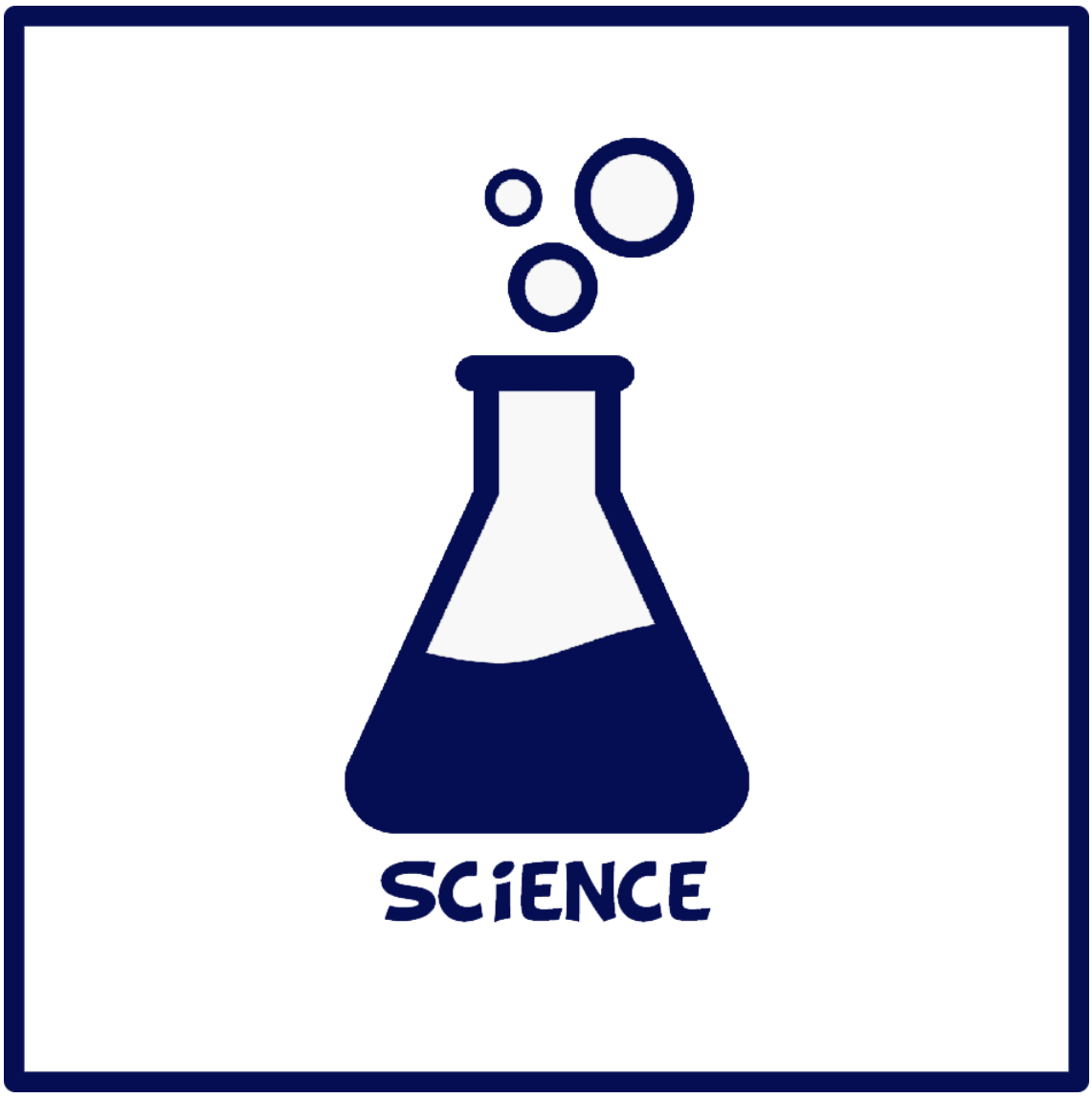
Personalised Learning Checklist

Student Name:	
Form Group:	

Year 11 PLC Separate Sciences



Separate Foundation Topics Grades 1-5

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Separate Higher Topics Grades 4-9)

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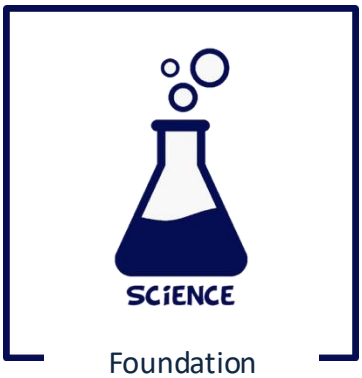


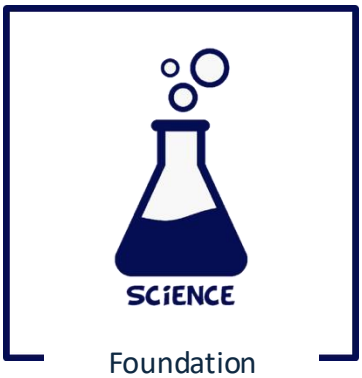
Foundation

Biology

Paper 1

Review of Learning

		Self Assessment		
Topic	**Knowledge/Skills**			
Cells	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			
	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			
	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)			
	Describe the process of active transport, including examples - gut and roots			
	Explain the differences between diffusion, osmosis and active transport			



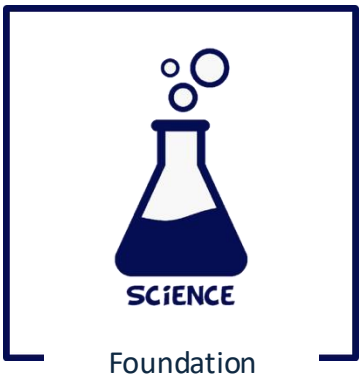
Foundation

Biology

Paper 1

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Organisation	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: use qualitative reagents to test for a range of carbohydrates, lipids and proteins			
	Required practical: 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			



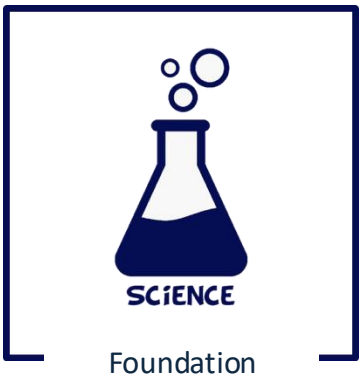
Foundation

Biology

Paper 1

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Infection and response	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)			
	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			
	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			



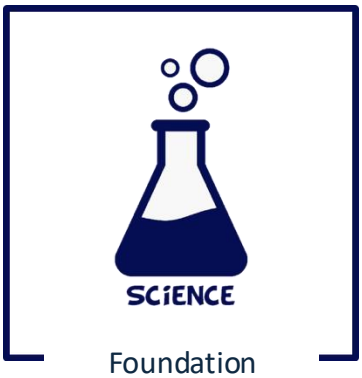
Foundation

Biology

Paper 1

Review of Learning

		Self Assessment		
Topic	**Knowledge/Skills**			
Bioenergetics	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			
	Describe how the glucose produced in photosynthesis is used by plants			
	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			



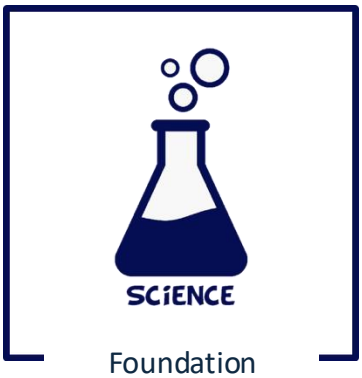
Foundation

Biology

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Ecology	Explain the terms 'interdependence' and 'stable community'			
	Name some abiotic and biotic factors that affect communities			
	Explain how a change in an abiotic or biotic factor might affect a community			
	Describe structural, behavioural and functional adaptations of organisms			
	Describe what an extremophile is			
	Represent the feeding relationships within a community using a food chain and describe these relationships			
	Explain how and why ecologists use quadrats and transects			
	Describe and interpret predator-prey cycles			
	Required practical: measure the population size of a common species in a habitat. Use sampling to investigate the effect of one factor on distribution			
	Describe the processes involved in the carbon cycle			
	Describe the processes involved in the water cycle			
	Bio ONLY: Explain how temperature, water and availability of oxygen affect the rate of decay of biological material			
	Bio ONLY: Explain how the conditions for decay are optimised by farmers and gardeners, and the reasons for this			
	Bio ONLY: Describe how methane gas can be produced from decaying materials for use as a fuel			
	Bio ONLY: Required practical: investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change			
	Bio ONLY: Explain how environmental changes can affect the distribution of species in an ecosystem (temperature, water and atmospheric gases)			
	Describe what biodiversity is, why it is important, and how human activities affect it			
	Describe the impact of human population growth and increased living standards on resource use and waste production			
	Explain how pollution can occur, and the impacts of pollution			
	Describe how humans reduce the amount of land available for other animals and plants			
	Explain the consequences of peat bog destruction			
	Describe what deforestation is and why it has occurred in tropical areas			
	Explain the consequences of deforestation			
	Describe how the composition of the atmosphere is changing, and the impact of this on global warming			
	Describe some biological consequences of global warming			
	Describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity			



Foundation

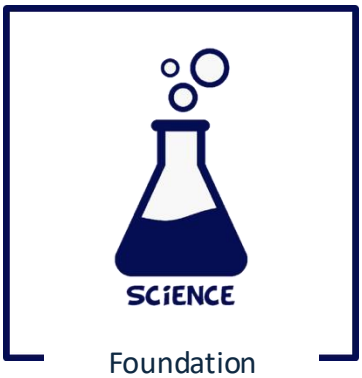
Biology

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Ecology	Describe programmes that aim to reduce the negative effects of humans on ecosystems and biodiversity			
	Bio ONLY: Describe the different trophic levels and use numbers and names to represent them			
	Bio ONLY: Describe what decomposers are and what they do			
	Bio ONLY: Construct pyramids of biomass accurately from data and explain what they represent			
	Bio ONLY: State how much energy producers absorb from the Sun and how much biomass is transferred			
	Bio ONLY: Explain how biomass is lost between trophic levels, including the consequences of this and calculate efficiency between trophic levels			
	Bio ONLY: Explain the term 'food security' and describe biological factors that threaten it			
	Bio ONLY: Explain how the efficiency of food production can be improved			
	Bio ONLY: Explain the term 'factory farming', including examples, and ethical objections			
	Bio ONLY: Explain the importance of maintaining fish stocks at a level where breeding continues			
	Bio ONLY: Explain some methods that can help to conserve fish stocks			
	Bio ONLY: Describe how modern biotechnology is used in food production, including the fungus Fusarium as an example			
	Bio ONLY: Describe the uses of genetically modified organisms in insulin and food production			

Topic	Knowledge/Skills	Self Assessment		
Homeostasis and response	Describe what homeostasis is and why it is important stating specific examples from the human body			
	Describe the common features of all control systems			
	State the function of the nervous system and name its important components			
	Describe how information passes through the nervous system			
	Describe what happens in a reflex action and why reflex actions are important			
	Explain how features of the nervous system are adapted to their function, including a reflex arc (inc all types of neurone and the synapse)			
	Bio ONLY: State the function of the brain and how it is structured, including identifying he cerebral cortex, cerebellum and medulla on a diagram of the brain			
	Bio ONLY: Describe the functions of different regions of the brain			
	Bio ONLY: State the function of the eye and how it is structured, including names of specific parts			
	Bio ONLY: Describe the functions of different parts of the eye, including relating structure to function			
	Bio ONLY: Describe what accommodation is, and how it is carried out			
	Bio ONLY: Explain what myopia and hyperopia are and how they are treated, including interpreting ray diagrams			



Foundation

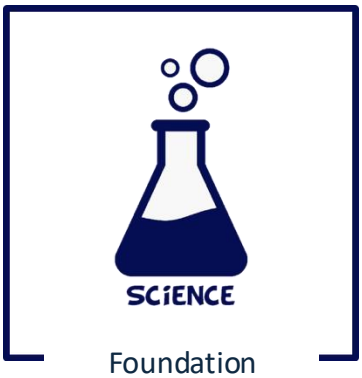
Biology

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Homeostasis and response	*Bio ONLY: Describe how body temperature is monitored and controlled*			
	Describe how water, ions and urea are lost from the body			
	Describe the consequences of losing or gaining too much water for body cells			
	Describe how the kidneys produce urine			
	Describe the endocrine system, including the location of the pituitary, pancreas, thyroid, adrenal gland, ovary and testis and the role of hormones			
	State that blood glucose concentration is monitored and controlled by the pancreas			
	Describe the body's response when blood glucose concentration is too high			
	Explain what type 1 and type 2 diabetes are and how they are treated			
	Describe how kidney failure can be treated by organ transplant or dialysis and recall the basic principles of dialysis			
	Describe what happens at puberty in males and females, inc knowledge of reproductive hormones			
	Describe the roles of the hormones involved in the menstrual cycle (FSH, LH and oestrogen)			
	Describe how fertility can be controlled by hormonal and non-hormonal methods of contraception (giving specific examples from the spec)			
	Bio ONLY: Describe hormone-linked plant responses, to include phototropism and gravitropism and the role of auxin			

Topic	Knowledge/Skills	Self Assessment		
Inheritance, variation, and evolution	Describe how genetic information is stored in the nucleus of a cell (inc genes & chromosomes) (examined in paper 1)			
	Describe the processes that happen during the cell cycle, including mitosis (inc recognise and describe where mitosis occurs) (examined in paper 1)			
	Describe stem cells, including sources of stem cells in plants and animals and their roles (examined in paper 1)			
	Describe the use of stem cells in the production of plant clones and therapeutic cloning (examined in paper 1)			
	Discuss the potential risks, benefits and issues with using stem cells in medical research/treatments (inc diabetes and paralysis) (examined in paper 1)			
	Describe features of sexual and asexual reproduction			
	Describe what happens during meiosis and compare to mitosis			
	Describe what happens at fertilisation			
	Bio ONLY: Explain advantages of sexual and asexual reproduction			
	Bio ONLY: Describe examples of organisms that reproduce both sexually and asexually (malarial parasites, fungi, strawberry plants and daffodils)			
	Describe the structure of DNA and its role in storing genetic information inside the cell			



Foundation

Biology

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Inheritance, variation, and evolution	*Bio ONLY: Describe the structure of DNA, including knowledge of nucleotide units*			
	Describe how characteristics are controlled by one or more genes, including examples			
	Explain important genetic terms: gamete, chromosome, gene, allele, genotype, phenotype, dominant, recessive, homozygous and heterozygous			
	Explain and use Punnet square diagrams, genetic crosses and family trees			
	Describe cystic fibrosis and polydactyly as examples of inherited disorders			
	Evaluate social, economic and ethical issues concerning embryo screening when given appropriate information			
	Describe how the chromosomes are arranged in human body cells, including the function of the sex chromosomes			
	Explain how sex is determined and carry out a genetic cross to show sex inheritance			
	Describe what variation is and how it can be caused within a population			
	Describe mutations and explain their influence on phenotype and changes in a species			
	Explain the theory of evolution by natural selection			
	Describe how new species can be formed			
	Describe what selective breeding is			
	Explain the process of selective breeding, including examples of desired characteristics and risks associated with selective breeding			
	Describe what genetic engineering is, including examples, and how it is carried out			
	Explain some benefits, risks and concerns related to genetic engineering			
	Bio ONLY: Describe different cloning techniques, to include: tissue culture, cuttings, embryo transplants and adult cell cloning			
	Bio ONLY: Describe the ideas proposed by Darwin in his theory of natural selection and explain why this theory was only gradually accepted			
	Bio ONLY: Describe other inheritance-based theories that existed (apart from the theory of natural selection), and the problems with these theories			
	Bio ONLY: Describe the work of Alfred Russel Wallace			
	Bio ONLY: Explain how new species can be formed			
	Bio ONLY: Describe how our understanding of genetics has developed over time, to include knowledge of Mendel			
	Describe some sources of evidence for evolution			
	Describe what fossils are, how they are formed and what we can learn from them			
	Explain why there are few traces of the early life forms, and the consequences of this in terms of our understanding of how life began			
	Describe some of the causes of extinction			
	Describe how antibiotic-resistant strains of bacteria can arise and spread (inc MRSA)			
	Describe how the emergence of antibiotic-resistant bacteria can be reduced and controlled, to include the limitations of antibiotic development			
	Describe how organisms are named and classified in the Linnaean system			
	Explain how scientific advances have led to the proposal of new models of classification, inc three-domain system			
	Describe and interpret evolutionary trees			

Chemistry

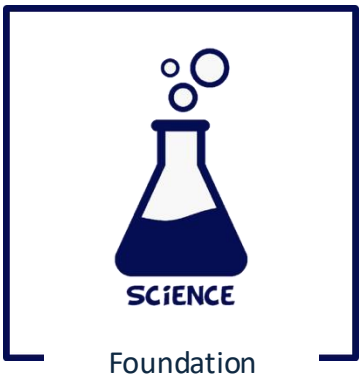
Paper 1

Review of Learning

Foundation

Topic	Knowledge/Skills	Self Assessment		
A simple model of the atom, symbols, relative atomic mass, electronic charge and isotope	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			
	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			

Topic	Knowledge/Skills	Self Assessment		
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 noble 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)			



Foundation

Chemistry

Paper 1

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
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			

Topic	Knowledge/Skills	Self Assessment		
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			
	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			

Foundation

Chemistry

Paper 1

Review of Learning

		Self Assessment		
Topic	**Knowledge/Skills**			
Structure and bonding of carbon	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			
	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			

		Self Assessment		
Topic	**Knowledge/Skills**			
Use of amount of substance in relation to masses of pure substances	Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution			
	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 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			
	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			

Chemistry

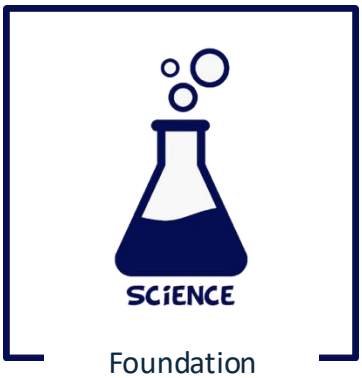
Paper 1

Foundation

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Reactions of Acids	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			
	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			

Topic	Knowledge/Skills	Self Assessment		
Electrolysis, Exothermic and endothermic reactions, Chemical cells and fuel cells	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			
	Describe how energy is transferred to or from the surroundings during a chemical reaction			
	Explain exothermic and endothermic reactions on the basis of the temperature change of the surroundings and give examples of everyday uses			
	Describe what the collision theory is and define the term activation energy			
	Interpret and draw reaction profiles of exothermic and endothermic reactions, inc identifying the relative energies of reactants and products, activation energy and overall energy change			
	Chem ONLY: Describe what a simple cell and a battery is and how they produce electricity			
	Chem ONLY: Describe why alkaline batteries are non-rechargeable, state why some cells are rechargeable and evaluate the use of cells			
	Chem ONLY: Describe fuel cells and compare fuel cells to rechargeable cells and batteries			
	Chem ONLY: Describe the overall reaction in a hydrogen fuel cell			



Foundation

Chemistry

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Rate of reaction	Calculate the rate of a chemical reaction over time, using either the quantity of reactant used or the quantity of product formed, measured in g/s or cm^3/s			
	Draw and interpret graphs showing the quantity of product formed or reactant used up against time and use the tangent to the graph as a measure of the rate of reaction			
	Describe how different factors affect the rate of a chemical reaction, including the concentration, pressure, surface area, temperature and presence of catalysts			
	Use collision theory to explain changes in the rate of reaction, including discussing activation energy			
	Describe the role of a catalyst in a chemical reaction and state that enzymes are catalysts in biological systems			
	Draw and interpret reaction profiles for catalysed reactions			
	Explain what a reversible reaction is, including how the direction can be changed and represent it using symbols: A + B ⇌ C + D			

Topic	Knowledge/Skills	Self Assessment		
Reversible reactions and dynamic equilibrium, Carbon compounds as fuels and feedstock	Explain that, for reversible reactions, if a reaction is endothermic in one direction, it is exothermic in the other direction			
	Describe the State of dynamic equilibrium of a reaction as the point when the forward and reverse reactions occur at exactly the same rate			
	Describe what crude oil is and where it comes from, including the basic composition of crude oil and the general chemical formula for the alkanes			
	State the names of the first four members of the alkanes and recognise substances as alkanes from their formulae			
	Describe the process of fractional distillation, state the names and uses of fuels that are produced from crude oil by fractional distillation			
	Describe trends in the properties of hydrocarbons, including boiling point, viscosity and flammability and explain how their properties influence how they are used as fuels			
	Describe and write balanced chemical equations for the complete combustion of hydrocarbon fuels			
	Describe the process of cracking and state that the products of cracking include alkanes and alkenes and describe the test for alkenes			
	Balance chemical equations as examples of cracking when given the formulae of the reactants and products			
	Explain why cracking is useful and why modern life depends on the uses of hydrocarbons			

Chemistry

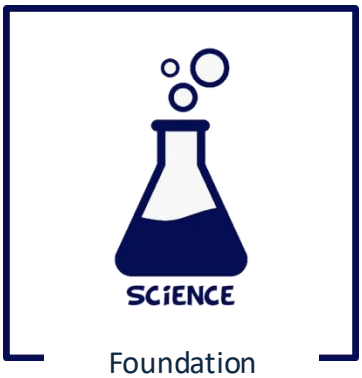
Paper 2

Foundation

Review of Learning

		Self Assessment		
Topic	**Knowledge/Skills**			
Reactions of alkenes and alcohols	*Chem ONLY: State the names and draw structural formulae of the first four members of the alkenes and recognise substances as alkenes from their formulae*			
	Chem ONLY: Describe the basic composition of alkenes, including the C=C functional group, the general chemical formula for the alkanes and describe what unsaturated means			
	Chem ONLY: Describe the combustion reactions of alkenes and the reactions of alkenes with hydrogen, water and the halogens			
	Chem ONLY: Draw fully displayed structural formulae of the first four members of the alkenes and the products of their addition reactions with hydrogen, water, chlorine, bromine and iodine			
	Chem ONLY: State the functional group of alcohols and the first four members of the homologous series of alcohols and represent alcohols using formulae			
	Chem ONLY: Describe some properties and reactions of the first four members of alcohols, including dissolving in water, reacting with sodium, burning in air, oxidation and uses			
	Chem ONLY: State the functional group of carboxylic acids and the first four members of the homologous series of carboxylic acids and represent them using diagrams and formulae			
	Chem ONLY: Describe some properties and reactions of carboxylic acids, including dissolving in water, reacting with carbonates and reacting with alcohols			

		Self Assessment		
Topic	**Knowledge/Skills**			
Synthetic and naturally occurring polymers Purity, formulations and chromatography Identification of gases	*Chem ONLY: Describe how alkenes can be used to make polymers by addition polymerisation*			
	Chem ONLY: Identify addition polymers and monomers from diagrams and from the presence of the functional group and draw diagrams to represent the formation of an addition polymers			
	Chem ONLY: Describe DNA as a large molecule of two polymer chains made from four different monomers called nucleotides in the form of a double helix			
	Chem ONLY: State and describe some other naturally occurring polymers such as proteins, starch and cellulose			
	Define a pure substance and identify pure substances and mixtures from data about melting and boiling points			
	Describe a formulation and identify formulations given appropriate information			
	Describe chromatography, including the terms stationary phase and mobile phase and identify pure substances using paper chromatography			
	Explain what the Rf value of a compound represents, how the Rf value differs in different solvents and interpret and determine Rf values from chromatograms			
	Explain how to test for the presence of hydrogen, oxygen, carbon dioxide and chlorine			



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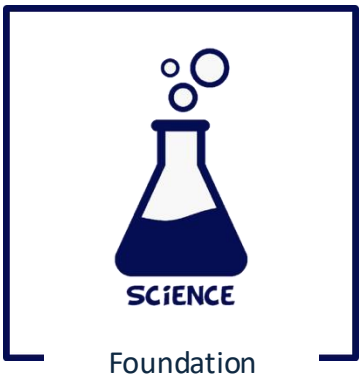
Chemistry

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Identification of ions by chemical and spectroscopic means	*Chem ONLY: Identify some metal ions from the results of flame tests and describe how to conduct a flame test*			
	Chem ONLY: Describe how sodium hydroxide solution can be used to identify some metal ions and identify metal ions from the results of their reactions with sodium hydroxide solution			
	Chem ONLY: Write balanced equations for the reactions between sodium hydroxide solution and some metal ions to produce insoluble hydroxides			
	Chem ONLY: Describe how to identify carbonates using limewater			
	Chem ONLY: Describe how to identify negative ions, including halide ions using silver nitrate and sulfate ions using barium chloride			
	Required practical 7: use of chemical tests to identify the ions in unknown single ionic compounds			
	Chem ONLY: State the advantages of using instrumental methods to identify elements and compounds compared to chemical tests			
	Chem ONLY: Describe the process of and how to use flame emission spectroscopy to identify metal ions; interpret the results of a flame emission spectroscopy tests			
	Describe the composition of gases in the Earth's atmosphere using percentages, fractions or ratios			
	Describe how early intense volcanic activity may have helped form the early atmosphere and how the oceans formed			
	Explain why the levels of carbon dioxide in the atmosphere changes as the oceans were formed			
	State the approximate time in Earth's history when algae started producing oxygen and describe the effects of a gradually increasing oxygen level			
	Explain the ways that atmospheric carbon dioxide levels decreased			

Topic	Knowledge/Skills	Self Assessment		
Carbon dioxide and methane as greenhouse gases	Name some greenhouse gases and describe how they cause an increase in Earth's temperature			
	List some human activities that produce greenhouse gases			
	Evaluate arguments for and against the idea that human activities cause a rise in temperature that results in global climate change			
	State some potential side effects of global climate change, including discussing scale, risk and environmental implications			
	Define the term carbon footprint and list some actions that could reduce the carbon footprint			
	Describe the combustion of fuels as a major source of atmospheric pollutants and name the different gases that are released when a fuel is burned			
	Predict the products of combustion of a fuel given appropriate information about the composition of the fuel and the conditions in which it is used			
	Describe the properties and effects of carbon monoxide, sulfur dioxide and particulates in the atmosphere			
	Describe and explain the problems caused by increased amounts of these pollutants in the air			



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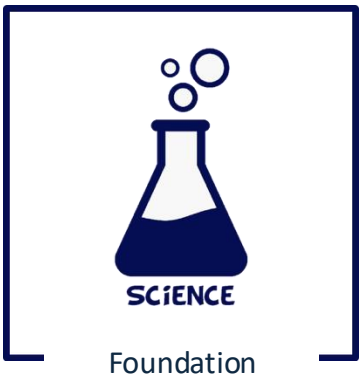
Chemistry

Paper 2

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Using the Earth's resources and obtaining potable water	State what humans use Earth's resources for, give some examples of natural resources that they use			
	Define the term finite and distinguish between finite and renewable resources			
	Explain what sustainable development is and discuss the role chemistry plays in sustainable development, including improving agricultural and industrial processes			
	State examples of natural products that are supplemented or replaced by agricultural and synthetic products			
	Discuss the importance of water quality for human life, including defining potable water			
	Describe methods to produce potable water, including desalination of salty water or sea water and the potential problems of desalination			
	Describe waste water as a product of urban lifestyles and industrial processes that includes organic matter, harmful microbes and harmful chemicals			
	Describe the process of sewage treatment and compare the ease of obtaining potable water from waste water as opposed to ground or salt water			
	Describe, carry out and interpret a simple comparative life cycle assessment (LCA) of materials or products			
	Discuss the advantages and disadvantages of LCAs			
	Carry out simple comparative LCAs for shopping bags made from plastic and paper			
	Discuss how to reduce the consumption of raw resources and explain how reusing and recycling reduces energy use (inc environmental impacts)			

Topic	Knowledge/Skills	Self Assessment		
Using materials	*Chem ONLY: Define corrosion and describe rusting as an example of corrosion*			
	Chem ONLY: Describe ways to prevent corrosion, including providing coatings, sacrificial protection and explain how sacrificial protection works			
	Chem ONLY: Describe the following alloys bronze, gold, steels and aluminium, their uses and describe the benefits of using alloys instead of pure metals			
	Chem ONLY: Compare the properties of materials, including glass and clay ceramics, polymers and composites and explain how their properties are related to their uses			
	Chem ONLY: Discuss the different types of polymers and how their composition affects their properties, including thermosoftening and thermosetting polymers			
	Chem ONLY: Explain what composites are and provide examples of composites and their benefits over other types of materials			
	Chem ONLY: Define corrosion and describe rusting as an example of corrosion			
	Chem ONLY: Describe ways to prevent corrosion, including providing coatings, sacrificial protection and explain how sacrificial protection works			
	Chem ONLY: Describe the following alloys bronze, gold, steels and aluminium, their uses and describe the benefits of using alloys instead of pure metals			



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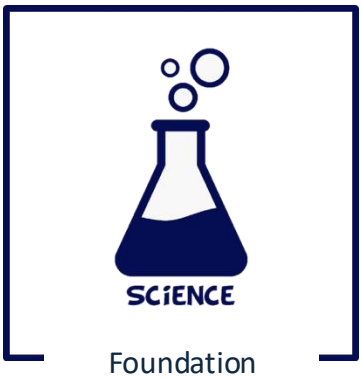
Chemistry

Paper 2

Review of Learning

		Self Assessment		
Topic	**Knowledge/Skills**			
The Haber process and the use of NPK fertilisers	*Chem ONLY: Describe the Haber process, including the reactants and products, recycling of remaining hydrogen and nitrogen and the chemical equation*			
	Chem & HT ONLY: For the Haber process interpret graphs of reaction conditions versus rate			
	Chem ONLY: Apply the principles of dynamic equilibrium to the Haber process and discuss the trade-off between the rate of production and the position of equilibrium			
	Chem ONLY: Explain how the commercially used conditions for the Haber process are related to the availability and cost of raw materials and energy supplies			
	Chem ONLY: Recall the names of the salts produced when phosphate rock is treated with nitric acid, sulfuric acid and phosphoric acid			
	Chem ONLY: Describe NPK fertilisers and the compounds they are composed of and compare the industrial production of fertilisers with the laboratory preparations			



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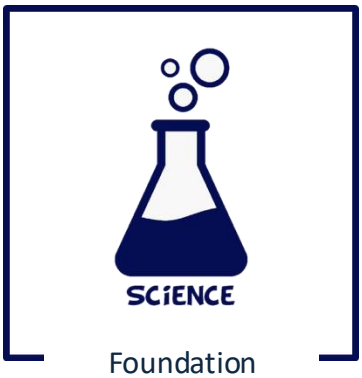
Physics

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
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			
	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			
	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			
	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			

Topic	Knowledge/Skills	Self Assessment		
Space	*PHY ONLY: List the types of body that make up the solar system and describe our solar system as part of a galaxy*			
	PHY ONLY: Explain how stars are formed			
	PHY ONLY: Describe the life cycle of a star the size of the Sun and of a star which is much more massive than the Sun			
	PHY ONLY: Explain how fusion processes lead to the formation of new elements and how supernovas have allowed heavy elements to appear in later solar systems			
	PHY & HT ONLY: Explain that, for circular orbits, the force of gravity leads to a constantly changing velocity but unchanged speed			
	PHY & HT ONLY: Explain that, for a stable orbit, the radius must change if the speed changes			
	PHY ONLY: Explain, qualitatively, the red-shift of light from galaxies that are receding and how this red-shift changes with distance from Earth			
	PHY ONLY: Explain why the change of each galaxy's speed with distance is evidence of an expanding universe			
	PHY ONLY: Explain how scientists are able to use observations to arrive at theories, such as the Big Bang theory and discuss that there is still much about the universe that is not understood			



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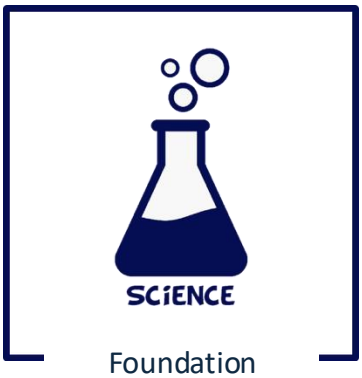
Physics

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Energy	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'			
	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			
	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 energy output / total energy input]***			
	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			
	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			



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Physics

Review of Learning

Topic	Knowledge/Skills	Self Assessment		
Electricity	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*			
	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			
	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			
	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 *[$P = I^2 R$]*			

Physics

Foundation

Review of Learning

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	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			
	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			
	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			