KS4 Science

(AQA Combined Science Trilogy)

Exam Details:

AQA Combined Science Trilogy is assessed over six papers, each 16.7% of the final marks and lasting 1 hour and 15 minutes

- **Biology paper 1:** Topics 1–4: Cell Biology; Organisation; Infection and response; and Bioenergetics
- **Biology paper 2**: Topics 5–7: Homeostasis and response; Inheritance, variation and evolution; and Ecology
- **Chemistry Paper 1:** Topics 8–12: Atomic structure and the periodic table; Bonding, structure, and the properties of matter; Quantitative chemistry; Chemical changes; and Energy changes.
- **Chemistry Paper 2**: Topics 13-17 The rate and extent of chemical change; Organic chemistry; Chemical analysis; Chemistry of the atmosphere; and Using resources
- **Physics paper 1:** Topics 18–21: Energy; Electricity; Particle model of matter; and Atomic structure
- **Physics Paper 2:** Topics 22–24: Forces; Waves; and Magnetism and electromagnetism

Students will either be entered for:
Foundation Paper (grades 1-5) or Higher Paper (grades 5-9)

Biology Combined Scientific content

Title	Topic	Sub-topic			
4.1 Cell biology	4.1.1 Cell structure	4.1.1.1 Eukaryotes and prokaryotes			
		4.1.1.2 Animal and plant cells			
		4.1.1.2 Required practical 1: Microscopy			
		4.1.1.3 Cell specialisation			
		4.1.1.4 Cell differentiation			
		4.1.1.5 Microscopy			
	4.1.2 Cell division	4.1.2.1 Chromosomes			
		4.1.2.2 Mitosis and the cell cycle			
		4.1.2.3 Stem cells			
	4.1.3 Transport in cells	4.1.3.1 Diffusion			
		4.1.3.2 Osmosis			
		4.1.3.2 Required practical 3: Osmosis			
		4.1.3.3 Active transport			
4.2 Organisation	4.2.1 Principles of organisation				
	4.2.2 Animal tissues, organs and organ systems	4.2.2.1 The human digestive system			
		4.2.2.1 Required practical 4: Food tests			
		4.2.2.1 Required practical 5: Enzymes			
		4.2.2.2 The heart and blood vessels			
		4.2.2.3 Blood			
		4.2.2.4 Coronary heart disease: a non-communicable disease			
		4.2.2.5 Health issues			
		4.2.2.6 The effect of lifestyle on some non-communicable diseases			
		4.2.2.7 Cancer			
	4.2.3 Plant tissues, organs and systems	4.2.3.1 Plant tissues			
		4.2.3.2 Plant organ system			

4.3 Infection and response	4.3.1 Communicable diseases	4.3.1.1 Communicable (infectious) diseases			
		4.3.1.2 Viral diseases			
		4.3.1.3 Bacterial diseases			
		4.3.1.4 Fungal diseases			
		4.3.1.5 Protist diseases			
		4.3.1.6 Human defence systems			
		4.3.1.7 Vaccination			
		4.3.1.8 Antibiotics and painkillers			
		4.3.1.9 Discovery and development of drugs			
4.4 Bioenergetics	4.4.1 Photosynthesis	4.4.1.1 Photosynthetic reaction			
		4.4.1.2 Rate of photosynthesis			
		4.4.1.2 Required practical 6: Photosynthesis			
		4.4.1.3 Uses of glucose from photosynthesis			
	4.4.2 Respiration	4.4.2.1 Aerobic and anaerobic respiration			
		4.4.2.2 Response to exercise			
		4.4.2.3 Metabolism			
4.5 Homeostasis and response	4.5.1 Homeostasis				
	4.5.2 The human nervous system	4.5.2.1 Structure and function			
		4.5.2.1 Required practical 7: Reaction time			
	4.5.3 Hormonal coordination in humans	4.5.3.1 Human endocrine system			
		4.5.3.2 Control of blood glucose concentration			
		4.5.3.4 Hormones in human reproduction			
		4.5.3.5 Contraception			
		4.5.3.6 The use of hormones to treat infertility (HT only)			
		4.5.3.7 Negative feedback (HT only)			

4.6 Inheritance, variation and evolution	4.6.1 Reproduction	4.6.1.1 Sexual and asexual reproduction			
		4.6.1.2 Meiosis			
		4.6.1.4 DNA and the genome			
		4.6.1.6 Genetic inheritance			
		4.6.1.7 Inherited disorders			
		4.6.1.8 Sex determination			
	4.6.2 Variation and evolution	4.6.2.1 Variation			
		4.6.2.2 Evolution			
		4.6.2.3 Selective breeding			
		4.6.2.4 Genetic engineering			

		4.6.3.4 Evidence for evolution			
		4.6.3.5 Fossils			
		4.6.3.6 Extinction			
		4.6.3.7 Resistant bacteria			
	4.6.4 Classification of living organisms				
4.7 Ecology	4.7.1 Adaptations, interdependence and competition	4.7.1.1 Communities			
		4.7.1.2 Abiotic factors			
		4.7.1.3 Biotic factors			
		4.7.1.4 Adaptations			
	4.7.2 Organisation of an ecosystem	4.7.2.1 Levels of organisation			
		4.7.2.1 Required practical 9: Field investigations			
		4.7.2.2 How materials are cycled			
	4.7.3 Biodiversity and the effect of human interaction on ecosystems	4.7.3.1 Biodiversity			
		4.7.3.2 Waste management			
		4.7.3.3 Land use			
		4.7.3.4 Deforestation			
		4.7.3.5 Global warming			
		4.7.3.6 Maintaining biodiversity			

Chemistry Combined Scientific content

Title	Topic	Sub-topic			
4.1 Atomic structure and the periodic table	4.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes	4.1.1.1 Atoms, elements and compounds			
		4.1.1.2 Mixtures			
		4.1.1.3 Development of the model of the atom (common content physics)			
		4.1.1.4 Relative electrical charges of subatomic particles			
		4.1.1.5 Size and mass of atoms			
		4.1.1.6 Relative atomic mass			
		4.1.1.7 Electronic structure			
	4.1.2 The periodic table	4.1.2.1 The periodic table			
		4.1.2.2 Development of the periodic table			
		4.1.2.3 Metals and non-metals			
		4.1.2.4 Group 0			
		4.1.2.5 Group 1			
		4.1.2.6 Group 7			
4.2 Bonding, structure, and the properties of matter	4.2.1 Chemical bonds, ionic, covalent and metallic	4.2.1.1 Chemical bonds			
		4.2.1.2 Ionic bonding			
		4.2.1.3 Ionic compounds			
		4.2.1.4 Covalent bonding			
		4.2.1.5 Metallic bonding			
	4.2.2 How bonding and structure are related to the properties of a substance	4.2.2.1 The three states of matter			
		4.2.2.2 State symbols			
		4.2.2.3 Properties of ionic compounds			
		4.2.2.4 Properties of small molecules			
		4.2.2.5 Polymers			
		4.2.2.6 Giant covalent structures			
		4.2.2.7 Properties of metals and alloys			
		4.2.2.8 Metals as conductors			

	4.2.3 Structure and bonding of carbon	4.2.3.1 Diamond			
		4.2.3.2 Graphite			
		4.2.3.3 Graphene and fullerenes			

4.3 Quantitative chemistry	4.3.1 Chemical measurements, conservation of mass and the quantitative interpretation of chemical equations	4.3.1.1 Conservation of mass and balanced chemical equations			
		4.3.1.2 Relative formula mass			
		4.3.1.3 Mass changes when a reactant or product is a gas			
		4.3.1.4 Chemical measurements			
	4.3.2 Use of amount of substance in relation to masses of pure substances	4.3.2.1 Moles (HT only)			
		4.3.2.2 Amounts of substances in equations (HT only)			
		4.3.2.3 Using moles to balance equations (HT only)			
		4.3.2.4 Limiting reactants (HT only)			
		4.3.2.5 Concentration of solutions (HT only)			
4.4 Chemical changes	4.4.1 Reactivity of metals	4.4.1.1 Metal oxides			
		4.4.1.2 The reactivity series			
		4.4.1.3 Extraction of metals and reduction			
		4.4.1.4 Oxidation and reduction in terms of electrons (HT only)			
	4.4.2 Reactions of acids	4.4.2.1 Reactions of acids with metals			
		4.4.2.2 Neutralisation of acids and salt production			
		4.4.2.3 Soluble salts			
		4.4.2.3 Required practical 1: Making salts			
		4.4.2.4 The pH scale and neutralisation			
		4.4.2.5 Required practical 2: Neutralisation			
		4.4.2.6 Strong and weak acids (HT only)			
	4.4.3 Electrolysis	4.4.3.1 The process of electrolysis			
		4.4.3.2 Electrolysis of molten ionic compounds			
		4.4.3.3 Using electrolysis to extract metals			
		4.4.3.4 Electrolysis of aqueous solutions			
		4.4.3.4 Required practical 3: Electrolysis			
		4.4.3.5 Representation of reactions at electrodes as half equations (HT only)			
4.5 Energy changes	4.5.1 Exothermic and endothermic reactions	4.5.1.1 Energy transfer during exothermic and endothermic reactions			
		4.5.1.1 Required practical 4: Temperature changes			
		4.5.1.2 Reaction profiles			
		4.5.1.3 The energy change reactions (HT only)			
	4.5.2 Chemical cells and fuel cells	4.5.2.1 Cells and batteries			
		4.5.2.2 Fuel cells			
4.6 The rate and extent of chemical change	4.6.1 Rate of reaction	4.6.1.1 Calculating rates of reactions			
		4.6.1.2 Factors which affect the rate of chemical reactions			
		4.6.1.2 Required practical 5: Rates of reaction			
		4.6.1.3 Collision theory and activation energy			
		4.6.1.4 Catalysts			

	4.6.2 Reversible reactions and dynamic equilibrium	4.6.2.1 Reversible reactions			
		4.6.2.2 Energy changes and reversible reactions			
		4.6.2.3 Equilibrium			
		4.6.2.4 The effect of changing conditions on equilibrium (HT only)			
		4.6.2.5 The effect of changing concentration (HT only)			
		4.6.2.6 The effect of temperature on equilibrium (HT only)			
		4.6.2.7 The effect of pressure changes on equilibrium (HT only)			
4.8 Chemical analysis	4.8.1 Purity, formulation and chromatography	4.8.1.1 Pure substances			
		4.8.1.2 Formulations			
		4.8.1.3 Chromatography			
		4.8.1.3 Required practical 6: Chromatography			

	4.8.2 Identification of common gases	4.8.2.1 Test for hydrogen			
		4.8.2.2 Test for oxygen			
		4.8.2.3 Test for carbon dioxide			
		4.8.2.4 Test for chlorine			
4.9 Chemistry of the atmosphere	4.9.1 The composition and evolution of the Earth's atmosphere	4.9.1.1 The proportions of different gases in the atmosphere			
		4.9.1.2 The Earth's early atmosphere			
		4.9.1.3 How oxygen increased			
		4.9.1.4 How carbon dioxide decreased			
	4.9.2 Carbon dioxide and methane as greenhouse gases	4.9.2.1 Greenhouse gases			
		4.9.2.2 Human activities which contribute to an increase in greenhouse gases			
		4.9.2.3 Global climate change			
		4.9.2.4 The carbon footprint and its reduction			
	4.9.3 Common atmospheric pollutants and their sources	4.9.3.1 Atmospheric pollutants from fuels			
		4.9.3.2 Properties and effects of atmospheric pollutants			
4.10 Using resources	4.10.1 Using the Earth's resources and obtaining potable water	4.10.1.1 Using the Earth's resources and sustainable development			
		4.10.1.2 Potable water			
		4.10.1.2 Required practical 8: Water purification			
		4.10.1.3 Waste water treatment			
		4.10.1.4 Alternative methods of extracting metals (HT only)			
	4.10.2 Life cycle assessment and recycling	4.10.2.1 Life cycle assessment			
		4.10.2.2 Ways of reducing the use of resources			

Physics Scientific content

Title	Topic	Sub-topic			
4.1 Energy	4.1.1 Energy changes in a system, and the ways energy is stored before and after such changes	4.1.1.1 Energy stores and systems			
		4.1.1.2 Changes in energy			
		4.1.1.3 Energy changes in systems			
		4.1.1.3 Required practical 1: Specific heat capacity			
		4.1.1.4 Power			
	4.1.2 Conservation and dissipation of energy	4.1.2.1 Energy transfers in a system			
		4.1.2.1 Required practical 2: Thermal insulation			
		4.1.2.2 Efficiency			
	4.1.3 National and global energy	4.1.3.1 National and global energy resources			
4.2 Electricity	4.2.1 Current, potential difference and resistance	4.2.1.1 Standard circuit diagram symbols			
		4.2.1.2 Electrical charge and current			
		4.2.1.3 Current, resistance and potential difference			
		4.2.1.3 Required practical 3: Resistance			
		4.2.1.4 Resistors			
		4.2.1.4 Required practical 4: I-V characteristics			
	4.2.2 Series and parallel circuits	4.2.2.1 Series and parallel circuits			
	4.2.3 Domestic uses and safety	4.2.3.1 Direct and alternating potential difference			
		4.2.3.2 Mains electricity			
	4.2.4 Energy transfers	4.2.4.1 Power			
		4.2.4.2 Energy transfers in everyday appliances			
		4.2.4.3 The National Grid			
4.3 Particle model of matter	4.3.1 Changes of state and the particle model	4.3.1.1 Density of materials			
		4.3.1.1 Required practical 5: Density			
		4.3.1.2 Changes of state			
	4.3.2 Internal energy and energy transfers	4.3.2.1 Internal energy			
		4.3.2.2 Temperature changes in a system and specific heat capacity			
		4.3.2.3 Changes of heat and specific latent heat			
	4.3.3 Particle model and pressure	4.3.3.1 Particle motion in gases			
	4.4.1 Atoms and isotopes	4.4.1.1 The structure of an atom			

4.4 Atomic structure		4.4.1.2 Mass number, atomic number and isotopes			
		4.4.1.3 The development of the model of the atom (common content with chemistry)			
	4.4.2 Atoms and nuclear radiation	4.4.2.1 Radioactive decay and nuclear radiation			
		4.4.2.2 Nuclear equations			
		4.4.2.3 Half-lives and the random nature of radioactive decay			
		4.4.2.4 Radioactive contamination			
4.5 Forces	4.5.1 Forces and their interactions	4.5.1.1 Scalar and vector quantities			
		4.5.1.2 Contact and non-contact forces			
		4.5.1.3 Gravity			
		4.5.1.4 Resultant forces			
	4.5.2 Work done and energy transfer	4.5.2.1 Work done and energy transfer			
	4.5.3 Forces and elasticity	4.5.3.1 Forces and elasticity			
		4.5.3.1 Required practical 6: Force and extension			
	4.5.6 Forces and motion 4.5.6.1 Describing motion along a line	4.5.6.1.1 Distance and displacement			
		4.5.6.1.2 Speed			
		4.5.6.1.3 Velocity			
		4.5.6.1.4 The distance–time relationship			
		4.5.6.1.5 Acceleration			
	4.5.6.2 Forces, accelerations and Newton's Laws of motion	4.5.6.2.1 Newton's First Law			
		4.5.6.2.2 Newton's Second Law			
		4.5.6.2.2 Required practical 7: Acceleration			
		4.5.6.2.3 Newton's Third Law			
	4.5.6.3 Forces and braking	4.5.6.3.1 Stopping distance			
		4.5.6.3.2 Reaction time			
		4.5.6.3.3 Factors affecting braking distance 1			
		4.5.6.3.4 Factors affecting braking distance 2			
	4.5.7 Momentum (HT only)	4.5.7.1 Momentum is a property of moving objects			
		4.5.7.2 Conservation of momentum			
4.6 Waves	4.6.1 Waves in air, fluids and solids	4.6.1.1 Transverse and longitudinal waves			
		4.6.1.2 Properties of waves			
		4.6.1.2 Required practical 8: Waves			
		4.6.1.3 Required practical 9: Light			
	4.6.2 Electromagnetic waves	4.6.2.1 Types of electromagnetic waves			
		4.6.2.2 Properties of electromagnetic waves 1			
		4.6.2.2 Required practical 10: Radiation and absorption			
		4.6.2.3 Properties of electromagnetic waves 2			
		4.6.2.4 Uses and applications of electromagnetic waves			

4.7 Magnetism and electromagnetism	4.7.1 Permanent and induced magnetism, magnetic forces and fields	4.7.1.1 Poles of a magnet			
		4.7.1.2 Magnetic fields			
	4.7.2 The motor effect	4.7.2.1 Electromagnetism			
		4.7.2.2 Fleming’s left-hand rule (HT only)			
		4.7.2.3 Electric motors (HT only)			