Edexcel IGCSE Science (Double Award)

	Biology		
	Subsection	**Syllabus point**	**Presentations**
B1: The nature and variety of living organisms	**(a) Characteristics of living organisms**	B1.1 Recall that living organisms share the following basic characteristics: • they require nutrition • they respire • they excrete their waste • they respond to their surroundings • they move • they control their internal conditions • they reproduce • they grow and develop.	
	(b) Variety of living organisms	B1.2 Describe the common features shared by organisms within the following main groups, plants, animals, fungi, bacteria, protoctists and viruses, and for each group describe examples and their features as follows (details of life cycle and economic importance are **not** required).	
		Plants: These are multicellular organisms; they contain chloroplasts and are able to carry out photosynthesis; they have cellulose cell walls; they store carbohydrates as starch or sucrose. Examples include flowering plants, such as a cereal (for example maize) and a herbaceous legume (for example peas or beans).	• ***Classifying Organisms***
		Animals: These are multicellular organisms; they do not contain chloroplasts and are not able to carry out photosynthesis; they have no cell walls; they usually have nervous coordination and are able to move from one place to another; they often store carbohydrate as glycogen. Examples include mammals (for example humans) and insects (for example housefly and mosquito).	• ***Classifying Organisms***

	Fungi: These are organisms that are not able to carry out photosynthesis; their body is usually organised into a mycelium made from thread-like structures called hyphae, which contain many nuclei; some examples are single-celled; they have cell walls made of chitin; they feed by extracellular secretion of digestive enzymes onto food material and absorption of the organic products; this is known as saprotrophic nutrition; they may store carbohydrate as glycogen. Examples include *Mucor*, which has the typical fungal hyphal structure, and yeast which is single-celled.	• ***Classifying Organisms***
	Bacteria: These are microscopic single-celled organisms; they have a cell wall, cell membrane, cytoplasm and plasmids; they lack a nucleus but contain a circular chromosome of DNA; some bacteria can carry out photosynthesis but most feed off other living or dead organisms. Examples include *Lactobacillus bulgaricus*, a rod-shaped bacterium used in the production of yoghurt from milk, and *Pneumococcus*, a spherical bacterium that acts as the pathogen causing pneumonia.	• ***Classifying Organisms*** • ***Causes of Disease***
	Protoctists: These are microscopic single-celled organisms. Some, like *Amoeba,* that live in pond water, have features like an animal cell, while others, like *Chlorella*, have chloroplasts and are more like plants. A pathogenic example is *Plasmodium*, responsible for causing malaria.	
	Viruses: These are small particles, smaller than bacteria; they are parasitic and can reproduce only inside living cells; they infect every type of living organism. They have a wide variety of shapes and sizes; they have no cellular structure but have a protein coat and contain one type of nucleic acid, either DNA or RNA. Examples include the tobacco mosaic virus that causes discolouring of the leaves of tobacco plants by preventing the formation of chloroplasts, the influenza virus that causes 'flu' and the HIV virus that causes AIDS.	• ***Classifying Organisms*** • ***Causes of Disease***
	B1.3 Recall the term 'pathogen' and know that pathogens may be fungi, bacteria, protoctists or viruses.	• ***Causes of Disease***

B2: Structures and functions in living organisms	**(a) Levels of organisation**	B2.1 Describe the levels of organisation within organisms: organelles, cells, tissues, organs and systems.	
	(b) Cell structure	B2.2 Recall that the nucleus of a cell contains chromosomes on which genes are located.	• ***Similarity and Variation*** • ***Inheritance***
		B2.3 Describe the functions of the nucleus, cytoplasm, cell membrane, cell wall, chloroplast and vacuole.	
		B2.4 Describe the differences between plant and animal cells.	
	(c) Biological molecules	B2.5 Recall the chemical elements present in carbohydrates, proteins and lipids (fats and oils).	• ***Nutrients***
		B2.6 Describe the structure of carbohydrates, proteins and lipids as large molecules made up from smaller basic units: starch and glycogen from simple sugar; protein from amino acids; lipid from fatty acids and glycerol.	• ***Nutrients***
		B2.7 Describe the tests for glucose and starch.	
		B2.8 Understand the role of enzymes as biological catalysts in metabolic reactions.	
		B2.9 Understand how the functioning of enzymes can be affected by changes in temperature.	• ***Homeostasis***
		B2.10 Describe how to carry out simple controlled experiments to illustrate how enzyme activity can be affected by changes in temperature.	
	(d) Movement of substances into and out of cells	B2.11 Recall simple definitions of diffusion, osmosis and active transport.	
		B2.12 Understand that movement of substances into and out of cells can be by diffusion, osmosis and active transport.	

		B2.13 Understand the factors that affect the rate of movement of substances into and out of cells, to include the effects of surface area to volume ratio, temperature and concentration gradient.	
		B2.14 Describe simple experiments on diffusion and osmosis using living and non-living systems.	
	(e) Nutrition	**FLOWERING PLANTS**	
		B2.15 Describe the process of photosynthesis and understand its importance in the conversion of light energy to chemical energy.	• ***Energy Transfer in Food Chains***
		B2.16 Recall the word equation and the balanced chemical symbol equation for photosynthesis.	
		B2.17 Understand how carbon dioxide concentration, light intensity and temperature affect the rate of photosynthesis.	
		B2.18 Explain how the structure of the leaf is adapted for photosynthesis.	
		B2.19 Recall that plants require mineral ions for growth and that magnesium ions are needed for chlorophyll and nitrate ions are needed for amino acids.	
		B2.20 describe simple controlled experiments to investigate photosynthesis, showing the evolution of oxygen from a water plant, the production of starch and the requirements of light, carbon dioxide and chlorophyll.	
		HUMANS	
		B2.21 Recall sources and describe functions of carbohydrate, protein, lipid (fats and oils), vitamins A, C and D, the mineral ions calcium and iron, water and dietary fibre as components of the diet.	• ***Nutrients*** • ***Diet, Exercise and Health***
		B2.22 Recognise of the structures of the human alimentary canal and describe in outline the functions of the mouth, oesophagus, stomach, small intestine, large intestine and pancreas.	
		B2.23 Understand the processes of ingestion, digestion, absorption, assimilation and egestion.	
		B2.24 Explain how and why food is moved through the gut by peristalsis.	

		B2.25 Understand the role of digestive enzymes, to include the digestion of starch to glucose by amylase and maltase, the digestion of proteins to amino acids by proteases and the digestion of lipids to fatty acids and glycerol by lipases.	
		B2.26 Recall that bile is produced by the liver and stored in the gall bladder, and understand the role of bile in neutralising stomach acid and emulsifying lipids	
		B2.27 Explain how the structure of a villus helps absorption of the products of digestion in the small intestine.	
	(f) Respiration	B2.28 Recall that the process of respiration releases energy in living organisms.	
		B2.29 Describe the differences between aerobic and anaerobic respiration.	
		B2.30 Recall the word equation and the balanced chemical symbol equation for aerobic respiration in living organisms.	
		B2.31 Recall the word equation for anaerobic respiration in plants and in animals.	
	(g) Gas exchange	B2.32 Understand the role of diffusion in gas exchange.	
		FLOWERING PLANTS	
		B2.33 Understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis.	
		B2.34 Explain how the structure of the leaf is adapted for gas exchange.	
		B2.35 Describe the role of stomata in gas exchange.	
		HUMANS	
		B2.36 Describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes.	
		B2.37 Understand the role of the intercostal muscles and the diaphragm in ventilation.	
		B2.38 Explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries.	
		B2.39 Understand the biological consequences of smoking in relation to the lungs and the circulatory system	• ***Alcohol and Tobacco***
		B2.40 Describe a simple experiment to	

		investigate the effect of exercise on breathing in humans.	
	(h) Transport	B2.41 Understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell.	
		B2.42 Understand the need for a transport system in multicellular organisms.	
		FLOWERING PLANTS	
		B2.43 Describe the role of the xylem in transporting water and mineral salts from the roots to other parts of the plant.	
		B2.44 Explain how water is absorbed by root hair cells	
		B2.45 Recall that transpiration is the evaporation of water from the surface of a plant.	
		B2.46 Explain how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity.	
		B2.47 Describe experiments that investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot.	
		HUMANS	
		B2.48 Recall the composition of the blood: red blood cells, white blood cells, platelets and plasma.	
		B2.49 Understand the role of plasma in the transport of carbon dioxide, digested food, urea, hormones and heat energy.	
		B2.50 Describe the adaptations of red blood cells for the transport of oxygen, including shape, structure and the presence of haemoglobin.	
		B2.51 Describe how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen.	• ***The Body's Defences***
		B2.52 Describe the structure of the heart and how it functions.	• ***Heart Disease***
		B2.53 Understand that the heart rate changes during exercise and under the influence of adrenaline.	
		B2.54 Describe the structure of arteries, veins and capillaries and understand their roles.	• ***Heart Disease***

		B2.55 Recall the general plan of the circulation system to include the blood vessels to and from the heart, the lungs, the liver and the kidneys.	
	(i) Excretion	**FLOWERING PLANTS**	
		B2.56 Recall the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf.	
		HUMANS	
		B2.57 Recall that the lungs, kidneys and skin are organs of excretion.	
		B2.58 Understand how the kidney carries out its roles of excretion and of osmoregulation.	• ***Controlling Water Content***
		B2.59 Describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra.	
		B2.60 Describe the structure of a nephron, to include Bowman's capsule and glomerulus, convoluted tubules, loop of Henlé and collecting duct.	
		B2.61 Describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate.	
		B2.62 Understand that water is reabsorbed into the blood from the collecting duct.	
		B2.63 Understand that selective reabsorption of glucose occurs at the proximal convoluted tubule.	
		B2.64 Describe the role of ADH in regulating the water content of the blood.	• ***Controlling Water Content***
		B2.65 Recall that urine contains water, urea and salts.	
	(j) Coordination and response	B2.66 Understand that organisms are able to respond to changes in their environment.	• ***Homeostasis*** • ***The Nervous System***
		B2.67 Understand that homeostasis is the maintenance of a constant internal environment and that body water content and body temperature are both examples of homeostasis.	• ***Homeostasis*** • ***Controlling Water Content***
		B2.68 Understand that a coordinated response requires a stimulus, a receptor and an effector.	• ***The Nervous System***
		FLOWERING PLANTS	
		B2.69 Understand that plants respond to stimuli.	• ***Plant Hormones***
		B2.70 Describe the geotropic responses of roots and stems.	• ***Plant Hormones***

		B2.71 Describe positive phototropism of stems.	• ***Plant Hormones***
		HUMANS	
		B2.72 Describe how responses can be controlled by nervous or by hormonal communication and understand the differences between the two systems.	• ***Homeostasis*** • ***The Nervous System***
		B2.73 Recall that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves.	• ***The Nervous System***
		B2.74 Understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and out of the central nervous system, resulting in rapid responses.	• ***The Nervous System***
		B2.75 Describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object.	• ***Reflex Reactions***
		B2.76 Describe the structure and function of the eye as a receptor.	• ***The Eye and Seeing***
		B2.77 Understand the sources, roles and effects of the following hormones: ADH, adrenaline, insulin, testosterone, progesterone and oestrogen.	• ***Controlling Water Content*** • ***Controlling Blood Sugar*** • ***Hormones and Fertility***
B3: Reproduction and inheritance	**(a) Reproduction**	B3.1 Describe the differences between sexual and asexual reproduction.	• ***Cloning***
		B3.2 Understand that fertilisation involves the fusion of a male and female gamete to produce a zygote that undergoes cell division and develops into an embryo.	• ***Cloning*** • ***Similarity and Variation***
		FLOWERING PLANTS	
		B3.3 Describe the structures of an insect-pollinated and a wind-pollinated flower and explain how each is adapted for pollination.	• ***Adaptation***
		B3.4 Understand that the growth of the pollen tube followed by fertilisation leads to seed and fruit formation.	
		B3.5 Understand that plants can reproduce asexually by natural methods (illustrated by runners) and by artificial methods (illustrated by cuttings).	• ***Cloning*** • ***Plant Hormones***
		HUMANS	
		B3.6 Recall the structure and function of the male and female reproductive systems.	
		B3.7 Understand the roles of oestrogen and progesterone in the menstrual cycle.	• ***Hormones and Fertility***

		B3.8 Recall the roles of oestrogen and testosterone in the development of secondary sexual characteristics.	
	(b) Inheritance	B3.9 Recall that the nucleus of a cell contains chromosomes on which genes are located.	• ***Similarity and Variation*** • ***Inheritance***
		B3.10 Understand that a gene is a section of a molecule of DNA.	• ***Similarity and Variation*** • ***Inheritance***
		B3.11 Describe a DNA molecule as two strands coiled to form a double helix, the strands being linked by a series of paired bases: adenine (A) with thymine (T), and cytosine (C) with guanine (G).	• ***Similarity and Variation***
		B3.12 Understand that genes exist in alternative forms called alleles which give rise to differences in inherited characteristics.	• ***Inheritance***
		B3.13 Recall the meaning of the terms dominant, recessive, homozygous, heterozygous, phenotype and genotype.	• ***Inheritance***
		B3.14 describe patterns of monohybrid inheritance using a genetic diagram	• ***Inheritance***
		B3.15 Understand how to interpret family pedigrees.	• ***Inheritance*** • ***Inherited Disorders***
		B3.16 Predict probabilities of outcomes from monohybrid crosses.	• ***Inheritance***
		B3.17 Recall that the sex of a person is controlled by one pair of chromosomes, XX in a female and XY in a male.	• ***Inheritance***
		B3.18 Describe the determination of the sex of offspring at fertilisation, using a genetic diagram.	• ***Inheritance***
		B3.19 Understand that division of a diploid cell by mitosis produces two cells which contain identical sets of chromosomes.	
		B3.20 Understand that mitosis occurs during growth, repair, cloning and asexual reproduction.	
		B3.21 Understand that division of a cell by meiosis produces four cells, each with half the number of chromosomes, and that this results in the formation of genetically different haploid gametes	
		B3.22 Understand that random fertilisation produces genetic variation of offspring.	• ***Similarity and Variation***
		B3.23 Recall that in human cells the diploid number of chromosomes is 46 and the haploid number is 23.	• ***Similarity and Variation*** • ***Inheritance***

		B3.24 Understand that variation within a species can be genetic, environmental, or a combination of both.	• ***Similarity and Variation***
		B3.25 Recall that mutation is a rare, random change in genetic material that can be inherited.	• ***Similarity and Variation*** • ***Evolution***
		B3.26 Describe the process of evolution by means of natural selection.	• ***Evolution***
		B3.27 Understand that many mutations are harmful but some are neutral and a few are beneficial.	• ***Similarity and Variation*** • ***Evolution***
		B3.28 Understand how resistance to antibiotics can increase in bacterial populations.	• ***Evolution***
B4: Ecology and the environment	**(a) The organism in the environment**	B4.1 Understand the terms population, community, habitat and ecosystem.	• ***Competition*** • ***Energy Transfers in Food Chains***
		B4.2 Recall the use of quadrats to estimate the population size of an organism in two different areas.	
		B4.3 Describe the use of quadrats as a technique for sampling the distribution of organisms in their habitats.	
	(b) Feeding relationships	B4.4 Recall the names given to different trophic levels to include producers, primary, secondary and tertiary consumers and decomposers.	• ***Energy Transfers in Food Chains***
		B4.5 Understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer.	• ***Energy Transfers in Food Chains***
		B4.6 Understand the transfer of substances and of energy along a food chain.	• ***Energy Transfers in Food Chains***
		B4.7 Explain why about only 10% of energy is transferred from one trophic level to the next.	• ***Energy Transfers in Food Chains***
	(c) Cycles within ecosystems	B4.8 Describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion.	• ***The Carbon Cycle***
	(d) Human influences on the environment	B4.9 Understand the biological consequences of pollution of air by sulfur dioxide and by carbon monoxide.	• ***Human Impact on the Environment*** • ***Changing the Atmosphere (Chemistry)***
		B4.10 Recall that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases.	• ***Human Impact on the Environment*** • ***Changing the Atmosphere (Chemistry)***
		B4.11 Understand how human activities contribute to greenhouse gases.	• ***Human Impact on the Environment*** • ***Changing the Atmosphere (Chemistry)***

		B4.12 Understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences.	• ***Human Impact on the Environment*** • ***Environmental Change and its Effects***
		B4.13 Understand that eutrophication can result from leached minerals from fertiliser.	• ***Human Impact on the Environment*** • ***Measuring Environmental Change***
		B4.14 Understand the effects of deforestation, including leaching, soil erosion, disturbance of the water cycle and of the balance in atmospheric oxygen and carbon dioxide.	• ***Human Impact on the Environment*** • ***Measuring Environmental Change*** • ***Sustainability***
B5: Uses of biological resources	**(a) Food production**	**CROP PLANTS**	
		B5.1 Describe how glasshouses and polythene tunnels can be used to increase the yield of certain crops.	
		B5.2 Understand the effects on crop yield of increased carbon dioxide and increased temperature in glasshouses.	
		B5.3 Understand the use of fertiliser to increase crop yield.	
		B5.4 Understand the reasons for pest control and the advantages and disadvantages of using pesticides and biological control with crop plants.	
		MICROORGANISMS	
		B5.5 Understand the role of yeast in the production of beer.	
		B5.6 Describe a simple experiment to investigate carbon dioxide production by yeast, in different conditions.	
		B5.7 Interpret and label a diagram of an industrial fermenter and explain the need to provide suitable conditions in the fermenter, including aseptic precautions, nutrients, optimum temperature and pH, oxygenation and agitation, for the growth of microorganisms.	
		FISH FARMING	
		B5.8 Explain the methods which are used to farm large numbers of fish to provide a source of protein, including maintenance of water quality, control of intraspecific and interspecific predation, control of disease, removal of waste products, quality and frequency of feeding and the use of selective breeding.	

	(b) Selective breeding	B5.9 Understand that plants with desired characteristics can be developed by selective breeding.	• ***Genetic Engineering***
		B5.10 Understand that animals with desired characteristics can be developed by selective breeding.	• ***Genetic Engineering***
	(c) Genetic modification	B5.11 Describe the use of restriction enzymes to cut DNA at specific sites and ligase enzymes to join pieces of DNA together.	
		B5.12 Describe how plasmids and viruses can act as vectors, which take up pieces of DNA, then insert this recombinant DNA into other cells.	• ***Genetic Engineering***
		B5.13 Understand that large amounts of human insulin can be manufactured from genetically modified bacteria that are grown in a fermenter.	• ***Genetic Engineering***
		B5.14 Evaluate the potential for using genetically modified plants to improve food production (illustrated by plants with improved resistance to pests).	• ***Genetic Engineering***
	(d) Cloning	B5.15 Describe the process of micropropagation (tissue culture) in which small pieces of plants (explants) are grown *in vitro* using nutrient media.	• ***Cloning*** • ***Plant Hormones***
		B5.16 Understand how micropropagation can be used to produce commercial quantities of identical plants (clones) with desirable characteristics.	
		B5.17 Describe the stages in the production of cloned mammals involving the introduction of a diploid nucleus from a mature cell into an enucleated egg cell, illustrated by Dolly the sheep.	• ***Cloning***

Edexcel IGCSE Science (Double Award)

	Chemistry		
	Subsection	**Syllabus point**	**Presentations**
C1: Principles of chemistry	**(a) States of matter**	C1.1 Understand the arrangement, movement and energy of the particles in each of the three states of matter: solid, liquid and gas.	
		C1.2 Describe how the interconversion of solids, liquids and gases are achieved and recall the names used for these interconversions.	
		C1.3 Describe the changes in arrangement, movement and energy of particles during these interconversions.	
	(b) Atoms	C1.4 Describe simple experiments leading to the idea of the small size of particles and their movement including: i dilution of coloured solutions ii diffusion experiments.	
		C1.5 Understand the terms atom and molecule.	• ***Introducing Atoms***
		C1.6 Understand the differences between elements, compounds and mixtures.	• ***Introducing Atoms***
		C1.6 Describe techniques for the separation of mixtures, including simple distillation, fractional distillation, filtration, crystallisation and paper chromatography.	• ***Fractional Distillation*** • ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***
	(c) Atomic structure	C1.7 Recall that atoms consist of a central nucleus, composed of protons and neutrons, surrounded by electrons, orbiting in shells.	• ***Introducing Atoms***
		C1.8 Recall the relative mass and relative charge of a proton, neutron and electron.	• ***Introducing Atoms***
		C1.9 Understand the terms atomic number, mass number, isotopes and relative atomic mass (A_r).	• ***Introducing Atoms***
		C1.10 Calculate the relative atomic mass of an element from the relative abundances of its isotopes.	
		C1.11 Understand that the Periodic Table is an arrangement of elements in order of atomic number.	• ***Introducing Atoms***
		C1.12 Deduce the electronic configurations of the first 20 elements from their positions in the Periodic Table.	• ***Introducing Atoms***

		C1.13 Deduce the number of outer electrons in a main group element from its position in the Periodic Table.	• ***Introducing Atoms***
	(d) Relative formula masses and molar volumes	C1.14 Calculate relative formula masses (M_r) from relative atomic masses (A_r).	
		C1.15 Understand the use of the term mole to represent the amount of substance.	
		C1.16 Carry out mole calculations using relative atomic mass (A_r) and relative formula mass (M_r).	
	(e) Chemical formulae and chemical equations	C1.17 Write word equations and balanced chemical equations to represent the reactions studied in this specification.	• ***Chemical Reactions***
		C1.18 Use the state symbols (s), (l), (g) and (aq) in chemical equations to represent solids, liquids, gases and aqueous solutions respectively.	• ***Chemical Reactions***
		C1.19 Understand how the formulae of simple compounds can be obtained experimentally, including metal oxides, water and salts containing water of crystallisation.	• ***Chemical Reactions***
		C1.20 Calculate empirical and molecular formulae from experimental data.	
		C1.21 Calculate reacting masses using experimental data and chemical equations.	
		C1.22 Carry out mole calculations using volumes and molar concentrations.	
	(f) Ionic compounds	C1.23 Describe the formation of ions by the gain or loss of electrons.	• ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***
		C1.24 Understand oxidation as the loss of electrons and reduction as the gain of electrons.	• ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***
		C1.25 Recall the charges of common ions in this specification.	
		C1.26 Deduce the charge of an ion from the electronic configuration of the atom from which the ion is formed.	• ***Introducing Atoms***
		C1.27 Explain, using dot and cross diagrams, the formation of ionic compounds by electron transfer, limited to combinations of elements from Groups 1, 2, 3, and 5, 6, 7.	
		C1.28 Understand ionic bonding as a strong electrostatic attraction between oppositely charged ions.	

		C1.29 Understand that ionic compounds have high melting and boiling points because of strong electrostatic forces between oppositely charged ions.	
	(g) Covalent substances	C1.30 Describe the formation of a covalent bond by the sharing of a pair of electrons between two atoms.	
		C1.31 Understand covalent bonding as a strong attraction between the bonding pair of electrons and the nuclei of the atoms involved in the bond.	
		C1.32 Explain, using dot and cross diagrams, the formation of covalent compounds by electron sharing for the following substances: i hydrogen ii chlorine iii hydrogen chloride iv water v methane vi ammonia vii oxygen viii nitrogen ix carbon dioxide x ethane xi ethane.	
		C1.33 Recall that substances with simple molecular structures are gases or liquids, or solids with low melting points.	
		C1.34 Explain why substances with simple molecular structures have low melting points in terms of the relatively weak forces between the molecules.	
		C1.35 Explain the high melting points of substances with giant covalent structures in terms of the breaking of many strong covalent bonds.	
	(h) Metallic crystals	C1.36 Describe a metal as a giant structure of positive ions surrounded by a sea of delocalised electrons.	
		C1.37 Explain the malleability and electrical conductivity of a metal in terms of its structure and bonding.	
	(i) Electrolysis	C1.38 Understand an electric current as a flow of electrons or ions.	
		C1.39 Understand why covalent compounds do not conduct electricity.	
		C1.40 Understand why ionic compounds conduct electricity only when molten or in solution.	• ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***

		C1.41 Describe simple experiments to distinguish between electrolytes and non-electrolytes.	
		C1.42 Recall that electrolysis involves the formation of new substances when ionic compounds conduct electricity.	• ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***
		C1.43 Describe simple experiments for the electrolysis, using inert electrodes, of molten salts such as lead (II) bromide.	• ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***
		C1.44 Write ionic half-equations representing the reactions at the electrodes during electrolysis.	• ***Extracting Metals by Electrolysis*** • ***Electrolysis of Solutions***
C2: Chemistry of the elements	**(a) The Periodic Table**	C2.1 Understand the terms group and period.	
		C2.2 Recall the positions of metals and non-metals in the Periodic Table.	• ***Properties of Metals***
		C2.3 Explain the classification of elements as metals or non-metals on the basis of their electrical conductivity and the acid-base character of their oxides.	
		C2.4 Understand why elements in the same group of the Periodic Table have similar chemical properties.	• ***Introducing Atoms***
		C2.5 Recall the noble gases (Group 0) as a family of inert gases and explain their lack of reactivity in terms of their electronic configurations.	• ***Introducing Atoms***
	(b) The Group 1 elements – lithium, sodium and potassium	C2.6 Describe the reactions of these elements with water and understand that the reactions provide a basis for their recognition as a family of elements.	• ***Acids and Alkalis***
		C2.7 Recall the relative reactivities of the elements in Group 1.	
	(c) The Group 7 elements – chlorine, bromine and iodine	C2.8 Recall the colours and physical states of the elements at room temperature.	
		C2.9 Make predictions about the properties of other halogens in this group.	
		C2.10 Understand the difference between hydrogen chloride gas and hydrochloric acid.	
		C2.11Explain, in terms of dissociation, why hydrogen chloride is acidic in water but not in methylbenzene.	
		C2.12 Recall the relative reactivities of the elements in Group 7.	
		C2.13 Describe experiments to show that a more reactive halogen will displace a less	

		reactive halogen from a solution of one of its salts.	
		C2.14 Understand these displacement reactions as redox reactions.	
	(d) Oxygen and oxides	C2.15 Recall the gases present in air and their approximate percentage by volume.	• ***Earth's atmosphere***
		C2.16 Describe how experiments involving the reactions of elements such as copper, iron and phosphorus with air can be used to determine the percentage by volume of oxygen in air.	
		C2.17 Describe the laboratory preparation of oxygen from hydrogen peroxide.	
		C2.18 Describe the reactions with oxygen in air of magnesium, carbon and sulfur, and the acid-base character of the oxides produced.	
		C2.19 Describe the laboratory preparation of carbon dioxide from calcium carbonate and dilute hydrochloric acid.	
		C2.20 Describe the formation of carbon dioxide from the thermal decomposition of metal carbonates such as copper (II) carbonate.	• ***Calcium Carbonate***
		C2.21 Recall the properties of carbon dioxide, limited to its solubility and density.	
		C2.22 Explain the use of carbon dioxide in carbonating drinks and in fire extinguishers, in terms of its solubility and density.	
		C2.23 Recall the reactions of carbon dioxide and sulfur dioxide with water to produce acidic solutions.	
		C2.24 Recall that sulfur dioxide and nitrogen oxides are pollutant gases which contribute to acid rain, and describe the problems caused by acid rain.	• ***Fossil Fuels and the Environment*** • ***Reducing Pollution***
	(e) Hydrogen and water	C2.25 Describe the reactions of dilute hydrochloric and dilute sulfuric acids with magnesium, aluminium, zinc and iron.	
		C2.26 Describe the combustion of hydrogen.	
		C2.27 Describe the use of anhydrous copper (II) sulfate in the chemical test for water.	• ***Combustion***
		C2.28 Describe a physical test to show whether water is pure.	

	(f) Reactivity series	C2.29 Recall that metals can be arranged in a reactivity series based on the reactions of the metals and their compounds: potassium, sodium, lithium, calcium, magnesium, aluminium, zinc, iron, copper, silver and gold.	• ***Extracting Metals by Reduction*** • ***Extracting Metals by Electrolysis***
		C2.30 Describe how reactions with water and dilute acids can be used to deduce the following order of reactivity: potassium, sodium, lithium, calcium, magnesium, zinc, iron, and copper.	• ***Extracting Metals by Reduction*** • ***Extracting Metals by Electrolysis***
		C2.31 Deduce the position of a metal within the reactivity series using displacement reactions between metals and their oxides, and between metals and their salts in aqueous solutions.	• ***Extracting Metals by Reduction*** • ***Extracting Metals by Electrolysis***
		C2.32 Understand oxidation and reduction as the addition and removal of oxygen respectively.	• ***Extracting Metals by Reduction*** • ***Extracting Metals by Electrolysis***
		C2.33 Understand the terms redox, oxidising agent and reducing agent.	
		C2.34 Recall the conditions under which iron rusts.	• ***Properties of Metals***
		C2.35 Describe how the rusting of iron may be prevented by grease, oil, paint, plastic and galvanising.	
		C2.36 Understand the sacrificial protection of iron in terms of the reactivity series.	
	(g) Tests for ions and gases	C2.37 Describe simple tests for the cations: i Li^+, Na^+, K^+, Ca^{2+} using flame tests ii NH_{4+} using sodium hydroxide solution and identifying the ammonia evolved iii Cu^{2+}, Fe^{2+} and Fe^{3+} using sodium hydroxide solution.	
		C2.38 Describe simple tests for the anions: i Cl^-, Br^- and I^- using dilute nitric acid and silver nitrate solution ii SO_4^{2-} using dilute hydrochloric acid and barium chloride solution iii CO_3^{2-} using dilute hydrochloric acid and identifying the carbon dioxide evolved.	
		C2.39 describe simple tests for the gases: i hydrogen ii oxygen iii carbon dioxide iv ammonia v chlorine.	• ***Chemical reactions***

C3: Organic chemistry	**(a) Introduction**	C3.1 Explain the terms homologous series, hydrocarbon, saturated, unsaturated, general formula and isomerism.	• ***Cracking Hydrocarbons*** • ***Plant Oils***
	(b) Alkanes	C3.2 Recall that alkanes have the general formula C_nH_{2n+2}.	• ***Cracking Hydrocarbons*** • ***Hydrocarbon Fuels***
		C3.3 Draw displayed formulae for alkanes with up to five carbon atoms in a molecule, and name the straight-chain isomers.	• ***Cracking Hydrocarbons*** • ***Hydrocarbon Fuels***
		C3.4 Recall the products of the complete and incomplete combustion of alkanes.	• ***Combustion*** • ***Incomplete Combustion***
		C3.5 Recall the reaction of methane with bromine to form bromomethane in the presence of UV light.	
	(c) Alkenes	C3.6 Recall that alkenes have the general formula C_nH_{2n}.	• ***Cracking Hydrocarbons*** • ***Hydrocarbon Fuels***
		C3.7 Draw displayed formulae for alkenes with up to four carbon atoms in a molecule, and name the straight-chain isomers.	• ***Cracking Hydrocarbons*** • ***Hydrocarbon Fuels***
		C3.8 Describe the addition reaction of alkenes with bromine, including the decolorising of bromine water as a test for alkenes.	• ***Cracking Hydrocarbons*** • ***Plant Oils***
C4: Physical chemistry	**(a) Acids, alkalis and salts**	C4.1 Describe the use of the indicators litmus, phenolphthalein and methyl orange to distinguish between acidic and alkaline solutions.	
		C4.2 Understand how the pH scale, from 0-14, can be used to classify solutions as strongly acidic, weakly acidic, neutral, weakly alkaline or strongly alkaline.	• ***Acids and Alkalis***
		C4.3 Describe the use of universal indicator to measure the approximate pH value of a solution.	• ***Acids and Alkalis***
		C4.4 Define acids as sources of hydrogen ions, H^+, and alkalis as sources of hydroxide ions, OH^-.	
		C4.5 Predict the products of reactions between dilute hydrochloric, nitric and sulfuric acids; and metals, metal oxides and metal carbonates (excluding the reactions between nitric acid and metals).	• ***Chemical Reactions***

		C4.6 Recall the general rules for predicting the solubility of salts in water: i all common sodium, potassium and ammonium salts are soluble ii all nitrates are soluble iii common chlorides are soluble, except silver chloride iv common sulfates are soluble, except those of barium and calcium v common carbonates are insoluble, except those of sodium, potassium and ammonium.	
		C4.7 Describe how to prepare soluble salts from acids.	• ***Acids and Alkalis***
		C4.8 Describe how to prepare insoluble salts using precipitation reactions.	• ***Acids and Alkalis***
		C4.9 Describe how to carry out acid-alkali titrations.	○ ***Acids and Alkalis***
	(b) Energetics	C4.10 Recall that chemical reactions in which heat energy is given out are described as exothermic and those in which heat energy is taken in are endothermic.	
		C4.11 Describe simple calorimetry experiments for reactions such as combustion, displacement, dissolving and neutralisation in which heat energy changes can be calculated from measured temperature changes.	
		C4.12 Understand the use of ΔH to represent molar enthalpy change for exothermic and endothermic reactions.	
		C4.13 Represent exothermic and endothermic reactions on a simple energy level diagram.	
		C4.14 Recall that the breaking of bonds is endothermic and that the making of bonds is exothermic.	
	(c) Rates of reaction	C4.15 Describe experiments to investigate the effects of changes in surface area of a solid, concentration of solutions, temperature and the use of a catalyst on the rate of a reaction.	
		C4.16 Describe the effects of changes in surface area of a solid, concentration of solutions, pressure of gases, temperature and the use of a catalyst on the rate of a reaction.	
		C4.17 Understand the term activation energy and represent it on a reaction profile.	

		C4.18 Explain the effects of changes in surface area of a solid, concentration of solutions, pressure of gases and temperature on the rate of a reaction in terms of particle collision theory.	
		C4.19 Understand that a catalyst speeds up a reaction by providing an alternative pathway with lower activation energy.	
	(d) Equilibria	C4.20 Recall that some reactions are reversible and are indicated by the symbol ⇌ in equations.	
		C4.21 Describe reversible reactions such as the dehydration of hydrated copper (II) sulfate and the effect of heat on ammonium chloride.	
		C4.22 Understand the concept of dynamic equilibrium.	
		C4.23 Predict the effects of changing the pressure and temperature on the equilibrium position in reversible reactions.	
C5: Chemistry in society	**(a) Extraction and uses of metals**	C5.1 Explain how the methods of extraction of the metals in this section are related to their positions in the reactivity series.	• ***Extracting Metals by Reduction*** • ***Extracting Metals by Electrolysis***
		C5.2 Describe and explain the extraction of aluminium from purified aluminium oxide by electrolysis, including: i the use of molten cryolite as a solvent and to decrease the required operating temperature ii the need to replace the positive electrodes iii the cost of the electricity as a major factor.	• ***Extracting Metals by Electrolysis***
		C5.3 Write ionic half-equations for the reactions at the electrodes in aluminium extraction.	• ***Extracting Metals by Reduction*** • ***Extracting Metals by Electrolysis***
		C5.4 Describe and explain the main reactions involved in the extraction of iron from iron ore (haematite), using coke, limestone and air in a blast furnace.	• ***Extracting Metals by Reduction***
		C5.5 Explain the uses of aluminium and iron, in terms of their properties.	• ***Properties of Metals*** • ***Alloys***
	(b) Natural oil and gas	C5.6 Recall that crude oil is a mixture of hydrocarbons.	• ***Crude Oil*** • ***Hydrocarbon Fuels***
		C5.7 Describe how the industrial process of fractional distillation separates crude oil into fractions.	• ***Fractional Distillation***

		C5.8 Recall the names and uses of the main fractions obtained from crude oil: refinery gases, gasoline, kerosene, diesel, fuel oil and bitumen.	• ***Fractional Distillation***
		C5.9 Describe the trend in boiling point and viscosity of the main fractions.	• ***Fractional Distillation***
		C5.10 Recall that incomplete combustion of fuels may produce carbon monoxide and explain that carbon monoxide is poisonous because it reduces the capacity of the blood to carry oxygen.	• ***Incomplete Combustion***
		C5.11 Recall that, in car engines, the temperature reached is high enough to allow nitrogen and oxygen from air to react, forming nitrogen oxides.	• ***Reducing Pollution***
		C5.12 Recall that fractional distillation of crude oil produces more long-chain hydrocarbons than can be used directly and fewer short-chain hydrocarbons than required.	• ***Fractional Distillation*** • ***Hydrocarbon Fuels*** • ***Cracking Hydrocarbons***
		C5.13 Describe how long-chain alkanes are converted to alkenes and shorter-chain alkanes by catalytic cracking, using silica or alumina as the catalyst and a temperature in the range of 600-700 °C.	• ***Hydrocarbon Fuels*** • ***Cracking Hydrocarbons***
	(c) Synthetic polymers	C5.14 Recall that an addition polymer is formed by joining up many small molecules called monomers.	• ***Making Polymers***
		C5.15 Draw the repeat unit of addition polymers, including poly(ethene), poly(propene) and poly(chloroethene).	• ***Making Polymers***
		C5.16 Deduce the structure of a monomer from the repeat unit of an addition polymer.	• ***Making Polymers***
	(d) The manufacture of some important chemicals	C5.17 Recall that nitrogen from air, and hydrogen from natural gas or the cracking of hydrocarbons, are used in the manufacture of ammonia.	
		C5.18 Describe the manufacture of ammonia by the Haber process, including the essential conditions: i a temperature of about 450 °C ii a pressure of about 200 atmospheres iii an iron catalyst.	
		C5.19 Understand how the cooling of the reaction mixture liquefies the ammonia produced and allows the unused hydrogen and nitrogen to be re-circulated.	
		C5.20 Recall the use of ammonia in the manufacture of nitric acid and fertilisers.	

Edexcel IGCSE Science (Double Award)

	Physics		
	Subsection	**Syllabus point**	**Presentations**
P1: Forces and motion	**(a) Units**	P1.1 Use the following units: kilogram (kg), metre (m), metre/second (m/s), metre/second^2 (m/s^2), newton (N), second (s), newton per kilogram (N/kg).	
	(b) Movement and position	P1.2 Understand and use distance-time graphs.	
		P1.3 Recall and use the relationship between average speed, distance moved and time: $\text{average speed} = \frac{\text{distance moved}}{\text{time taken}}$	
		P1.4 Recall and use the relationship between acceleration, velocity and time $\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$ $a = \frac{(v - u)}{t}$	
		P1.5 Interpret velocity–time graphs.	
		P1.6 Determine acceleration from the gradient of a velocity-time graph.	
		P1.7 Determine the distance travelled from the area between a velocity-time graph and the time axis.	
	(c) Forces, movement and shape	P1.8 Express a force as a push or pull of one body on another.	
		P1.9 Identify various types of force (e.g. gravitational, electrostatic, etc.).	
		P1.10 Understand that friction is a force that opposes motion.	
		P1.11 Recall and use the relationship between unbalanced force, mass and acceleration: force = mass × acceleration F = m × a	
		P1.12 Recall and use the relationship between weight, mass and g: weight = mass × g $W = m \times g$	
		P1.13 Describe the forces acting on falling objects and explain why falling objects reach a terminal velocity.	

		P1.14 Describe the factors affecting vehicle stopping distance including speed, mass, road condition and reaction time.	
		P1.15 Recall and use the relationship between the moment of a force and its distance from the pivot: moment = force × perpendicular distance from pivot.	
		P1.16 Recall that the weight of a body acts through its centre of gravity.	
		P1.17 Describe how extension varies with applied force for helical springs, metal wires and rubber bands.	
		P1.18 Recall that the initial linear region of a force-extension graph is associated with Hooke's law.	
		P1.19 Associate elastic behaviour with the ability of a material to recover its original shape after the forces causing deformation have been removed.	
	(c) Astronomy	P1.20 Recall that the moon orbits the Earth and that some planets also have moons.	• ***The Solar System***
		P1.21 Understand gravitational field strength, g, and recall that it is different on other planets and the moon from that on the Earth.	• ***The Solar System***
		P1.22 Explain that gravitational force: – causes the planets to orbit the sun – causes the moon and artificial satellites to orbit the earth – causes comets to orbit the sun.	• ***The Solar System***
		P1.23 Use the relationship between orbital speed, orbital radius and time period: orbital speed = $\frac{2 \times \pi \times \text{orbital radius}}{\text{time period}}$ $v = \frac{2 \times \pi \times r}{T}$	
		P1.24 Describe how the orbit of a comet differs from that of a planet.	• ***Asteroids and Comets***
		P1.25 Recall that the solar system is part of the Milky Way galaxy: – describe a galaxy as a large collection of billions of stars – state that the universe is a large collection of billions of galaxies.	• ***The Universe***

P2: Electricity and electromagnetism	**(a) Units**	P2.1 Use the following units: ampere (A), coulomb (C), joule (J), ohm (Ω), second (s), volt (V), watt (W).	• ***Using Electricity***
	(b) Mains electricity	P2.2 Recall the hazards of electricity including frayed cables, long cables, damaged plugs, water around sockets, and pushing metal objects into sockets.	
		P2.3 Describe the uses of insulation, double insulation, earthing, fuses and circuit breakers in a range of domestic appliances.	
		P2.4 Know some of the different ways in which electrical heating is used in a variety of domestic contexts.	
		P2.5 Understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature.	
		P2.6 Recall and use the relationship: power = current × voltage $P = I \times V$ and apply the relationship to the selection of appropriate fuses.	• ***Using Electricity***
		P2.7 Use the relationship between energy transferred, current, voltage and time: energy transferred = current × voltage × time $E = I \times V \times t$	• ***Using Electricity***
		P2.8 Recall that mains electricity is alternating current (a.c.) and understand the difference between this and the direct current (d.c.) supplied by a cell or battery.	• ***Electricity Distribution***
	(c) Energy and potential difference in circuits	P2.9 Explain why a series or parallel circuit is more appropriate for particular applications, including domestic lighting.	
		P2.10 Understand that the current in a series circuit depends on the applied voltage and the number and nature of other components.	
		P2.11 Describe how current varies with voltage in wires, resistors, metal filament lamps and diodes, and how this can be investigated experimentally.	
		P2.12 Describe the qualitative effect of changing resistance on the current in a circuit.	
		P2.13 Describe the qualitative variation of resistance of LDRs with illumination and of thermistors with temperature.	
		P2.14 Know that lamps and LEDs can be used to indicate the presence of a current in	

		a circuit.	
		P2.15 Recall and use the relationship between voltage, current and resistance: voltage = current × resistance $V = I \times R$.	
		P2.16 Understand that current is the rate of flow of charge.	
		P2.17 Recall and use the relationship between charge, current and time: charge = current × time $Q = I \times t$	
		P2.18 Identify common materials which are electrical conductors or insulators, including metals and plastics.	
		P2.19 Recall that electric current in solid metallic conductors is a flow of negatively charged electrons.	
P3: Waves	**(a) Units**	P3.1 Use the following units: degree (°), hertz (Hz), metre (m), metre/second (m/s), second (s).	• ***Wave Properties***
	(b) Properties of waves	P3.2 Describe longitudinal and transverse waves in ropes, springs and water where appropriate.	• ***Wave Properties***
		P3.3 State the meaning of amplitude, frequency, wavelength and period of a wave.	• ***Wave Properties***
		P3.4 Recall that waves transfer energy and information without transferring matter.	• ***Wave Properties***
		P3.5 Recall and use the relationship between the speed, frequency and wavelength of a wave: wave speed = frequency × wavelength $v = f \times \lambda$	• ***Wave Properties***
		P3.6 Use the relationship between frequency and time period: $\text{frequency} = \frac{1}{\text{time period}}$ $f = \frac{1}{T}$	
		P3.7 Use the above relationships in different contexts including sound waves and electromagnetic waves	
	(c) The electromagnetic spectrum	P3.8 Understand that light is part of a continuous electromagnetic spectrum which includes radio, microwave, infra-red,	• ***The Electromagnetic Spectrum***

		visible, ultraviolet, X-ray and gamma ray radiations and that all these waves travel at the same speed in free space.	
		P3.9 Recall the order of the electromagnetic spectrum in decreasing wavelength and increasing frequency, including the colours of the visible spectrum.	• ***The Electromagnetic Spectrum***
		P3.10 Recall some of the uses of electromagnetic radiations, including • radio waves: broadcasting and communications • microwaves: cooking and satellite transmissions • infra-red: heaters and night-vision equipment • visible light: optical fibres and photography • ultraviolet: fluorescent lamps • X-rays: observing the internal structure of objects and materials and medical applications • gamma rays: sterilising food and medical equipment.	• ***The Electromagnetic Spectrum*** • ***Communicating with Radio waves and Microwaves*** • ***Heating with Microwaves and Infrared*** • ***Communicating with Visible Light and Infrared*** • ***Ultraviolet Radiation*** • ***Ionizing Radiation*** • ***Radioactivity***
		P3.11 Recall the detrimental effects of excessive exposure of the human body to electromagnetic waves, including • microwaves : internal heating of body tissue • infra-red : skin burns • ultraviolet : damage to surface cells and blindness • gamma rays : cancer, mutation.	• ***Heating with Microwaves and Infrared*** • ***Ultraviolet Radiation*** • ***Ionizing Radiation*** • ***Radioactivity***
	(d) Light and sound	P3.12 Recall that light waves are transverse waves which can be reflected and refracted.	• ***Wave Properties*** • ***Reflection, Refraction and Diffraction***
		P3.13 Recall that the angle of incidence equals the angle of reflection.	• ***Reflection, Refraction and Diffraction***
		P3.14 Construct ray diagrams to illustrate the formation of a virtual image in a plane mirror.	• ***Reflection, Refraction and Diffraction***
		P3.15 Describe experiments to investigate the refraction of light, using rectangular blocks, semicircular blocks and triangular prisms.	• ***Reflection, Refraction and Diffraction***
		P3.16 Recall and use the relationship between refractive index, angle of incidence and angle of refraction $n = \frac{\sin i}{\sin r}$	
		P3.17 Describe an experiment to determine the refractive index of glass, using a glass block.	

		P3.18 Describe the role of total internal reflection in transmitting information along optical fibres and in prisms.	• ***Communicating with Visible Light and Infrared***
		P3.19 Recall the meaning of critical angle c.	• ***Communicating with Visible Light and Infrared***
		P3.20 Recall and use the relationship between critical angle and refractive index $\sin c = \frac{1}{n}$	
		P3.21 Recall that sound waves are longitudinal waves which can be reflected.	• ***Wave Properties***
		P3.22 Recall that the frequency range for human hearing is 20 Hz – 20 000 Hz.	
		P3.23 Describe how to measure the speed of sound in air.	• ***Wave Properties***
P4: Energy resources and energy transfer	**(a) Units**	P41. Use the following units: kilogram (kg), joule (J), metre (m), metre/second (m/s), metre/second^2 (m/s^2), newton (N), second (s), watt (W).	• ***Energy Transformations*** • ***Using Electricity***
	(b) Energy transfer	P4.2 Describe energy transfers involving the following forms of energy: thermal (heat), light, electrical, sound, kinetic, chemical, nuclear and potential (elastic and gravitational).	• ***Energy Transformations***
		P4.3 Understand that energy is conserved.	• ***Energy Transformations***
		P4.4 Recall and use the relationship: efficiency = $\frac{\text{useful energy output}}{\text{total energy output}}$	• ***Energy Transformations***
		P4.5 Describe a variety of everyday and scientific devices and situations, explaining the fate of the input energy in terms of the above relationship, including their representation by Sankey diagrams.	• ***Energy Transformations***
		P4.6 Recall that energy transfer may take place by conduction, convection and radiation.	• ***Particles and Energy Transfer***
		P4.7 Describe the role of convection in everyday phenomena.	• ***Particles and Energy Transfer*** • ***Insulation***
		P4.8 Describe how insulation is used to reduce energy transfers from buildings and the human body.	• ***Insulation***
	(c) Work and power	P4.9 Recall and use the relationship between work, force and distance moved work done = force × distance moved in the direction of the force $W = F \times d$	

		P4.10 Understand that work done is equal to energy transferred.	
		P4.11 Recall and use the relationship: gravitational potential energy = mass × g × height GPE = m × g × h	
		P4.12 Recall and use the relationship: kinetic energy = ½ × mass × speed^2 KE = ½ × m × v^2	
		P4.13 Understand how conservation of energy produces a link between potential energy, kinetic energy and work.	
		P4.14 Describe power as the rate of transfer of energy or the rate of doing work.	• ***Using Electricity***
		P4.15 Use the relationship between power, work done (energy transferred) and time taken: power = work done / time taken $P = \frac{W}{t}$	• ***Using Electricity***
	(d) Energy resources and electricity generation	P4.16 Understand the energy transfers involved in generating electricity using: • wind • water • geothermal resources • solar heating systems • solar cells • fossil fuels • nuclear power.	• ***Power Stations*** • ***Energy from the Sun*** • ***Energy Resources***
P5: Solids, liquids and gases	**(a) Units**	P5.1 Use the following units: degrees Celsius (°C), joule (J), kelvin (K), kilogram (kg), kilogram/metre^3 (kg/m^3), metre (m), metre^2 (m^2), metre^3 (m^3), metre/second (m/s), metre/second^2 (m/s^2), newton (N), pascal (Pa).	• ***Thermal Radiation***
	(b) Density and pressure	P5.2 Recall and use the relationship between density, mass and volume: density = mass / volume $\rho = \frac{m}{V}$	
		P5.3 Describe how to determine density using direct measurements of mass and volume.	

		P5.4 Recall and use the relationship between pressure, force and area: pressure = $\frac{\text{force}}{\text{area}}$ $p = \frac{F}{A}$	
		P5.5 Understand that the pressure at a point in a gas or liquid which is at rest acts equally in all directions.	
		P5.6 Recall and use the relationship for pressure difference: pressure difference = height × density × g $p = h \times \rho \times g$	
	(c) Ideal gas molecules	P5.7 Understand the significance of Brownian motion.	
		P5.8 Recall that molecules in a gas have a random motion and that they exert a force and hence a pressure on the walls of the container.	
		P5.9 Understand that there is an absolute zero of temperature which is – 273 °C.	
		P5.10 Describe the kelvin scale of temperature and be able to convert between the Kelvin and Celsius scales.	
		P5.11 Understand that an increase in temperature results in an increase in the speed of gas molecules.	
		P5.12 Describe the qualitative relationship between pressure and Kelvin temperature for a gas in a sealed container.	
		P5.13 Use the relationship between pressure and volume of a fixed mass of gas at constant temperature: $p_1V_1 = p_2V_2$	
P6: Magnetism and Electromagnetism	**(a) Units**	P6.1 Use the following units: ampere (A), volt (V), watt (W).	• ***Using Electricity***
	(b) Magnetism	P6.2 Understand the term 'magnetic field line'.	
		P6.3 Sketch and recognise the magnetic field pattern for a permanent bar magnet and that between two bar magnets.	
		P6.4 Know how to use two permanent magnets to produce a uniform magnetic field pattern.	
	(c) Electromagnetism	P6.5 Recall that an electric current in a conductor produces a magnetic field round it.	

		P6.6 Recall that a force is exerted on a current-carrying wire in a magnetic field, and how this effect is applied in simple d.c. electric motors and loudspeakers.	
		P6.7 Use the left hand rule to predict the direction of the resulting force when a wire carries a current perpendicular to a magnetic field.	
		P6.8 Recall that the force on a current-carrying conductor in a magnetic field increases with the strength of the field and with the current.	
	(d) Electromagnetic induction	P6.9 Recall that a voltage is induced in a conductor or a coil when it moves through a magnetic field or when a magnetic field changes through it; also recall the factors which affect the size of the induced voltage.	• ***Generators***
		P6.10 Describe the generation of electricity by the rotation of a magnet within a coil of wire and of a coil of wire within a magnetic field; also describe the factors which affect the size of the induced voltage.	• ***Generators***
P7: Radioactivity and particles	**(a) Units**	P7.1 Use the following units: becquerel (Bq), centimetre (cm), hour (h), minute (min), second(s).	
	(b) Radioactivity	P7.2 Describe the structure of an atom in terms of protons, neutrons and electrons and use symbols such as $^{14}_{6}C$ to describe particular nuclei.	• ***Radioactivity*** • ***Introducing Atoms (Chemistry)***
		P7.3 Understand the terms atomic (proton) number, mass (nucleon) number and isotope.	• ***Introducing Atoms (Chemistry)***
		P7.4 Understand that alpha and beta particles and gamma rays are ionising radiations emitted from unstable nuclei in a random process.	• ***Radioactivity***
		P7.5 Describe the nature of alpha and beta particles and gamma rays and recall that they may be distinguished in terms of penetrating power.	• ***Radioactivity***
		P7.6 Describe the effects on the atomic and mass numbers of a nucleus of the emission of each of the three main types of radiation.	• ***Radioactivity***
		P7.7 Understand how to complete balanced nuclear equations.	
		P7.8 Understand that ionising radiations can be detected using a photographic film or a Geiger-Muller detector.	• ***Radioactivity***

		P7.9 Recall the sources of background radiation.	• ***Radioactivity***
		P7.10 Understand that the activity of a radioactive source decreases over a period of time and is measured in becquerels.	
		P7.11 recall the term 'half-life' and understand that it is different for different radioactive isotopes.	
		P7.12 Use the concept of half-life to carry out simple calculations on activity.	
		P7.13 Describe the uses of radioactivity in medical and non-medical tracers, in radiotherapy and in the radioactive dating of archaeological specimens and rocks.	• ***Radioactivity***
		P7.14 Describe the dangers of ionising radiations, including • radiation can cause mutations in living organisms • radiation can damage cells and tissue • the problems arising in the disposal of radioactive waste.	• ***Radioactivity*** • ***Ionizing Radiation***
	(c) Particles	P7.15 Describe the results of Geiger and Marsden's experiments with gold foil and alpha particles.	
		P7.16 Describe Rutherford's nuclear model of the atom and how it accounts for the results of Geiger and Marsden's experiment and understand the factors (charge and speed) which affect the deflection of alpha particles by a nucleus.	
		P7.17 Understand that a nucleus of U-235 can be split (the process of fission) by collision with a neutron, and that this process releases energy in the form of kinetic energy of the fission products.	• ***Power Stations***
		P7.18 Recall that the fission of U-235 produces two daughter nuclei and a small number of neutrons.	
		P7.19 Understand that a chain reaction can be set up if the neutrons produced by one fission strike other U-235 nuclei.	
		P6.20 Understand the role played by the control rods and moderator when the fission process is used as an energy source to generate electricity.	