism & P6 EM induction** (EM waves and electricity).
- Links to **P8 Space Physics** (light, radiation, EM spectrum).
- Supports understanding of **communications technology**.

Common Misconceptions

- Sound is a transverse wave → sound is longitudinal.
- EM waves need a medium → they can travel through vacuum.
- Frequency changes wavelength → wavelength depends on speed/frequency relationship.
- Radio waves are "slower than light" → all EM waves travel at the speed of light in a vacuum.

National Curriculum / Specification

- KS4 Physics: "Waves, sound, EM spectrum, reflection, refraction, energy transfer."
- AQA 8463 P6: Waves.
- Practical: measuring wave speed, observing reflection/refraction.

P7 Magnetism and Electromagnetism

Learning Objectives

- Describe magnetic fields and forces on charged particles.
- Explain electromagnets and solenoids.
- Understand motors, generators, and transformers.
- Calculate induced voltage and use Fleming's rules.
- Understand electromagnetic induction and its applications.

What previous knowledge is required?

- Electricity (P2).
- Forces (P5).
- Waves (P6) for EM wave understanding.

How will this topic content help with future learning?

- Supports **P8 Space Physics** (Earth's magnetic field).
- Essential for electrical engineering concepts and industry applications.
- Links to **renewable energy and power generation**.

Common Misconceptions

- Magnetic field lines are physical objects → they are **representations of field direction and strength**.
- Current is "used up" in a circuit → current is the flow of charge, conserved throughout.
- Electromagnets are permanent → they require current to magnetise.
- Induced current requires contact → electromagnetic induction works without physical connection.

National Curriculum / Specification

- KS4 Physics: "Magnetism, electromagnetism, motors, generators, transformers."
- AQA 8463 P7: Magnetism & Electromagnetism.
- Practical: investigating magnetic fields, motor setups, induced voltage measurements.

P8 Space

Learning Objectives

- Describe the solar system, planets, moons, and artificial satellites.
- Explain orbits and gravitational forces.
- Understand seasons, day/night, and eclipses.
- Explain the life cycle of stars and the formation of black holes, neutron stars, and white dwarfs.
- Understand redshift and the expanding universe.
- Describe telescopes and observing the universe.

What previous knowledge is required?

- Forces and motion (P5).
- Energy (P1).
- Waves (P6) for EM radiation.
- Magnetism (P7) for planetary fields.

How will this topic content help with future learning?
• Supports understanding of **astrophysics and cosmology** at A-level. • Links to **gravity, orbital mechanics, and energy in space systems**. • Builds foundation for **practical astronomy and satellite technology**.
Common Misconceptions
• Gravity only exists on Earth → gravity exists everywhere in space. • Seasons are caused by distance from the Sun → they are caused by the tilt of Earth's axis. • Stars twinkle due to "own brightness change" → it's atmospheric refraction. • Black holes "suck everything in" → they only affect objects within their event horizon. • The universe has a fixed centre → expansion occurs uniformly; no centre.
National Curriculum / Specification
• KS4 Physics: "Space, solar system, forces, stars, and universe." • AQA 8463 P8: Space Physics. • Practical: observing motion of the Sun/Moon, satellite orbits, simulations of gravity and orbits.