Year 10	**Substantive Knowledge**	**Disciplinary Knowledge**	**Assessment**
Half-term 1 Bonding and structure Organisation	**<u>C2 – Bonding, Structure and properties of Matter</u>** • Describe the arrangement and movement of the particles in the three different states of matter. • Describe why changes of state happen using ideas about particles, energy and bonding. • Predict the physical state of a substance at a certain temperature when given information about its melting and boiling points. • Describe the link between the melting and boiling points of materials and the strength of the bonds between their particles. • Describe some limitations of the particle model. • State what an ion is and describe how they are formed. • State the charges on the ions of elements in groups 1,2, 6 and 7. • Describe how an ionic bond forms. Draw dot and cross diagrams to show this.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe what an ionic compound is made of and how these are arranged. • Explain why ionic compounds have high melting and boiling points. • Explain why ionic compounds only conduct electricity when they are molten or in solution. • Describe what a covalent bond is. Draw dot and cross diagrams to show this. • Describe what a molecular substance is. • Explain why they have low melting and boiling points. • Describe what a polymer is. Draw the symbol used to represent a polymer. • Explain why polymers have higher melting points than other molecular substances. • Describe the structure of diamond. Explain why diamond has very high melting and boiling points, is very hard, and does not conduct electricity. • Describe the structure of silicon dioxide. Explain why it has lower		

	melting and boiling points than diamond. • Describe the structure of graphite. Explain why graphite has very high melting and boiling points, is soft, and does conduct electricity. • Explain the properties of graphene using ideas about its structure and bonding. • Describe what a fullerene is and give some examples of their uses. • Deduce the chemical formula of a compound from a diagram of its structure. • Describe the limitations of using dot and cross, ball and stick and two dimensional diagrams to represent ionic and covalent compounds. • Describe the structure of metals. Explain why metals are good conductors of heat and electricity, have high melting and boiling points, and are malleable. • Describe what an alloy is and explain why they are harder than most pure metals.		

	Triple Science only. • Describe what a nanoparticle is. • State some of the concerns about using nanoparticles in modern technology (nanotechnology). • Evaluate the use of an example of nanotechnology when given appropriate information. **<u>AQA B2 – Organisation</u>** • State what metabolism means and the importance of enzymes to metabolism. • State what enzymes are and describe how they work (lock and key model). • Explain how and why temperature and pH can affect the rate of enzyme activity. • Describe how to investigate the effect of changing the pH or temperature on the activity of an enzyme. • Describe a variety of cells, tissues and organs in plants and animals. • Name and label the different organs in the digestive system.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe the functions and adaptations of each one. This includes the production and functions of amylase, proteases, lipases and bile. • Describe how to carry out the food tests – starch, sugar and protein. • Describe the organs in the human respiratory system including their functions and adaptations. • Describe the organs in the human circulatory system including their functions and adaptations. • Name the four components of human blood and describe the function of each. • Describe the adaptations of red and white blood cells to their functions. • Describe the different types of cardiovascular disease and treatments for each. • State what good health means and different factors that can affect your health. • Describe the difference between communicable and non-communicable diseases. State examples of each type of disease.		

	• State risk factors that can contribute to poor health and identify risk factors that have a proven causal mechanism for a disease. • Identify a correlation between a risk factor and the incidence of a disease from a scatter diagram. • Explain the importance of using an appropriate sample of the population to obtain scientific evidence linking a risk factor to a disease. • Describe how different diseases can interact to cause further health problems. • Explain the effects of certain life style choices on the incidence of non-communicable diseases within a population. • Describe what cancer is and the difference between benign and malignant cells. • Explain how the structures of different plant tissues are related to their functions. • Describe the meaning of transpiration and explain what the transpiration stream is. State		

	factors that can affect the rate of transpiration. • Describe what translocation means and explain why translocation is necessary in plants •		
Half-term 2 Electricity infection and response	**<u>B3 – Infection & Response</u>** • Name and label the different types of pathogens (viruses, bacteria, protists and fungi that cause diseases). • State the different ways in which bacteria and viruses cause disease symptoms. • Describe the different ways in which pathogens can be spread. • Describe ways in which the spread of pathogens can be prevented. • Describe the causes and symptoms of salmonella, gonorrhoea, rose black spot and malaria.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• State how the skin, nose, trachea, bronchi and stomach protect against pathogens. • Describe how white blood cells defend against pathogens. • Describe how can you become immune to a disease by natural processes. • Describe the process of vaccination and explain how a vaccine causes immunity. • State the benefits of herd immunity. • State what antibiotics are. • State the causes and problems of antibiotic resistance. • State the purpose of using pain killers and anti-virals, and why anti-viral drugs are difficult to develop. • State the traditional sources of digitalis, aspirin and penicillin. • Explain why new drugs must be tested for toxicity, efficacy and the correct dosage. • Explain why preclinical trials are done and how they are done. • Explain why clinical trials are done and how they are done.		

	• Triple Science only. • Describe how monoclonal antibodies are produced. • Describe some ways in which monoclonal antibodies are used. • Explain why monoclonal antibodies are not as widely used today as was previously hoped. • Describe a variety of ways in which plant diseases can be detected. • Describe three ways in which plant diseases can be identified. • Explain how and why an infestation of aphids affects a plant. • Explain how and why a nitrate ion deficiency affects a plant. • Explain how and why a magnesium ion deficiency affects a plant. • Describe a variety of physical, chemical and mechanical defence responses of plants.		

	P2 – Electricity • Describe Charge and flow of charge, How it link to current and what is meant by 1 ampere? • Describe Potential difference, resistance and current and how they are measured in a circuit • Describe the relationship between PD, current and resistance (Ohm's law). • Describe the practical procedure for investigating the relationship between current and voltage in bulbs, resistors and diodes. • Know where to use different types of resistor and how the resistance changes. • Know what different circuit symbols mean. • Describe the difference between a series and a parallel circuit. • Describe the practical procedure for investigating how changing either the length of a wire, or adding resistors in series or parallel, affects the overall resistance of a circuit. • Describe why adding resistors in series increases overall resistance	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	but adding resistors in parallel decreases overall resistance. • Describe the energy transfers that take place in some common electrical appliances. • Use power ratings to calculate the work done by electrical appliances. • Describe the different ways of generating mains electricity with pros and cons of each. • Describe the difference between direct PD and alternating PD. • Describe the structure of the national grid, including the reasons why transformers are used. • Describe the three core cable and mains electricity in the UK • Explain why the live wire remains dangerous even when an appliance is switched off. • Explain in terms of PD and current what happens when someone receives an electric shock. **<u>Triple Science only.</u>**		

	• Describe what is meant by static charge. • Describe how and why an object becomes charged. • Describe and draw the electric field around a charged object. • Describe and explain the forces that act on an object placed in an electric field. • Explain why sparking might occur between two objects.		
Half-term 3 Bioenergetics Quantitative Chem change (runs into HT4 by up to 2 weeks)	**<u>B4 – Bioenergetics</u>** • State examples of molecules made during metabolism (starch, glycogen, cellulose, lipids, proteins) and name the smaller molecules that each one is made of. • Describe how the body breaks down and excretes excess protein. • Describe what cellular respiration is and explain why it is vital to all types of life. • Explain why cellular respiration is important to metabolism.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe aerobic respiration and state where it takes place. • Recall the word and chemical equations for aerobic respiration. • Describe anaerobic respiration. State where it takes place. • Recall the word equation for anaerobic respiration. • Compare aerobic with anaerobic respiration in terms of the quantity of oxygen used and the energy and products produced. • Describe anaerobic respiration in bacteria and yeast cells (fermentation). • State examples of how we make use of this. • Recall the word equation for fermentation. • Describe and explain the effects of increasing the rate of exercise on the rate of respiration in muscle cells. • Describe what oxygen debt means and how the body corrects this. • Describe photosynthesis. State where it takes place.		

	• Recall the word and chemical equations for photosynthesis. • Measure and calculate the rate of photosynthesis in a plant. • State the useful product of photosynthesis. • Describe four or more ways that plants use this chemical. • Explain why plants need to absorb nitrate ions from the soil. • Describe how to investigate the effect of light intensity on the rate of photosynthesis in pondweed. • State the factors that can affect the rate of photosynthesis. • Explain why these different factors affect the rate of photosynthesis. • Recognise limiting factors when given a graph showing the rate of photosynthesis. • Use the inverse square law to predict how doubling the distance from a light will affect the rate of photosynthesis in a plant. • Apply knowledge of how limiting factors work to describe how to		

	grow crop plants in a greenhouse in the most economical way. **C3 – Quantitative Chemistry** • Describe the law of conservation of mass. • Explain why chemical equations must be balanced. • State what Mr is and how to calculate it when given a chemical formula. • State the value for Avagadro's constant and Describe what Avagadro's constant tells you. • Calculate the numbers of different atoms in a compound when given the number of mols of the compound. • Calculate the mass of 1 mole of a substance when given its chemical formula. • Calculate the number of mols of a substance when given the Mr and the mass. • Calculate the total Mr values for the reactants and products in a balanced chemical equation to show that the mass is conserved.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Convert the given masses of chemicals in a reaction to mols and then use the ratio of moles to balance the equation. • Describe what is meant by a reactant that is 'in excess' and a reactant that is 'limiting'. • Calculate the mass of a specified product when given the masses of the reactants and the balanced chemical equation for the reaction. • Describe the circumstances needed for an apparent loss of mass to happen during a chemical reaction. Describe in terms of atoms or molecules why mass seems to be lost under these circumstances. • Describe what concentration means and state the unit for concentration. • Recall and use the mathematical formula linking mass, concentration and volume. • Describe in terms of the mass of the solute, and the volume of the solvent, how to increase or		

	decrease the concentration of a solution. **Triple Science only** • Use theoretical and actual yields to calculate the percentage yield of a chemical reaction. • Give reasons why chemical reactions never have a 100% yield. • Describe what atom economy means. • Calculate the atom economy of a chemical reaction. • Justify why a particular chemical pathway is used to produce a product when given appropriate information about the reaction involved. • Calculate the concentration of a solution in mol/dm3 when given appropriate information. • Calculate the concentration of an unknown solution by using data given about another solution that it fully reacts with.		

	• State the volume of 1 mol of a gas at room temperature and pressure. • Calculate the volume of a gas when given its Mr and mass. • Use balanced chemical equations and other given data to calculate the volume of a gas involved in the reaction. **<u>C4 – Chemical Changes</u>** • Describe oxidation and reduction in terms of loss or gain of oxygen, and describe what happens during a redox reaction. • Describe oxidation and reduction in terms of loss or gain of electrons, and describe what happens during a redox reaction. • Explain why some metals form ions more easily than others and link this to the reactivity of metals. • Write word equations for the reactions of a variety of metals with water, sulfuric acid and hydrochloric acid.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Explain how displacement reactions be used to compare the reactivity of two different metals. Give an example and write an ionic equation to represent it. • Describe the reactions between an acid and (a) an alkali (b) a base and (c) a metal carbonate. • Name the salts produced by hydrochloric, sulfuric and nitric acids. • Name the salt produced by a reaction when given the names of the reactants. • Deduce the formula of a salt when given the ions that react to produce it • Describe the practical procedure for preparing a pure, dry sample of a salt. • State the aqueous ions produced by acids and by alkalis. • Describe the difference between a strong acid and a concentrated acid. • Describe what happens to the ions produced by the acid and alkali during a neutralisation reaction. Include the relevant		

	chemical equation that shows this. • Describe ways to identify the pH of a solution. • Describe the pH scale and how it links to the concentration of the ions in the solution. • Describe what electrolytes are and why are they able to conduct electricity. • State what forms at each electrode during the electrolysis of a molten compound. • State what could form at each electrode during the electrolysis of an aqueous solution. State the rules for what forms at each electrode. • Identify which chemical species are reduced and which are oxidised at the electrodes during electrolysis. • Write balanced half equations for the formation of the following substances at the electrodes during electrolysis: Water, Hydrogen, Chlorine, Zinc. • Predicting the products of the electrolysis of an aqueous solution.		

	• Explain why different types of metal require different methods to extract them from their ores. • Describe how aluminium is extracted from its ore. Include details of why a mixture is used as the electrolyte and why the positively charged electrode must be continually replaced. **Triple Science only.** • Describe the procedure for carrying out a titration. • Using titration to calculate the concentration of an unknown acid or alkali. • Calculate the concentration of an unknown acid or alkali in mol/dm3 or g/dm3 from the results of a titration experiment.		
Half-term 4 Energy change	**<u>C5 – Energy changes</u>** • Describe exothermic and endothermic reactions in terms	✓ Application of substantive knowledge within different scenarios ✓ Problem solving	❑ Exam style Assessment at the end of the unit ❑ Homework

particle model	of the temperature change of the surroundings. • State examples of exothermic and endothermic reactions. • Investigate how a chosen variable affects the temperature change in a chemical reaction. • Describe what the activation energy in a chemical reaction means. • Draw energy level diagrams to represent exothermic and endothermic reactions. • State whether energy is released or absorbed when bonds are broken. • State whether energy is released or absorbed when bonds are formed. • Describe exothermic and endothermic reactions in terms of the energy involved in breaking and making bonds. • Explain how to use the different energy values involved in the breaking of bonds and the forming of bonds to calculate the overall energy change during a chemical reaction. • Use diagrams showing the bonds in the reactants and products, as well as information about bond	✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ In class assessment

	energy, to calculate the energy change during a chemical reaction and decide whether it was exothermic or endothermic. **Triple Science only.** • Know the structure of a simple cell and battery. • Describe the factors that affect the voltage supplied by a cell. • Describe why alkaline batteries are non-rechargeable but other types of battery can be recharged. • Give a simple description of how a hydrogen fuel cell works. • Evaluate the use of a hydrogen fuel cell compared to other types of cell. • Write half equations for the reactions that take place at the electrodes in a hydrogen fuel cell. **P3- particle model** • Describe Internal energy- What is it? • List the three states of matter in order of internal energy.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Draw simple diagrams to represent the particles in the three states of matter. • Describe the arrangement and movement of particles in the three states of matter. • Describe and calculate specific heat capacity. • Describe and calculate specific latent heat (fusion and vaporisation). • Interpret graphs showing the temperature of a substance during heating and changes of state. • Describe and calculate density. • Describe the practical procedure for calculating the density of either a regularly shaped or an irregularly shaped object. • Explain how the motion of the particles of a gas are related to both its temperature and pressure. • Explain the relationship between the temperature and pressure of a gas that is at a constant volume.	✓ Analysing data and patterns ✓ Linking Science to real life application	

	Triple Science only. • Explain why increasing the volume of a gas at a fixed temperature causes a decrease in pressure. • Mathematically calculate pressure or volume changes in gases when given appropriate information. • Describe how work is done on a gas and explain the effect this has on the temperature of the gas. End of year exam prep for full paper 1 Bio, Chem, Phys		
Half-term 5 Atomic structure Chemical Analysis	**<u>P4- Atomic structure</u>** • Describe the basic structure of an atom and use given data to draw one. • State the typical sizes of an atom and a nucleus. • Describe what an isotope is. • Describe the history of the atomic model and explain why the model has changed over time.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe what ionisation means and why it happens. • Explain why some isotopes are radioactive (radioisotopes). • Describe what nuclear decay means. • Give different examples of nuclear radiation • For Alpha radiation- describe the structure and properties and how to write a balanced decay equation. • For Beta radiation- describe the structure and properties and how to write a balanced decay equation. • For Gamma radiation- describe the structure and properties • Describe how to measure the activity and count rate of a radioactive source. • Be able to convert count rate into activity (Bq). • Describe what is meant by half life. • Link the concept of half life to the random nature of radioactive decay.		

	• Calculate the half life of a radioisotope when given appropriate information. • Calculate the decline in the activity of a radioisotope as a ratio after a specified number of half lives. • Describe what radiation dose means and compare the hazards of irradiation and contamination. • Describe some precautions that can be taken to reduce the risk of irradiation. **Triple Science only.** • Describe the meaning of background radiation and state several sources. • Give reasons why different people receive different doses of background radiation. • Explain why the hazard associated with a radioisotope depends on its half life. • Evaluate the risk of using nuclear radiation in medicine to explore internal organs or destroy unwanted tissue.		

	• Describe the process of nuclear fission. • Draw and interpret diagrams showing nuclear fission, including the possibility of a chain reaction. • Explain how nuclear fission is used and controlled to produce energy in a nuclear reactor. • Describe the process of nuclear fusion. **C8- Chemical analysis** • Describe what is meant by a 'pure substance'. • Use data about mp and bp to distinguish pure substances from impure substances. • Describe what a 'formulation' is and give examples of useful formulations. • Explain in detail how paper chromatography separates mixtures. • Explain how chromatography can be used to identify pure and impure substances. • Interpret chromatograms and use them to calculate Rf values.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Using paper chromatography to separate colours and calculate Rf values. • Describe how to test for the presence of Hydrogen, Oxygen, Carbon dioxide and Chlorine. **Triple Science only** • Identify different metal ions using the results of flame tests. • Describe the precipitate formed when sodium hydroxide reacts with a range of different ions • Write balanced equations to represent the reactions that produce the precipitates. • Describe the test used to identify Carbonate ions, Halide ions and Sulfate ions. • Using a range of chemical tests to identify ions in solution. • State advantages of instrumental methods for detecting the presence of ions over the simpler tests described in this topic. • Describe how the instrumental method called flame emissions spectroscopy works.		

Half-term 6 Ecology	**B7 – Ecology** • Describe what an ecosystem is. • Describe the different levels of organisation in an ecosystem. • State the things that plants compete for, and that animals compete for in a community. • Describe several different examples of interdependence in a community. • Describe what a stable community is. • State different abiotic factors in an ecosystem and predict the effects on the a community if any of these change. • State different biotic factors in an ecosystem and predict the effects on the a community if any of these change. • Describe the three possible ways in which organisms can be adapted to survive in their habitat. • Use sampling techniques to investigate the numbers and distribution of an organism.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe what food chains and food webs show. • Describe the meanings of 'producer', and 'primary', 'secondary' and 'tertiary' consumers. • Explain why predator and prey numbers rise and fall in cycles. • Describe how the carbon cycle shows the recycling of carbon in the environment. • Describe how the water cycle shows the recycling of water in the environment. • Describe the role of microbes in recycling materials in the environment. • Describe the meaning of 'biodiversity' and give reasons why biodiversity is important. • Explain why pollution levels are increasing and give three examples of how pollution can occur. • State different ways in which humans reduce the amount of land available to wildlife. • Describe the negative impacts of peat bog destruction.		

	• Describe the main reasons for large scale deforestation and the environmental consequences of this. • Describe why global warming is happening, why most scientists are sure that it is caused by humans, and some of the biological consequences of it. • Describe five programmes that have been put in place to reduce the negative effect of human impact on ecosystems and biodiversity. **Triple Science only.** • Describe how variations in temperature, water and oxygen can affect the rate of decay. • Explain why gardeners try to achieve the optimum levels for decay. • Describe how decay can be used in a biogas generator. • Investigate the effect of temperature on the rate of decay of fresh milk.		

	• Explain how and why environmental changes can affect the distribution of species in an ecosystem. • Describe the four trophic levels found in food chains. • Describe how decomposers break down dead plant and animal matter. • Describe what a pyramid of biomass shows. • State the typical percentage values of both the energy transferred by plants from sunlight and between each trophic level in a food chain. • Construct a pyramid of biomass when provided with appropriate data. • Explain why only a small proportion of biomass is passed from one trophic level to the next. • Explain the impact that the loss of biomass has on the numbers of organisms found at each trophic level in a food chain. • Describe what is meant by food security and state some biological factors that are a threat to it.		

	• Describe how the efficiency of farming animals for food is increased and explain why this is an ethical issue. • Describe some of the steps that have been taken to improve the sustainability of fisheries. • Describe some applications of biotechnology that are being used to help provide food to the growing world population		

		✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

Year 11	**Substantive Knowledge**	**Disciplinary Knowledge**	**Assessment**
Half term 1 Rates and homeostasis	**<u>C6 – Rate and Extent of Chemical Change</u>** • State two ways to calculate a mean rate of reaction. • Select the appropriate units for measuring the rate of a reaction. • Calculate the mean rate of a reaction using numerical data or a graph. • Calculate the rate of a reaction at a specific time by using the gradient of a tangent • Describe how five different factors affect rate of reaction. • Explain collision theory and link this to rate of reaction. • Use collision theory to explain why each factor (except a catalyst) affects rate of reaction. • Explain why catalysts increase rate of reaction and label this on an energy level diagram. • Investigate how changing the concentration of a reactant affects the rate of a reaction. • State what a reversible reaction is and be able to draw the symbol representing this.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe the energy changes that can take place in a reversible reaction. • Explain what equilibrium means and describe the condition required for equilibrium. • Use Le Chatelier's principle to predict and explain the effects on the equilibrium position if there is a change to the concentration of a reactant or product, temperature or pressure. **<u>B5 – Homeostasis</u>** • Describe the meaning of homeostasis. • State three conditions in the human body that are controlled by homeostasis. • Describe the three features of a control system. • Compare nervous responses to chemical responses. • Describe the structure of the nervous system and how it is adapted to its function. • Describe what a reflex action is and explain why reflex actions are important.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• List the steps in a reflex arc in the correct order. • State the functions of sensory, relay and motor neurons. • Describe what a synapse is and how the nerve impulse passes from neuron to neuron. • Investigating the effect of a factor on human reaction time. • Describe generally how glands, hormones and target organs work together. • Identify the position of the major glands in the human body. • Describe the role of the pituitary gland and explain why it is called the master gland. • Describe how the homeostasis of glucose works. • Describe the causes and treatments of both type 1 and type 2 diabetes. • Describe what happens when blood glucose concentration drops too low. • Describe how the negative feedback cycle between insulin and glucagon controls blood glucose levels.		

	• Describe the roles of oestrogen and testosterone. • State the glands that produce LH, FSH, oestrogen and progesterone. • Describe the roles of LH, FSH, oestrogen and progesterone in the menstrual cycle. • Describe the interactions of LH, FSH, oestrogen and progesterone in the menstrual cycle. • Explain how a variety of hormonal and non-hormonal methods of contraception work. • Describe positive and negative aspects for each different form of contraception. • Describe how hormonal treatment and IVF can be used to treat infertility. • State some negative aspects of fertility treatment. • Describe the roles of thyroxine and adrenaline. • Describe how thyroxine levels are controlled by negative feedback. **Triple Science only.**		

	• Identify key areas of the brain on a diagram and describe what each area is responsible for. • Explain the difficulties of investigating some areas of brain function, or of treating brain diseases or damage. • Describe how neuroscientists have been able to map some areas of brain function. • Label a diagram of the eye. • Describe the functions of each part of the eye. • Describe the process of accommodation in the eye and explain how it allows the eye to focus on near and far objects. • Describe the conditions of myopia and hyperopia. • Describe how these eye conditions can be treated. • Interpret ray diagrams showing these two conditions and demonstrate how spectacle lenses correct them. • Describe how body temperature is monitored. • Describe how homeostasis causes the body to respond to both an		

	increase and a decrease in its temperature. • Explain how these responses lead to either an increase or a decrease in the temperature of the body. • Explain in terms of osmosis why the concentration of ions in the blood is important to cell function. • Describe how water, ions and urea are lost by the skin, lungs and kidneys. • Describe how and why the liver removes excess amino acids from the blood. • Describe how the kidneys produce urine and understand why the contents of urine are not always the same. • Describe the effect of the hormone ADH on the permeability of kidney tubules. • Explain how the pituitary gland and kidneys work together in the process of water homeostasis. • Describe how kidney transplants or dialysis can be used to treat patients with kidney failure.		

	• Describe how plant hormones cause both phototropism and geotropism. • Describe the roles of gibberellins and ethene in plants. • Investigate the effects of light or gravity on the growth of newly germinated seedlings. • Describe how plant hormones are used in the agricultural, horticultural and food industries.		
Half term 2 Organic and Forces	**C7 – Organic Chemistry** • Describe how crude oil was formed and why it is a finite resource. • Describe what crude oil is composed of. • Describe the meanings of 'hydrocarbon' and 'alkane'. • State the general formula used for the alkanes in the homologous series. • Know the names and formulae of the first four hydrocarbons in the homologous series. • Describe what a 'fraction' means in relation to crude oil.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• State a variety of uses for the fractions separated out from crude oil. • Explain how fractional distillation is used to separate crude oil into fractions. • Describe the properties of hydrocarbons that are affected by increasing molecule length. • Link the properties of hydrocarbons to how appropriate they would be to use as fuels. • Write word and balanced chemical equations for the combustion of hydrocarbons. • Describe the meaning of 'cracking' in relation to hydrocarbons. • Describe the processes of catalytic cracking and steam cracking. • State the products of cracking and their uses. • Give examples of why cracking is a useful process in modern society. • Describe how to test for the presence of an alkene. • Balance a given chemical equation for cracking.		

	Triple Science only • Describe the structure of an alkene molecule. • State the general formula for the homologous series of alkenes. • Explain why alkene molecules are unsaturated. • State the names and formulae of the first four alkenes in the homologous series. • Describe what happens during the combustion of an alkene. • Describe the reactions and conditions for the addition of hydrogen, water and halogens to alkenes. • Draw diagrams to represent the addition reactions of any of the first four alkenes. • Describe the structure and functional group of an alcohol molecule. • Name and draw the first four alcohol molecules. State the chemical formula of each. • Describe how fermentation is used to produce ethanol. • Describe the structure and functional group of a carboxylic acid molecule.		

	• Name and draw the first four carboxylic acid molecules. State the chemical formula of each. • Know why carboxylic acids are examples of weak acids. • Describe what happens during addition polymerisation. • Describe how to recognise an addition polymer when shown the monomers that is has been made from. • Draw a diagram to show the process of addition polymerisation. • Describe what happens during condensation polymerisation. • Describe what happens during the condensation polymerisation of amino acids. • Name the monomers that make up DNA, proteins, starch and cellulose **<u>P5 – Forces</u>** • Give definitions for, and examples of, contact and non-contact forces. • Give definitions for, and examples of, vector and scalar quantities.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Represent vector quantities on a diagram by using arrows of an appropriate length and direction. • Describe the relationship between gravity, mass and weight. • Describe what is meant by an object's centre of mass. • Describe what is meant by a 'resultant force'. • Calculate the resultant of two forces acting in a straight line. • Describe Newton's first law and the effect of resultant forces on motion. • Describe Newton's second law. • Calculate acceleration using information about mass and velocity. • Explain why terminal velocity is reached by objects moving in a fluid (eg air or water). • Investigate the effect of varying either the resultant force or the mass on the acceleration of an object. • Describe Newton's third law and how this leads to movement. • Calculate the work done by a force on a moving object.		

	• Describe why a joule can also be called a newton metre. • Describe the meaning of spring constant. • Describe the difference between elastic and inelastic deformation. • Calculate the spring constant of a spring from given data or a graph of force vs extension. • Investigate the relationship between force and extension in a spring. • Describe the difference between distance and displacement. • Describe the difference between speed and velocity. • State the typical speeds for walking, running cycling, other vehicles and sound. • Describe the difference between average speed and instantaneous speed. • Collect data about distance and time to calculate the average speed of a moving object. • Draw and interpret distance/time graphs and use the gradient of the line to calculate the speed.		

	• Draw and interpret velocity/time graphs and use the gradient of the line to calculate acceleration. • Describe what thinking distance, breaking distance and stopping distance mean. • State the typical range of reaction times of a human being. • Evaluate the effectiveness of different methods of measuring human reaction time. • State several factors that can affect thinking distance. • State several factors that can affect braking distance. • Describe the energy transfer that takes place as a vehicle's brakes reduce its speed. • Explain why large deceleration caused by brakes can be dangerous.		
Half term 3 Inheritance, Waves and magnetism	**<u>B6 – Inheritance, Variation and Evolution</u>** • Describe the differences between sexual and asexual reproduction.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving	❑ Exam style Assessment at the end of the unit

	• State the names of the gametes in plants and animals. • Describe how gametes are produces by meiosis. • Explain what happens when gametes fuse during fertilisation. • Describe simply the structure of DNA. • Describe what a gene is and state the function of a gene. • Describe the meaning of 'genome' and give three reasons why understanding the human genome is important. • Describe what alleles are. • Know the difference between genotype and phenotype, and how the two are linked. • Describe the difference between a dominant and a recessive allele. • Describe the difference between homozygous alleles and heterozygous alleles. • Interpret information about alleles using family trees. • Draw punnet square diagrams when given appropriate information about alleles.	✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Homework ❑ In class assessment

	• Use punnet square diagrams to calculate the probability of inheriting a particular phenotype. • State examples of characteristics controlled by a single gene or by multiple genes. • Know the causes and symptoms of polydactyly and cystic fibrosis. • Describe embryo screening and state some of its positive and negative aspects. • Describe the inheritance of gender in humans. • Describe the causes of variation in living organisms. • Describe how mutation leads to genetic variation. • Explain why mutations rarely lead to evolution even though they happen all of the time. • Describe the meaning of 'species'. • Explain how evolution by natural selection works to create a new species. • Describe how selective breeding is carried out. • State some uses and drawbacks of selective breeding.		

	• Describe the meaning of 'genetic engineering'. • Describe the steps in the genetic engineering process. • State some uses and concerns about genetic engineering. • Describe how the fossil record and antibiotic resistant bacteria are evidence of evolution. • State three different examples of fossil types. • State two reasons why the fossil record is incomplete. • Describe the meaning of 'extinction' and some factors that lead to extinction. • Explain why bacteria can evolve quickly. • Describe how bacteria become resistant to antibiotics. • State three ways to reduce the rate at which bacteria are becoming resistant. • Explain why scientists can't easily make new antibiotics to tackle the problem. • Describe how Linnaeus classified living organisms.		

	• Explain why this was eventually rejected and replaced with the three domain system. • Describe the meaning of 'extremophile' and give some examples. • Use evolutionary trees to decide how closely related different living organisms are. **Triple Science only.** • Describe in detail the structure of DNA in terms of nucleotides. • Describe the difference between coding and non-coding DNA. • Describe the process of protein synthesis. • Describe the roles of ribosomes and carrier molecules in protein synthesis. • Explain why different genes code for different proteins. • Explain why the correct amino acids sequence in a protein is important to its final, folded structure. • Explain why a change in the base sequence of a gene (mutation) in		

	coding DNA can lead to a change in the protein that the gene codes for, but does not always do so.. • Describe the possible effect of a mutation in non-coding DNA. • Describe the cloning processes and uses of tissue culture, cuttings, embryo transplants and adult cell cloning. • Describe how Charles Darwin developed his Theory of Natural Selection, and the influence of Alfred Russell Wallace on Darwin's work. • Explain why it took a very long time for Darwin's theory to be accepted by the scientific community.. • Describe the process of speciation. • Describe the work of Gregor Mendel and his conclusions. • Describe specific stages in the development of our understanding of genetics since the discoveries of Mendel.		

	<u>P6 – Waves</u> • Describe what a wave does in terms of energy and matter. • Describe the difference between a longitudinal and a transverse wave. • Give examples of longitudinal and transverse waves. • Use the wave equation to calculate the speed of a wave. • Measure the frequency, wavelength and wave speed of waves in water and solids. • Describe what is meant by an electromagnetic wave. • Explain why atoms can produce electromagnetic waves. • State the properties common to all types of electromagnetic wave. • List the different electromagnetic waves in the order they are found in the electromagnetic spectrum. • Place the electromagnetic waves in order of either wavelength, frequency or energy transferred. • Describe what is meant by radiation dose and state the factors that it depends on.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Explain why high energy electromagnetic waves are hazardous. • State uses of each type of electromagnetic wave. • Explain why each type of electromagnetic wave is suitable for its uses. • Describe how radio signals are produced and received during communication. • Describe the meanings of absorb, transmit, reflect and refract. • Explain what happens to an object in terms of energy when it absorbs an electromagnetic wave. • Give examples of how different materials absorb, reflect and emit radiation of different wavelengths. • Investigate the amount of infrared radiation absorbed or emitted by different surfaces. • Draw a ray diagram to show how a light ray is refracted as it passes through a clear plastic block. • Explain in terms of wavelength and wave speed why the refraction of waves takes place.		

	• Draw a wave front diagram to show the refraction of a wave as it crosses a boundary. **Triple Science only.** • Construct a ray diagram to show the reflection of a wave at a surface. • Investigate the reflection and refraction of light by different surfaces and substances. • Describe how a sound wave travels through a solid material. • Describe what happens when a sound wave in air reaches a solid surface such as the ear drum. • Explain why human hearing is limited to a certain frequency range. State this frequency range. • Describe how ultrasound and echo location techniques work • Describe the two different types of seismic waves. • Explain how seismic waves have been used to reveal the internal structure of the Earth. • State the difference between a concave and a convex lens.		

	• Draw the symbols used to represent concave and convex lenses. • Explain how both types of lens form an image. • Draw labelled ray diagrams to show light rays passing through both types of lens. • Identify an image as being either real or virtual. • Calculate the magnification produced by a lens. • Describe the difference between specular reflection and diffuse reflection (scattering). • Explain in terms of absorption and reflection why different objects have a variety of colours. • Explain in terms of absorption and transmission how colour filters work. • Describe the link between an object's temperature and how much infrared radiation it emits. • Describe what is meant by a perfect black body. • Interpret diagrams to explain how the balance of incoming radiation absorbed and emitted affects the temperature of the Earth's surface and atmosphere.		

	<u>P7 – Magnetism and Electromagnets</u> • Describe what is meant by a magnetic field. • Explain how to use a plotting compass to plot a magnetic field around a bar magnet. • Draw and label a diagram to show the magnetic field around a bar magnet. • Explain the difference in the force of magnetism at different positions in a magnetic field. • Describe the difference between a permanent magnet and an induced magnet. • Describe what possible outcomes happen when both a permanent magnet and an induced magnet are placed near to another permanent magnet. • Explain how magnetic compasses provide evidence that the Earth's core is magnetic. • Describe the magnetic field produced by a straight wire when a current flows through the wire.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Use Fleming's right hand rule to deduce the direction of the magnetic field around a straight wire. • Describe what a solenoid is, and how to convert a solenoid to an electromagnet. • Draw and label a diagram to show the magnetic field around a solenoid. • State three ways in which the strength of an electromagnet can be increased. • Explain how a current carrying conductor (eg wire) moves by the motor effect. • State three factors that increase the size of the force on the conductor during the motor effect. • Apply a given equation to calculate values in questions involving the motor effect. • Use Fleming's left hand rule to answer questions involving the motor effect. • Use the motor effect to explain the rotation of a wire **Triple Science only.** • Interpret diagrams to deduce how electromagnetic devices work.		

	• Use the motor effect to explain how loudspeakers and headphones work. • Explain how a magnet can be used to induce a potential difference in a wire. • State factors that affect the size of the induced potential difference. • State factors that affect the direction of the induced potential difference. • Explain how the generator effect is used in dynamos. • Draw and interpret graphs showing the potential difference generated against time. • Use the generator effect to explain how a microphone works. • Describe the structure of a transformer. • Explain how an alternating potential difference is induced in the secondary coil of a transformer. • Explain why transformers can only work if the input current is alternating not direct. • Explain how the ratio of primary coils to secondary coils changes the potential difference in a transformer.		

	• Use a given equation to complete calculations relating to potential difference changes in transformers. • Calculate the output power of a transformer and use this value to calculate the input current. • Explain how the reduced output current of a step up transformer improves the efficiency of energy transfer in the national grid.		
Half term 4 Chemical Analysis, Chem of atmosphere and using resources	**C8- Chemical analysis** • Describe what is meant by a 'pure substance'. • Use data about mp and bp to distinguish pure substances from impure substances. • Describe what a 'formulation' is and give examples of useful formulations. • Explain in detail how paper chromatography separates mixtures. • Explain how chromatography can be used to identify pure and impure substances. • Interpret chromatograms and use them to calculate Rf values.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Using paper chromatography to separate colours and calculate Rf values. • Describe how to test for the presence of Hydrogen, Oxygen, Carbon dioxide and Chlorine. **Triple Science only** • Identify different metal ions using the results of flame tests. • Describe the precipitate formed when sodium hydroxide reacts with a range of different ions • Write balanced equations to represent the reactions that produce the precipitates. • Describe the test used to identify Carbonate ions, Halide ions and Sulfate ions. • Using a range of chemical tests to identify ions in solution. • State advantages of instrumental methods for detecting the presence of ions over the simpler tests described in this topic. • Describe how the instrumental method called flame emissions spectroscopy works.		

	C9 – Chemistry of the atmosphere • Describe the composition of the atmosphere for the last 200 million years. • Explain why evidence for the earliest atmosphere of the Earth is limited. • Describe the changes to the atmosphere in the first billion years of the Earth's existence. • Explain why nitrogen levels then increased and carbon dioxide levels decreased. • State when algae and plants evolved and describe their impact on the atmosphere. • Describe how limestone, coal, crude oil and natural gas were formed. • Explain the effects of their formation on the composition of the atmosphere. • Name three different greenhouse gases. • Describe the greenhouse effect in terms of the interaction of short and long wavelength radiation with matter. • Explain why greenhouse gases are essential to all life on Earth.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe two human activities that increase the amount of CO2 in the atmosphere. • Describe two human activities that increase the amount of methane in the atmosphere. • Explain why peer reviewed evidence has been important in climate change science. • Explain why the evidence for climate change is still uncertain. • Describe four potential effects of global climate change. • Describe the scale, risk and environmental implications of global climate change. • Describe what is meant by the term 'carbon footprint'. • Describe some actions that can be taken to reduce a carbon footprint. • Give reasons why these actions may be limited. • State some sources of atmospheric pollutants. • State the names of the major atmospheric pollutants. • Describe how carbon monoxide, soot (carbon particulates), sulfur dioxide and oxides of nitrogen are produced by burning fuels.		

	• 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 and explain the problems caused by carbon monoxide, sulfur dioxide and particulates. **C10 – Using Resources** • State the major uses of resources by humans. • State the uses of resources obtained naturally or by agriculture. • State the uses of resources obtained from the Earth, oceans or atmosphere. • State examples of natural products that are supplemented or replaced by agricultural and synthetic products. • Distinguish between finite and renewable resources when given appropriate information. • Describe what 'potable water' is. • Describe the process of producing potable water in countries with plenty of rainfall.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe how desalination can be used to produce potable water in other countries. • Analysis and purification of different water samples. • Describe how sewage and agricultural waste water are treated. • Describe how industrial waste water is treated. • Explain why alternative methods of extracting metals are becoming increasingly necessary. • Describe how phytomining and bioleaching can be used to obtain metal compounds. • Describe ways in which the metal compounds can be processed to extract the metal. • Describe what a life cycle assessment is used to assess. • Describe the stages in the 'life and death' of a product that a LCA assesses. • Explain why the results of LCAs can not always be trusted. • Carry out simple comparative LCAs for shopping bags made from plastic and paper. • State three ways to reduce the use of resources.		

	• State four benefits of reducing the use of resources. • Describe the negative impacts of obtaining raw materials from the Earth. • State different materials that can either be reused or recycled. Describe the difference between reusing and recycling materials. **Triple Science only** • Give a definition of, and examples of, corrosion. • Describe how different types of coating can be used to prevent corrosion. • Explain why sacrificial protection prevents corrosion. • Describe the composition and uses of each of these alloys; Bronze, Gold alloys, • Steel, Aluminium. • Describe how each of these ceramics is made and give a use for each one; Soda-lime glass, Borosilicate glass, Clay ceramics. • Describe how LDPE and HDPE are produced from ethene.		

	• Describe the difference between the structures of thermosoftening and thermosetting polymers. • Describe what composites are and give some examples of different composites. • Describe the chemical reaction that takes place in the Haber process. • State the sources of the reactants used in the Haber process. • Describe how conditions in the Haber process are balanced to gain the most economically viable yield possible. • Interpret graphs of reaction conditions vs rate of reaction in the Haber process. • Describe what NPK fertilisers are. • Describe where the potassium found in NPK fertilisers is obtained from. • Describe what must be done to phosphate rock to produce phosphate salts that are used in NPK fertilisers. • Recall the names of the salts produced when phosphate rock is treated with sulfuric, nitric and phosphoric acid.		

Half term 5 Ecology	**<u>B7 – Ecology</u>** • Describe what an ecosystem is. • Describe the different levels of organisation in an ecosystem. • State the things that plants compete for, and that animals compete for in a community. • Describe several different examples of interdependence in a community. • Describe what a stable community is. • State different abiotic factors in an ecosystem and predict the effects on the a community if any of these change. • State different biotic factors in an ecosystem and predict the effects on the a community if any of these change. • Describe the three possible ways in which organisms can be adapted to survive in their habitat. • Use sampling techniques to investigate the numbers and distribution of an organism. • Describe what food chains and food webs show.	✓ Application of substantive knowledge within different scenarios ✓ Problem solving ✓ Constructing explanations ✓ Analysing data and patterns ✓ Linking Science to real life application	❑ Exam style Assessment at the end of the unit ❑ Homework ❑ In class assessment

	• Describe the meanings of 'producer', and 'primary', 'secondary' and 'tertiary' consumers. • Explain why predator and prey numbers rise and fall in cycles. • Describe how the carbon cycle shows the recycling of carbon in the environment. • Describe how the water cycle shows the recycling of water in the environment. • Describe the role of microbes in recycling materials in the environment. • Describe the meaning of 'biodiversity' and give reasons why biodiversity is important. • Explain why pollution levels are increasing and give three examples of how pollution can occur. • State different ways in which humans reduce the amount of land available to wildlife. • Describe the negative impacts of peat bog destruction. • Describe the main reasons for large scale deforestation and the		

	environmental consequences of this. • Describe why global warming is happening, why most scientists are sure that it is caused by humans, and some of the biological consequences of it. • Describe five programmes that have been put in place to reduce the negative effect of human impact on ecosystems and biodiversity. **Triple Science only.** • Describe how variations in temperature, water and oxygen can affect the rate of decay. • Explain why gardeners try to achieve the optimum levels for decay. • Describe how decay can be used in a biogas generator. • Investigate the effect of temperature on the rate of decay of fresh milk. • Explain how and why environmental changes can affect		

	the distribution of species in an ecosystem. • Describe the four trophic levels found in food chains. • Describe how decomposers break down dead plant and animal matter. • Describe what a pyramid of biomass shows. • State the typical percentage values of both the energy transferred by plants from sunlight and between each trophic level in a food chain. • Construct a pyramid of biomass when provided with appropriate data. • Explain why only a small proportion of biomass is passed from one trophic level to the next. • Explain the impact that the loss of biomass has on the numbers of organisms found at each trophic level in a food chain. • Describe what is meant by food security and state some biological factors that are a threat to it. • Describe how the efficiency of farming animals for food is		

	increased and explain why this is an ethical issue. • Describe some of the steps that have been taken to improve the sustainability of fisheries. • Describe some applications of biotechnology that are being used to help provide food to the growing world population.		