GCSE Combined Science: Physics (AQA – Trilogy)

Paper 1

6.1 Energy

6.1.1 Energy changes in a system, and the ways energy is stored before and after such changes

6.1.1.1 Energy stores and systems

	I can describe how energy is stored or transferred in different systems (e.g. moving object hitting a wall, boiling water, etc.).
	I can identify different energy stores (kinetic, thermal, chemical, etc.).
	I can explain changes in energy stores when a system changes.
	I can calculate energy transfers using work done by forces or by current.

6.1.1.2 Changes in energy

	I can use the formula for kinetic energy ($E_k = 1/2mv^2$) to calculate energy in moving objects.
	I can use the formula for elastic potential energy ($E_e = 1/2ke^2$) for stretched springs.
	I can use the formula for gravitational potential energy ($E_p = mgh$).

6.1.1.3 Energy changes in systems

	I can use the formula: $\Delta E = mc\Delta\theta$ to calculate energy changes from heating.
	I can describe specific heat capacity.
	I can link energy stores and changes in temperature.

6.1.1.4 Power

	I can define power as the rate of energy transfer or work done.
	I can use the formulae: $P = E/t$ and $P = W/t$.
	I can compare power of devices and explain power ratings.

6.1.2 Conservation and dissipation of energy

6.1.2.1 Energy transfers in a system

	I can explain how energy is conserved in closed systems.
	I can describe wasted energy and explain how energy spreads to less useful stores.

	I can describe how to reduce unwanted energy transfers, including insulation and lubrication.
	I can explain the effects of thermal conductivity on energy transfer.

6.1.2.2 Efficiency

	I can calculate efficiency using energy or power: efficiency = (useful output / total input)
	I can give efficiency as a decimal or percentage.
	(HT only) I can describe how to increase efficiency of energy transfers.

6.1.3 National and global energy resources

	I can describe the main renewable and non-renewable energy resources.
	I can compare the uses of energy resources for transport, electricity generation and heating.
	I can evaluate the reliability and environmental impact of different energy resources.
	I can explain why science alone cannot solve political or economic energy issues.

6.2 Electricity

6.2.1 Current, potential difference and resistance

6.2.1.1 Standard circuit diagram symbols

	I can recognise and draw standard circuit symbols

6.2.1.2 Electrical charge and current

	I can define current as a flow of electric charge.
	I can use the formula: Q = It to calculate charge flow.

6.2.1.3 Current, resistance and potential difference

	I can use the formula: V = IR to calculate potential difference, current or resistance.
	I can describe how resistance affects current.

6.2.1.4 Resistors

	I can describe and investigate how current varies with voltage for different components: Resistors (ohmic conductors), filament lamps, diodes.
	I can explain resistance changes in thermistors and LDRs.

	I can interpret I–V graphs.

6.2.2 Series and parallel circuits

	I can identify and construct series and parallel circuits.
	I can describe and calculate: o Current (same in series, shared in parallel). o Potential difference (shared in series, same in parallel). o Resistance (adds in series, reduced in parallel).
	I can explain how resistance changes when resistors are added in series or parallel.

6.2.3 Domestic uses and safety

6.2.3.1 Direct and alternating potential difference

	I can explain the difference between a.c. and d.c.
	I know UK mains is 230 V, 50 Hz a.c.

6.2.3.2 Mains electricity

	I can identify the live, neutral, and earth wires by colour and function.
	I can explain why the live wire is dangerous even when a switch is open.

6.2.4 Energy transfers

6.2.4.1 Power

	I can use the formulae: o $P = VI$ o $P = I^2R$
	I can explain how power relates to energy transfer over time.

6.2.4.2 Energy transfers in everyday appliances

	I can describe how appliances transfer energy from batteries or mains.
	I can use the formulae: o $E = Pt$ o $E = QV$

6.2.4.3 The National Grid

	I can describe how electricity is transmitted by the National Grid.
	I can explain the use of step-up and step-down transformers.
	I can explain why the National Grid is efficient for energy transfer.

6.4 Atomic structure

	I can describe the structure of an atom including the nucleus, protons, neutrons, and electrons.
	I can explain what isotopes are and how they differ in atomic structure.
	I can describe how atomic models have changed over time, including the plum pudding model and nuclear model.
	I can explain how new evidence from experiments led to changes in atomic models (e.g. Rutherford's scattering experiment).

6.4.2 Atoms and nuclear radiation

	I can describe what radioactive decay is and identify alpha, beta, and gamma radiation.
	I can explain how to write and interpret nuclear equations for radioactive decay.
	I can define half-life and use it to calculate decay over time using graphs or data.
	I can compare the risks of contamination and irradiation and describe safety precautions.
	I can explain how peer review helps evaluate radiation risks.

Paper 2

6.5 Forces

	I can explain the difference between scalar and vector quantities and give examples.
	I can identify contact and non-contact forces and give examples.
	I can describe how weight is affected by gravitational field strength and calculate weight using W = mg.
	I can calculate resultant forces and represent them using vector diagrams.
	I can calculate work done using W = Fs and describe the energy transfers involved.
	I can use F = ke and Ee = 1/2ke² for elastic objects and interpret force-extension graphs.
	I can describe motion using distance, displacement, speed, velocity, and acceleration.
	I can interpret and draw distance–time and velocity–time graphs and use gradients and areas under graphs.
	v^2-u² = 2as for calculations involving motion.
	I can explain Newton's three laws of motion with examples.
	I can describe factors that affect stopping distance, including reaction time and braking distance.
	I can explain how braking force affects energy transfer and deceleration.
	I can calculate momentum using p = mv and describe conservation of momentum (HT only).

6.6 Waves

	I can describe the difference between transverse and longitudinal waves.
	I can define amplitude, wavelength, frequency and period, and use T = 1/f.
	I can use the wave equation v = fλ to calculate wave speed.
	I can describe how to measure wave speed in air, water, and solids.
	I can describe the electromagnetic spectrum, including order of wavelength/frequency and common uses.
	I can describe reflection and refraction of waves (HT only).
	I can explain risks of UV, X-rays and gamma rays and describe uses of EM waves.

6.7 Magnetism and electromagnetism

	I can describe attraction and repulsion between magnetic poles and the difference between permanent and induced magnets.
	I can draw magnetic field lines around magnets and describe how a compass shows Earth's magnetic field.

	I can describe the magnetic field around a current-carrying wire and a solenoid.
	I can explain how solenoids and electromagnets work.
	I can use Fleming's left-hand rule to predict direction of force (HT only).
	I can calculate force using F = BIL (HT only).
	I can explain how electric motors work (HT only).

6.8 Key ideas

	I understand the importance of models in explaining scientific phenomena (e.g. particle model, wave model).
	I can explain cause and effect in physical systems (e.g. forces and acceleration).
	I understand the concept of a field in explaining action at a distance (e.g. gravity, magnetism).
	I know that differences (e.g. temperature, pressure, potential) drive physical changes.
	I recognise that proportionality is key in many physics equations (e.g. $F \propto a$).
	I understand that physics laws and models are expressed using mathematical equations.