Separate Science Paper 1 biology, chemistry, physics Revision book

Contents:

Separate Science Topics – Paper 1

Paper 1

What's assessed

Topics 1–4: Cell biology; Organisation; Infection and response; and Bioenergetics.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50 % of GCSE

Questions

Multiple choice, structured, closed short answer and open response.

Paper 1:

What's assessed

Topics 1–5: Atomic structure and the periodic table; Bonding, structure, and the properties of matter; Quantitative chemistry, Chemical changes; and Energy changes.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50 % of GCSE

Questions

Multiple choice, structured, closed short answer and open response.

Paper 1:

What's assessed

Topics 1–4: Energy; Electricity; Particle model of matter; and Atomic structure.

How it's assessed

- Written exam: 1 hour 45 minutes
- Foundation and Higher Tier
- 100 marks
- 50 % of GCSE

Questions

Multiple choice, structured, closed short answer and open response.

AQA Biology (8461) from 2016 Topic B4.1 Cell biology				
Topic	**Student Checklist**	**R**	**A**	**G**
4.1.1 Cell structure	Use the terms 'eukaryotic' and 'prokaryotic' to describe types of cells			
	Describe the features of bacterial (prokaryotic) cells			
	Demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, inc standard form			
	Recall the structures found in animal and plant (eukaryotic) cells inc algal cells			
	Use estimations and explain when they should be used to judge the relative size or area of sub-cellular structures			
	Required practical 1: use a light microscope to observe, draw and label a selection of plant and animal cells			
	Describe the functions of the structures in animal and plant (eukaryotic) cells			
	Describe what a specialised cell is, including examples for plants and animals			
	Describe what differentiation is, including differences between animals and plants			
	Define the terms magnification and resolution			
	Compare electron and light microscopes in terms of their magnification and resolution			
	Carry out calculations involving magnification using the formula: magnification = size of image/ size of real object -inc standard form			
	Bio ONLY: Describe how bacteria reproduce and the conditions required			
	Bio ONLY: Describe how to prepare an uncontaminated culture			
	Bio ONLY: Calculate cross-sectional areas of colonies or clear areas around colonies using πr^2			
	Bio ONLY: Calculate the number of bacteria in a population after a certain time if given the mean division time			
	Bio & HT ONLY: Express answers for last two points in standard form			
	Required practical 2: investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition			
4.1.2 Cell division	Describe how genetic information is stored in the nucleus of a cell (inc genes & chromosomes)			
	Describe the processes that happen during the cell cycle, including mitosis (inc recognise and describe where mitosis occurs)			
	Describe stem cells, including sources of stem cells in plants and animals and their roles			
	Describe the use of stem cells in the production of plant clones and therapeutic cloning			
	Discuss the potential risks, benefits and issues with using stem cells in medical research/treatments (inc diabetes and paralysis)			
4.1.3 Transport in cells	Describe the process of diffusion, including examples			
	Explain how diffusion is affected by different factors			
	Define and explain "surface area to volume ratio", and how this relates to single-celled and multicellular organisms (inc calculations)			
	Explain how the effectiveness of an exchange surface can be increased, inc examples of adaptations for small intestines, lungs, gills roots & leaves			
	Describe the process of osmosis (inc calculation of water uptake & percentage gain and loss of mass of plant tissue)			
	Required practical 3: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue			
	Describe the process of active transport, including examples - gut and roots			
	Explain the differences between diffusion, osmosis and active transport			

AQA Biology (8461) from 2016 Topic B4.2 Organisation				
Topic	**Student Checklist**	**R**	**A**	**G**
4.2.1 Principles of organisation & 4.2.2 Animal tissues, organs and organ systems	Describe the levels of organisation within living organisms			
	Describe the digestive system and how it works as an organ system (from KS3)			
	Describe basic features of enzymes (inc rate calculations for chemical reactions)			
	Describe the lock and key theory as a model of enzyme action and explain how the shape a of the active sites makes the enzyme specific			
	Explain the effect of temperature and pH on enzymes			
	Describe the digestive enzymes, including their names, sites of production and actions			
	Describe how the products of digestion are used			
	Describe the features and functions of bile and state where it is produced and released from			
	Required practical 4: use qualitative reagents to test for a range of carbohydrates, lipids and proteins			
	Required practical 5: investigate the effect of pH on the rate of reaction of amylase enzyme			
	Describe the structure of the human heart and lungs (inc how lungs are adapted for gaseous exchange)			
	Explain how the heart moves blood around the body (inc role and position of the aorta, vena cava, pulmonary artery & vein and coronary arteries)			
	Explain how the natural resting heart rate is controlled and how irregularities can be corrected			
	Describe the structure and function of arteries, veins and capillaries			
	Use simple compound measures such as rate and carry out rate calculations for blood flow			
	Describe blood and identify its different components, inc identifying blood cells from photographs/diagrams			
	Describe the functions of blood components, including adaptations to function			
	Describe what happens in coronary heart disease and what statins are used for			
	Describe and evaluate treatments for coronary heart disease and heart failure (inc drugs, mechanical devices or transplant)			
	Recall that heart valves can become faulty and describe the consequences of this			
	Describe how patients can be treated in the case of heart failure			
	Describe health and the explain causes of ill-health and the relationship between health and disease			
	Describe how different types of diseases may interact and translate disease incidence information between graphical and numerical forms			
	Describe what risk factors are and give examples discussing human and financial costs of non-communicable diseases at local, national and global levels			
	Describe what cancer is and explain the difference between benign and malignant tumours			
	Describe the known risk factors for cancer, including genetic and lifestyle risk factors			
4.2.3 Plant tissues, organs and system	Describe plant tissues (epidermal, palisade mesophyll, spongy mesophyll, xylem, phloem and meristem) and describe their functions			
	Explain how the structure of plant tissues are related to their function within the leaf (plant organ) inc stomata and guard cells			
	Recall the plant parts that form a plant organ system that transports substances around the plant			
	Explain how root hair cells, xylem and phloem are adapted to their functions			
	Describe the process of transpiration and translocation including the role of the different plant tissues			
	Explain how the rate of transpiration can be affected by different factors (inc naming the factors)			
	Describe the role of stomata and guard cells in the control of gas exchange and water loss			

AQA Biology (8461) from 2016 Topic B4.3 Infection and response				
Topic	**Student Checklist**	**R**	**A**	**G**
4.3.1 Communicable diseases	Explain what a pathogen is and how pathogens are spread (inc how viruses, bacteria, protists and fungi are spread in animals and plants)			
	Explain how pathogenic bacteria and viruses cause damage in the body			
	Explain how the spread of diseases can be reduced or prevented			
	Describe measles, HIV and tobacco mosaic virus as examples of viral pathogens			
	Describe salmonella food poisoning and gonorrhoea as examples of bacterial pathogens			
	Describe the signs, transmission and treatment of rose black spot infection in plants as an example of fungal pathogens			
	Describe the symptoms, transmission and control of malaria, including knowledge of the mosquito vector as an example of a protists pathogen			
	Describe defences that stop pathogens entering the human body (inc skin, nose, trachea & windpipe, stomach)			
	Recall the role of the immune system			
	Describe how white blood cells destroy pathogens			
	Describe how vaccination works, including at the population level			
	Explain how antibiotics and painkillers are used to treat diseases, including their limitations			
	Describe how sources for drugs have changed over time and give some examples			
	Describe how new drugs are tested, including pre-clinical testing and clinical trials (inc double blind trials and placebos)			
4.3.2 Monoclonal antibodies	***Bio & HT ONLY: Describe what monoclonal antibodies are and why they are useful***			
	Bio & HT ONLY: Describe how monoclonal antibodies are produced			
	Bio & HT ONLY: Explain how monoclonal antibodies are used for diagnosis, research, chemical testing and disease treatments			
	Bio & HT ONLY: Evaluate the advantages and disadvantages of monoclonal antibodies (inc side effects)			
	Bio & HT ONLY: Describe some observable signs of plant disease, and how plant diseases can be identified			
4.3.3 Plant	*Bio ONLY: Give examples of plant pathogens*			
	Bio ONLY: Give examples of plant ion deficiencies and their effects			
	Bio ONLY: Describe physical, chemical and mechanical defence responses of plants			

AQA Biology (8461) from 2016 Topic B4.4 Bioenergetics				
Topic	**Student Checklist**	**R**	**A**	**G**
4.4.1 Photosynthesis	Describe what happens in photosynthesis, including using a word equation and recognise the chemical formulas for carbon dioxide, water, oxygen & glucose			
	Explain why photosynthesis is an endothermic reaction			
	Recall the limiting factors of photosynthesis			
	Explain how limiting factors affect the rate of photosynthesis, including graphical interpretation (limited to one factor)			
	HT ONLY: Explain how the limiting factors of photosynthesis interact, inc graphical interpretation (two/three factors)			
	HT ONLY: Explain how limiting factors are important to the economics of greenhouses, including data interpretation			
	HT ONLY: Explain and use inverse proportion in the context of photosynthesis			
	Required practical 6: investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed			
	Describe how the glucose produced in photosynthesis is used by plants			
4.4.2 Respiration	Describe what happens in respiration including using a word equation and recognise the chemical formulas for carbon dioxide, water, oxygen & glucose			
	Describe aerobic and anaerobic respiration with regard to the need for oxygen, the differing products and the relative amounts of energy transferred			
	Recognise the equations for aerobic respiration, anaerobic respiration in muscles and anaerobic respiration in plants and yeast cells.			
	Recall what type of respiration fermentation is and its economic importance.			
	Describe what happens to heart rate, breathing rate and breath volume during exercise and why these changes occur			
	Explain what happens when muscles do not have enough oxygen and define the term oxygen debt			
	HT ONLY: Explain what happens to accumulated lactic acid in the body			
	Explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids			
	Explain what metabolism is, including examples			

AQA Chemistry (8462) from 2016 Topics C4.1 Atomic structure and the periodic table				
Topic	**Student Checklist**	**R**	**A**	**G**
4.1.1 A simple model of the atom, symbols, relative atomic mass, electronic charge and isotopes	State that everything is made of atoms and recall what they are			
	Describe what elements and compounds are			
	State that elements and compounds are represented by symbols; and use chemical symbols and formulae to represent elements and compounds			
	Write word equations and balanced symbol equations for chemical reactions, including using appropriate state symbols			
	HT ONLY: Write balanced half equations and ionic equations			
	Describe what a mixture is			
	Name and describe the physical processes used to separate mixtures and suggest suitable separation techniques			
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)			
	Describe the difference between the plum pudding model of the atom and the nuclear model of the atom			
	State the relative charge of protons, neutrons and electrons and describe the overall charge of an atom			
	State the relative masses of protons, neutrons and electrons and describe the distribution of mass in an atom			
	Calculate the number of protons, neutrons and electrons in an atom when given its atomic number and mass number			
	Describe isotopes as atoms of the same element with different numbers of neutrons			
	Define the term relative atomic mass and why it takes into account the abundance of isotopes of the element			
	Calculate the relative atomic mass of an element given the percentage abundance of its isotopes			
	Describe how electrons fill energy levels in atoms, and represent the electron structure of elements using diagrams and numbers			
4.1.2 The periodic table	Recall how the elements in the periodic table are arranged			
	Describe how elements with similar properties are placed in the periodic table			
	Explain why elements in the same group have similar properties and how to use the periodic table to predict the reactivity of elements			
	Describe the early attempts to classify elements			
	Explain the creation and attributes of Mendeleev's periodic table			
	Identify metals and non-metals on the periodic table, compare and contrast their properties			
	Explain how the atomic structure of metals and non-metals relates to their position in the periodic table			
	Describe nobel gases (group 0) and explain their lack of reactivity			
	Describe the properties of noble gases, including boiling points, predict trends down the group and describe how their properties depend on the outer shell of electrons			
	Describe the reactivity and properties of group 1 alkali metals with reference to their electron arrangement and predict their reactions			
	Describe the properties of group 7 halogens and how their properties relate to their electron arrangement, including trends in molecular mass, melting and boiling points and reactivity			
	Describe the reactions of group 7 halogens with metals and non-metals			
	Chem ONLY: Describe the properties of transition metals and compare them with group 1 elements, including melting points and densities, strength and hardness, and reactivity (for CR, Mn Fe, Co, Ni & Cu)			

AQA Chemistry (8462) from 2016 Topics C4.2 Bonding, structure, and the properties of matter				
Topic	**Student Checklist**	**R**	**A**	**G**
4.2.1 Chemical bonds, ionic, covalent and metallic	Describe the three main types of bonds: ionic bonds, covalent bonds and metallic bonds in terms of electrostatic forces and the transfer or sharing of electrons			
	Describe how the ions produced by elements in some groups have the electronic structure of a noble gas and explain how the charge of an ion relates to its group number			
	Describe the structure of ionic compounds, including the electrostatic forces of attraction, and represent ionic compounds using dot and cross diagrams			
	Describe the limitations of using dot and cross, ball and stick, two and three-dimensional diagrams to represent a giant ionic structure			
	Work out the empirical formula of an ionic compound from a given model or diagram that shows the ions in the structure			
	Describe covalent bonds and identify different types of covalently bonded substances, such as small molecules, large molecules and substances with giant covalent structures			
	Represent covalent bonds between small molecules, repeating units of polymers and parts of giant covalent structures using diagrams			
	Draw dot and cross diagrams for the molecules of hydrogen, chlorine, oxygen, nitrogen, hydrogen chloride, water, ammonia and methane			
	Deduce the molecular formula of a substance from a given model or diagram in these forms showing the atoms and bonds in the molecule			
	Describe the arrangement of atoms and electrons in metallic bonds and draw diagrams the bonding in metals			
4.2.2 How bonding and structure are related to the properties of substances	Name the three States of matter, identify them from a simple model and state which changes of state happen at melting and boiling points			
	Explain changes of state using particle theory and describe factors that affect the melting and boiling point of a substance			
	HT ONLY: Discuss the limitations of particle theory			
	Recall what (s), (l), (g) and (aq) mean when used in chemical equations and be able to use them appropriately			
	Explain how the structure of ionic compounds affects their properties, including melting and boiling points and conduction of electricity (sodium chloride structure only)			
	Explain how the structure of small molecules affects their properties			
	Explain how the structure of polymers affects their properties			
	Explain how the structure of giant covalent structures affects their properties			
	Explain how the structure of metals and alloys affects their properties, including explaining why they are good conductors			
	Explain why alloys are harder than pure metals in terms of the layers of atoms			
	Explain the properties of graphite, diamond and graphene in terms of their structure and bonding			
	Describe the structure of fullerenes, and their uses, including Buckminsterfullerene and carbon nanotubes			
	Chem ONLY: Compare the dimensions of nanoparticles to other particles and explain the effect of their surface area to volume ratio on their properties			
	Chem ONLY: Discuss the applications of nanoparticles and their advantages and disadvantages, including uses in medicine, cosmetics, fabrics and the development of catalysts			

AQA Chemistry (8462) from 2016 Topics C4.3 Quantitative chemistry

Topic	Student Checklist	R	A	G
4.3.1 Chemical measurements, conservation of mass and the quantitative interpretation	State that mass is conserved and explain why, including describing balanced equations in terms of conservation of mass			
	Explain the use of the multipliers in equations in normal script before a formula and in subscript within a formula			
	Describe what the relative formula mass (Mr) of a compound is and calculate the relative formula mass of a compound, given its formula			
	Calculate the relative formula masses of reactants and products to prove that mass is conserved in a balanced chemical equation			
	Explain observed changes of mass during chemical reactions in non-enclosed systems using the particle model when given the balanced symbol equation			
	Explain why whenever a measurement is made there is always some uncertainty about the result obtained			
4.3.2 Use of amount of substance in relation to masses of pure substances	**HT ONLY: State that chemical amounts are measured in moles (mol) and explain what a mol is with reference to relative formula mass and Avogadro's constant**			
	HT ONLY: Use the relative formula mass of a substance to calculate the number of moles in a given mass of the substance			
	HT ONLY: Calculate the masses of reactants and products when given a balanced symbol equation			
	HT ONLY: Use moles to write a balanced equation when given the masses of reactants and products (inc changing the subject of the equation)			
	HT ONLY: Explain the effect of limiting the quantity of a reactant on the amount of products in terms of moles or masses in grams			
	Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution			
	HT ONLY: Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution			
4.3.3 Yield and atom economy of chemical reactions	*Chem ONLY: Explain why it is not always possible to obtain the calculated or expected amount of a product*			
	Chem ONLY: Calculate the theoretical amount of a product and percentage yield of a product using the formula ***% yield = mass of product made/max theoretical mass of product x 100***			
	Chem & HT ONLY: Calculate the theoretical mass of a product from a given mass of reactant and the balanced equation for the reaction			
	Chem ONLY: Describe atom economy as a measure of the amount of reactants that end up as useful products			
	Chem ONLY: Calculate the percentage atom economy of a reaction to form a desired product using the equation ***% atom economy =RfM of desired product/sum of RfM of all reactants x 100***			
	Chem & HT ONLY: Explain why a particular reaction pathway is chosen to produce a specified product, given appropriate data			
4.3.4 Using concentrations of solutions in mol/dm^3	***Chem & HT ONLY: Calculate the amount of solute (in moles or grams) in a solution from its concentration in mol/dm^3***			
	Chem & HT ONLY: Calculate the concentration of a solution when it reacts completely with another solution of a known concentration			
	Chem & HT ONLY: Describe how to carry out titrations of strong acids and strong alkalis and calculate quantities in titrations involving concentrations in mol/dm^3 and g/dm^3			
	Chem & HT ONLY: Explain how the concentration of a solution in mol/dm3 is related to the mass of the solute and the volume of the solution			
	Chem & HT ONLY: Explain what the volume of one mole of any gas at room temperature is			
	Chem & HT ONLY: Calculate the volume of a gas at room temperature and pressure from its mass and relative formula mass			

AQA Chemistry (8462) from 2016 Topics C4.4 Chemical changes				
Topic	**Student Checklist**	**R**	**A**	**G**
4.4.1 Reactivity of metals	Describe how metals react with oxygen and state the compound they form, define oxidation and reduction			
	Describe the arrangement of metals in the reactivity series, including carbon and hydrogen, and use the reactivity series to predict the outcome of displacement reactions			
	Recall and describe the reactions, if any, of potassium, sodium, lithium, calcium, magnesium, zinc, iron and copper with water or dilute acids			
	Relate the reactivity of metals to its tendency to form positive ions and be able to deduce an order of reactivity of metals based on experimental results			
	Recall what native metals are and explain how metals can be extracted from the compounds in which they are found in nature by reduction with carbon			
	Evaluate specific metal extraction processes when given appropriate information and identify which species are oxidised or reduced			
4.4.2 Reactions of acids	**HT ONLY: Describe oxidation and reduction in terms of loss and gain of electrons**			
	HT ONLY: Write ionic equations for displacement reactions, and identify which species are oxidised and reduced from a symbol or half equation			
	HT ONLY: Explain in terms of gain or loss of electrons that the reactions between acids and some metals are redox reactions, and identify which species are oxidised and which are reduced (Mg, Zn, Fe + HCl & H_2SO_4)			
	Explain that acids can be neutralised by alkalis, bases and metal carbonates and list the products of each of these reactions			
	Predict the salt produced in a neutralisation reaction based on the acid used and the positive ions in the base, alkali or carbonate and use the formulae of common ions to deduce the formulae of the salt			
	Describe how soluble salts can be made from acids and how pure, dry samples of salts can be obtained			
	Required practical 1: *preparation of a pure, dry sample of a soluble salt from an insoluble oxide or carbonate using a Bunsen burner to heat dilute acid and a water bath or electric heater to evaporate the solution*			
	Recall what the pH scale measures and describe the scale used to identify acidic, neutral or alkaline solutions			
	Define the terms acid and alkali in terms of production of hydrogen ions or hydroxide ions (in solution), define the term base			
	Describe the use of universal indicator to measure the approximate pH of a solution and use the pH scale to identify acidic or alkaline solutions			
	Chem ONLY: Describe how to carry out titrations using strong acids and strong alkalis only (sulfuric, hydrochloric and nitric acids to find the reacting volumes accurately			
	Chem & HT ONLY: Calculate the chemical quantities in titrations involving concentrations in mol/dm^3 and in g/dm^3			
	Chem ONLY: ***Required practical 2:*** *determination of the reacting volumes of solutions of a strong acid and a strong alkali by titration*			
	HT ONLY: Use and explain the terms dilute and concentrated (in terms of amount of substance) and weak and strong (in terms of the degree of ionisation) in relation to acids			
	HT ONLY: Explain how the concentration of an aqueous solution and the strength of an acid affects the pH of the solution and how pH is related to the hydrogen ion concentration of a solution			
4.4.3 Electrolysis	Describe how ionic compounds can conduct electricity when dissolved in water and describe these solutions as electrolytes			
	Describe the process of electrolysis			
	Describe the electrolysis of molten ionic compounds and predict the products at each electrode of the electrolysis of binary ionic compounds			
	Explain how metals are extracted from molten compounds using electrolysis and use the reactivity series to explain why some metals are extracted with electrolysis instead of carbon			
	Describe the electrolysis of aqueous solutions and predict the products of the electrolysis of aqueous solutions containing single ionic compounds			
	Required practical 3: *investigate what happens when aqueous solutions are electrolysed using inert electrodes*			

AQA Physics (8463) from 2016 Topics P4.1. Energy

Topic	Student Checklist	R	A	G
4.1.1 Energy changes in a system, and the ways energy is stored before and after such changes	Define a system as an object or group of objects and state examples of changes in the way energy is stored in a system			
	Describe how all the energy changes involved in an energy transfer and calculate relative changes in energy when the heat, work done or flow of charge in a system changes			
	Use calculations to show on a common scale how energy in a system is redistributed			
	Calculate the kinetic energy of an object by recalling and applying the equation: ***[$E_k = ½mv^2$]***			
	Calculate the amount of elastic potential energy stored in a stretched spring by applying, but not recalling, the equation: ***[$E_e = ½ke^2$]***			
	Calculate the amount of gravitational potential energy gained by an object raised above ground level by recalling and applying, the equation: ***[$E_e = mgh$]***			
	Calculate the amount of energy stored in or released from a system as its temperature changes by applying, but not recalling, the equation: ***[$\Delta E = mc\Delta\theta$]***			
	Define the term 'specific heat capacity'			
	Required practical 1: *investigation to determine the specific heat capacity of one or more materials.*			
	Define power as the rate at which energy is transferred or the rate at which work is done and the watt as an energy transfer of 1 joule per second			
	Calculate power by recalling and applying the ***equations: [P = E/t & P = W/t]***			
	Explain, using examples, how two systems transferring the same amount of energy can differ in power output due to the time taken			
4.1.2 Conservation and dissipation of energy	State that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed and so the total energy in a system does not change			
	Explain that only some of the energy in a system is usefully transferred, with the rest 'wasted', giving examples of how this wasted energy can be reduced			
	Explain ways of reducing unwanted energy transfers and the relationship between thermal conductivity and energy transferred			
	Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls			
	Required practical 2: *investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material.*			
	Calculate efficiency by recalling and applying the equation: ***[efficiency = useful power output / total power input]***			
	HT ONLY: Suggest and explain ways to increase the efficiency of an intended energy transfer			
4.1.3 National and global energy resources	List the main renewable and non-renewable energy resources and define what a renewable energy resource is			
	Compare ways that different energy resources are used, including uses in transport, electricity generation and heating			
	Explain why some energy resources are more reliable than others, explaining patterns and trends in their use			
	Evaluate the use of different energy resources, taking into account any ethical and environmental issues which may arise			
	Justify the use of energy resources, with reference to both environmental issues and the limitations imposed by political, social, ethical or economic considerations			

AQA Physics (8463) from 2016 Topics P4.2. Electricity				
Topic	**Student Checklist**	**R**	**A**	**G**
4.2.1 Current, potential difference and resistance	Draw and interpret circuit diagrams, including all common circuit symbols			
	Define electric current as the rate of flow of electrical charge around a closed circuit			
	Calculate charge and current by recalling and applying the formula: ***[Q = It]***			
	Explain that current is caused by a source of potential difference and it has the same value at any point in a single closed loop of a circuit			
	Describe and apply the idea that the greater the resistance of a component, the smaller the current for a given potential difference (p.d.) across the component			
	Calculate current, potential difference or resistance by recalling and applying the equation: ***[V = IR]***			
	Required practical 3: *Use circuit diagrams to set up and check circuits to investigate the factors affecting the resistance of electrical circuits*			
	Define an ohmic conductor			
	Explain the resistance of components such as lamps, diodes, thermistors and LDRs and sketch/interpret IV graphs of their characteristic electrical behaviour			
	Explain how to measure the resistance of a component by drawing an appropriate circuit diagram using correct circuit symbols			
	Required practical 4: *use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements*			
4.2.2 Series and parallel circuits	Show by calculation and explanation that components in series have the same current passing through them			
	Show by calculation and explanation that components connected in parallel have the same the potential difference across each of them			
	Calculate the total resistance of two components in series as the sum of the resistance of each component using the equation: ***[$R_{total} = R_1 + R_2$]***			
	Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance			
	Solve problems for circuits which include resistors in series using the concept of equivalent resistance			
4.2.3 Domestic uses and safety	Explain the difference between direct and alternating voltage and current, stating what UK mains is			
	Identify and describe the function of each wire in a three-core cable connected to the mains			
	State that the potential difference between the live wire and earth (0 V) is about 230 V and that both neutral wires and our bodies are at, or close to, earth potential (0 V)			
	Explain that a live wire may be dangerous even when a switch in the mains circuit is open by explaining the danger of providing any connection between the live wire and earth			

4.2.4 Energy transfers	Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it			
	Calculate power by recalling and applying the equations: ***[P = VI]*** and ***[P = I^2 R]***			
	Describe how appliances transfer energy to the kinetic energy of motors or the thermal energy of heating devices			
	Calculate and explain the amount of energy transferred by electrical work by recalling and applying the equations: ***[E = Pt]*** and ***[E = QV]***			
	Explain how the power of a circuit device is related to the potential difference across it, the current through it and the energy transferred over a given time.			
	Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use			
	Identify the National Grid as a system of cables and transformers linking power stations to consumers			
	Explain why the National Grid system is an efficient way to transfer energy, with reference to change in potential difference reducing current			
4.2.5 Static electricity	*PHY ONLY: Describe the production of static electricity by the rubbing of insulating surfaces*			
	PHY ONLY: Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact			
	PHY ONLY: Explain how the transfer of electrons between objects can explain the phenomenon of static electricity, including how insulators are charged and sparks are created			
	PHY ONLY: Draw the electric field pattern for an isolated charged sphere			
	PHY ONLY: Explain the concept of an electric field and the decrease in its strength as the distance from it increases			
	PHY ONLY: Explain how the concept of an electric field helps to Explain the non-contact force between charged objects as well as other electrostatic phenomena such as sparking			

AQA Physics (8463) from 2016 Topics P4.3. Particle model of matter				
TOPIC	**Student Checklist**	**R**	**A**	**G**
4.3.1 Changes of state and the particle model	Calculate the density of a material by recalling and applying the equation: [ρ = m/V]			
	Recognise/draw simple diagrams to model the difference between solids, liquids and gases			
	Use the particle model to explain the properties of different states of matter and differences in the density of materials			
	Required practical 5: *use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids*			
	Recall and describe the names of the processes by which substances change state			
	Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass			
4.3.2 Internal energy and energy transfers	State that the internal energy of a system is stored in the atoms and molecules that make up the system			
	Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system			
	Calculate the change in thermal energy by applying but not recalling the equation ***[ΔE =m c Δθ]***			
	Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: ***[E = mL]***			
	Interpret and draw heating and cooling graphs that include changes of state			
	Distinguish between specific heat capacity and specific latent heat			
4.3.3 Particle model and	Explain why the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy			
	Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure			

	Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased			
	PHY ONLY: Explain, with reference to the particle model, how increasing the volume in which a gas is contained can lead to a decrease in pressure when the temperature is constant			
	PHY ONLY: Calculate the pressure for a fixed mass of gas held at a constant temperature by applying, but not recalling, the equation: [pV = constant]			
	PHY & HT ONLY: Explain how work done on an enclosed gas can lead to an increase in the temperature of the gas, as in a bicycle pump			

AQA Physics (8463) from 2016 Topics P4.4. Atomic structure				
TOPIC	**Student Checklist**	**R**	**A**	**G**
4.4.1 Atoms and isotopes	Describe the basic structure of an atom and how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation			
	Define electrons, neutrons, protons, isotopes and ions			
	Relate differences between isotopes to differences in conventional representations of their identities, charges and masses			
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)			
4.4.2 Atoms and nuclear radiation	Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube			
	Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays			
	Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation			
	Use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers			
	Define half-life of a radioactive isotope			
	HT ONLY: Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives			
	Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present			
	Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review			
4.4.3 Hazards and uses of radioactive emissions and of background radiation	*PHY ONLY: State, giving examples, that background radiation is caused by natural and man-made sources and that the level of radiation may be affected by occupation and/or location*			
	PHY ONLY: Explain the relationship between the instability and half-life of radioactive isotopes and why the hazards associated with radioactive material differ according to the half-life involved			
	PHY ONLY: Describe and evaluate the uses of nuclear radiation in exploration of internal organs and controlling or destroying unwanted tissue			
	PHY ONLY: Evaluate the perceived risks of using nuclear radiation in relation to given data and consequences			
	PHY ONLY: Describe nuclear fission			
	PHY ONLY: Draw/interpret diagrams representing nuclear fission and how a chain reaction may occur			
	PHY ONLY: Describe nuclear fusion			

AQA TRILOGY Physics (8464) from 2016 Topics T6.1. Energy				
Topic	**Student Checklist**	**R**	**A**	**G**
6.1.1 Energy changes in a system, and the ways energy is stored before and after such changes	Define a system as an object or group of objects and state examples of changes in the way energy is stored in a system			
	Describe how all the energy changes involved in an energy transfer and calculate relative changes in energy when the heat, work done or flow of charge in a system changes			
	Use calculations to show on a common scale how energy in a system is redistributed			
	Calculate the kinetic energy of an object by recalling and applying the equation: ***[E_k = ½mv²]***			
	Calculate the amount of elastic potential energy stored in a stretched spring by applying, but not recalling, the equation: ***[E_e= ½ke²]***			
	Calculate the amount of gravitational potential energy gained by an object raised above ground level by recalling and applying, the equation: ***[E_e = mgh]***			
	Calculate the amount of energy stored in or released from a system as its temperature changes by applying, but not recalling, the equation: ***[ΔE = mcΔθ]***			
	Define the term 'specific heat capacity'			
	Required practical 14: *investigation to determine the specific heat capacity of one or more materials.*			
	Define power as the rate at which energy is transferred or the rate at which work is done and the watt as an energy transfer of 1 joule per second			
	Calculate power by recalling and applying the ***equations: [P = E/t & P = W/t]***			
	Explain, using examples, how two systems transferring the same amount of energy can differ in power output due to the time taken			
6.1.2 Conservation and dissipation of energy	State that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed and so the total energy in a system does not change			
	Explain that only some of the energy in a system is usefully transferred, with the rest 'wasted', giving examples of how this wasted energy can be reduced			
	Explain ways of reducing unwanted energy transfers and the relationship between thermal conductivity and energy transferred			
	Describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls			
	Calculate efficiency by recalling and applying the equation: ***[efficiency = useful power output / total power input]***			
	HT ONLY: Suggest and explain ways to increase the efficiency of an intended energy transfer			
6.1.3 National and global energy resources	List the main renewable and non-renewable energy resources and define what a renewable energy resource is			
	Compare ways that different energy resources are used, including uses in transport, electricity generation and heating			
	Explain why some energy resources are more reliable than others, explaining patterns and trends in their use			
	Evaluate the use of different energy resources, taking into account any ethical and environmental issues which may arise			
	Justify the use of energy resources, with reference to both environmental issues and the limitations imposed by political, social, ethical or economic considerations			

AQA TRILOGY Physics (8464) from 2016 Topics T6.2. Electricity				
Topic	**Student Checklist**	**R**	**A**	**G**
6.2.1 Current, potential difference and resistance	Draw and interpret circuit diagrams, including all common circuit symbols			
	Define electric current as the rate of flow of electrical charge around a closed circuit			
	Calculate charge and current by recalling and applying the formula: ***[Q = It]***			
	Explain that current is caused by a source of potential difference and it has the same value at any point in a single closed loop of a circuit			
	Describe and apply the idea that the greater the resistance of a component, the smaller the current for a given potential difference (p.d.) across the component			
	Calculate current, potential difference or resistance by recalling and applying the equation: ***[V = IR]***			
	Required practical 15: *Use circuit diagrams to set up and check circuits to investigate the factors affecting the resistance of electrical circuits*			
	Define an ohmic conductor			
	Explain the resistance of components such as lamps, diodes, thermistors and LDRs and sketch/interpret IV graphs of their characteristic electrical behaviour			
	Explain how to measure the resistance of a component by drawing an appropriate circuit diagram using correct circuit symbols			
	Required practical 16: *use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements*			
6.2.2 Series and parallel circuits	Show by calculation and explanation that components in series have the same current passing through them			
	Show by calculation and explanation that components connected in parallel have the same the potential difference across each of them			
	Calculate the total resistance of two components in series as the sum of the resistance of each component using the equation: ***[$R_{total} = R_1 + R_2$]***			
	Explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance			
	Solve problems for circuits which include resistors in series using the concept of equivalent resistance			
6.2.3 Domestic uses and safety	Explain the difference between direct and alternating voltage and current, stating what UK mains is			
	Identify and describe the function of each wire in a three-core cable connected to the mains			
	State that the potential difference between the live wire and earth (0 V) is about 230 V and that both neutral wires and our bodies are at, or close to, earth potential (0 V)			
	Explain that a live wire may be dangerous even when a switch in the mains circuit is open by explaining the danger of providing any connection between the live wire and earth			

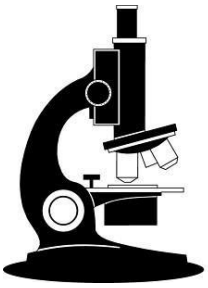
6.2.4 Energy transfers	Explain how the power transfer in any circuit device is related to the potential difference across it and the current through it			
	Calculate power by recalling and applying the equations: ***[P = VI]*** and ***[$P = I^2 R$]***			
	Describe how appliances transfer energy to the kinetic energy of motors or the thermal energy of heating devices			
	Calculate and explain the amount of energy transferred by electrical work by recalling and applying the equations: ***[E = Pt]*** and ***[E = QV]***			
	Explain how the power of a circuit device is related to the potential difference across it, the current through it and the energy transferred over a given time.			
	Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use			
	Identify the National Grid as a system of cables and transformers linking power stations to consumers			
	Explain why the National Grid system is an efficient way to transfer energy, with reference to change in potential difference reducing current			

AQA TRILOGY Physics (8464) from 2016 Topics T6.3. Particle model of matter				
TOPIC	**Student Checklist**	**R**	**A**	**G**
6.3.1 Changes of state and the particle model	Calculate the density of a material by recalling and applying the equation: [ρ = m/V]			
	Recognise/draw simple diagrams to model the difference between solids, liquids and gases			
	Use the particle model to explain the properties of different states of matter and differences in the density of materials			
	Required practical 17: *use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids*			
	Recall and describe the names of the processes by which substances change state			
	Use the particle model to explain why a change of state is reversible and affects the properties of a substance, but not its mass			
6.3.2 Internal energy and energy transfers	State that the internal energy of a system is stored in the atoms and molecules that make up the system			
	Explain that internal energy is the total kinetic energy and potential energy of all the particles in a system			
	Calculate the change in thermal energy by applying but not recalling the equation ***[ΔE =m c Δθ]***			
	Calculate the specific latent heat of fusion/vaporisation by applying, but not recalling, the equation: ***[E = mL]***			
	Interpret and draw heating and cooling graphs that include changes of state			
	Distinguish between specific heat capacity and specific latent heat			
6.3.3 Particle model and pressure	Explain why the molecules of a gas are in constant random motion and that the higher the temperature of a gas, the greater the particles' average kinetic energy			
	Explain, with reference to the particle model, the effect of changing the temperature of a gas held at constant volume on its pressure			
	Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased			

AQA TRILOGY Physics (8464) from 2016 Topics T6.4. Atomic structure				
TOPIC	**Student Checklist**	**R**	**A**	**G**
6.4.1 Atoms and isotopes	Describe the basic structure of an atom and how the distance of the charged particles vary with the absorption or emission of electromagnetic radiation			
	Define electrons, neutrons, protons, isotopes and ions			
	Relate differences between isotopes to differences in conventional representations of their identities, charges and masses			
	Describe how the atomic model has changed over time due to new experimental evidence, inc discovery of the atom and scattering experiments (inc the work of James Chadwick)			
6.4.2 Atoms and nuclear radiation	Describe and apply the idea that the activity of a radioactive source is the rate at which its unstable nuclei decay, measured in Becquerel (Bq) by a Geiger-Muller tube			
	Describe the penetration through materials, the range in air and the ionising power for alpha particles, beta particles and gamma rays			
	Apply knowledge of the uses of radiation to evaluate the best sources of radiation to use in a given situation			
	Use the names and symbols of common nuclei and particles to complete balanced nuclear equations, by balancing the atomic numbers and mass numbers			
	Define half-life of a radioactive isotope			
	HT ONLY: Determine the half-life of a radioactive isotope from given information and calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives			
	Compare the hazards associated with contamination and irradiation and outline suitable precautions taken to protect against any hazard the radioactive sources may present			
	Discuss the importance of publishing the findings of studies into the effects of radiation on humans and sharing findings with other scientists so that they can be checked by peer review			

GCSE AQA Combined Science (Trilogy)
Required Practicals Paper 1

Biology Paper 1



Unit 1 – Cell Biology

Required Practical – Using a microscope

YouTube links: Using a light microscope Preparing a microscope slide (Onion cell) BBC

Bitesize links: Calculating magnification

Required Practical – Osmosis (potato practical)

YouTube links: Investigating Osmosis

BBC Bitesize links: Osmosis overview

Required Practical – Bacterial Growth

YouTube links: Bacterial Growth

BBC Bitesize links: Bacterial Growth

Unit 2 – Organisation

Required Practical – Testing for carbohydrates, lipids and proteins

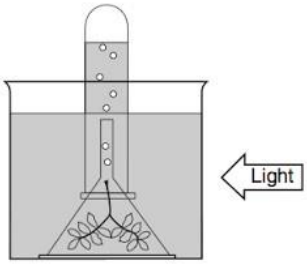
YouTube links: Food test

BBC Bitesize links: Food testing

Required Practical – Investigate the effect of pH on Amylase enzyme

YouTube links: Effect of pH

BBC Bitesize links: Enzymes Effect of pH on enzymes Digestive Enzymes



Unit 3 – Infection and response

No required practical investigations for this unit

Unit 4 – Bioenergetics

Required Practical – Investigating effect of light intensity on photosynthesis

YouTube links: Light intensity with pond weed

BBC Bitesize links: Factors effecting photosynthesis Light intensity investigation

Chemistry Paper 1

Unit 1 – Atomic Structure and the periodic table

No required practical investigations for this unit

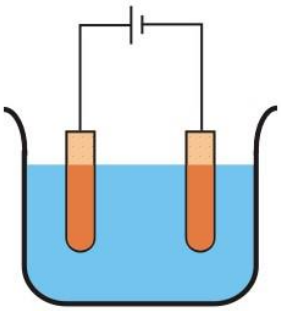
Unit 2 – Bonding, structure, and the properties of matter

No required practical investigations for this unit

Unit 3 – Quantitative chemistry

No required practical investigations for this unit

Unit 4 – Chemical changes



Required Practical – Creating a soluble salt

YouTube links: Making salts Visual method

BBC Bitesize links: Making salts Copper sulphate production

Required Practical – Electrolysis

YouTube links: Electrolysis

BBC Bitesize links: Electrolysis

Required Practical – Titration

YouTube links: Titration

BBC Bitesize links: Titration

Unit 5 – Energy changes

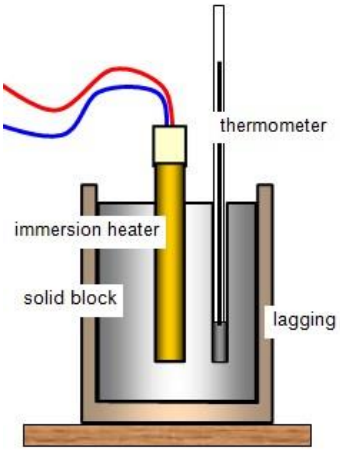
Required Practical – Temperature changes

YouTube links: Temperature changes practical

BBC Bitesize links: Exothermic and Endothermic reactions

Physics Paper 1

Unit 1 – Energy



Required practical – Specific heat capacity

YouTube links: Specific heat capacity

BBC Bitesize links: Specific heat capacity

Unit 1 – Energy

Require Practical – Insulation

YouTube links:Insulation

BBC Bitesize links: Insulation

Unit 2 – Electricity

Required practical – Resistance of a wire

YouTube links: Resistance of the wire

BBC Bitesize links: Resistance (general) Current, voltage, resistance

Required practical – Generating I-V graphs

YouTube links: Practical method Graph characteristics in detail

BBC Bitesize links: Current-Voltage graphs

Unit 3 – Particle model of matter

Required practical – Calculating density

YouTube links: Density of regular objects Density of irregular objects

BBC Bitesize links: Density Density equation

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Topic 3: Infection and Response — Click Link Here

Topic 4: Bioenergetics — Click Link Here

Paper 2

Topic 5: Homeostasis and Response — Click Link Here

Topic 6: Inheritance, Variation and Evolution — Click Link Here

Topic 7: Ecology — Click Link Here

Practical Skills — Click Link Here

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Topic 2: , Structure and the Properties of Matter — Click Link Here

Topic 3: Quantitative Chemistry — Click Link Here

Topic 4: Chemical Changes — Click Link Here

Topic 5: Energy Changes — Click Link Here

Paper 2

Topic 6: The Rate and Extent of Chemical Change — Click Link Here

Topic 7: Organic Chemistry — Click Link Here

Topic 8: Chemical Analysis — Click Link Here

Topic 9: Chemistry of the Atmosphere — Click Link Here

Topic 10: Using Resources — Click Link Here

Practical Skills — Click Link Here

AQA GCSE Physics Revision

Paper 1

Topic 1: **Energy** — Click Link Here

Topic 2: **Electricity** — Click Link Here

Topic 3: **Particle Model of Matter** — Click Link Here

Topic 4: **Atomic Structure** — Click Link Here

Paper 2

Topic 5: **Forces** — Click Link Here

Topic 6: **Waves** — Click Link Here

Topic 7: **Magnetism and Electromagnetism** — Click Link Here

Topic 8: **Space Physics** — Click Link Here

Practical Skills — Click Link Here