Subject: Year 10 Combined Science
Year Overview

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Key content – knowledge and skills	National Curriculum focus
In light of school closures during the summer term 2020, the following year 9 topics have been carried through into year 10. Work has been set via distance learning for these topics but will still need to be revisited. **<u>Biology Infections and Response:</u>** Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. **<u>Biology Bioenergetics:</u>** In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue	Translate numeric data into graphical form. Applying knowledge of a range of techniques, apparatus and materials appropriate to the experiment. Applying scientific principles to the context of real life situations.

Additional topics include (already planned for year 10): **Physics Electricity:** **Chemistry: Quantitative Chemistry:** **Chemistry- Chemical changes** **Biology- Homeostasis and response:** **Biology: Inheritance, variation and evolution** **Chemistry: energy changes:** **Chemistry: Rate of reaction:** **Physics: Forces:** **Physics: Waves:**	

Key assessment points
End of unit assessment
Christian ethos
British values
Know that there are consequences in rules are not followed Scientific developments may give rise to moral dilemmas Understanding that science has a major effect on the quality of our lives

Subject: Combined Science (year 10)
Medium-term plan

Week	Month	Learning Intentions and/or Key Questions
Aut1-1	September	**Biology- Infection and Response:** • I can suggest how communicable diseases are spread. • I can suggest links between lifestyle and health. • I can discuss the validity of a statement based on evidence in the form of data. • I can explain why viruses are always pathogens but not all bacteria are. • I can explain how pathogens are passed from one organism to another and use this to suggest ways of preventing the spread. • I can explain what is meant by exponential growth and analyse a graph showing it. • I can suggest how to measure the growth of bacteria and discuss uncertainty. • I can plan a detailed investigation to find out how a variable affects the growth of bacteria. • I can write a prediction using detailed scientific knowledge.
Aut1-2		
Aut1-3		
Aut1-4		
Aut1-5	October	
Aut1-6		
Aut1-7		

		• I can calculate the number of bacteria in a sample when using a counting chamber. • I can apply knowledge of sampling techniques to ensure samples are representative. • I can use scientific knowledge to explain in detail how methods reduce or prevent the spread of disease. • I can use an example to explain how the scientific method has been applied to help prevent the spread of disease. • I can explain how measles, HIV and tobacco mosaic virus affect the infected organism. • I can explain why viral infections are often more difficult to prevent and treat than bacterial infections. • I can write a persuasive letter to parents urging them to vaccinate their children against measles. • I can suggest why more people die from viral diseases compared to bacterial diseases. • I can explain in detail how methods to control the spread of salmonella and gonorrhoea work. • I can explain how rose black spot affects the growth of a plant. • I can explain why it is so expensive to stop the spread of malaria. • I can explain how a reduced or over active immune system can cause illness. • I can explain in detail how antibody production fights pathogens. • I can evaluate an analogy of the human defence systems against disease. • I can analyse data on plant growth to write conclusions using scientific knowledge. • I can suggest how plant diseases affect food security. • I can explain in detail how and why ion deficiencies affect plant growth. • I can explain in detail how plant defence responses work. • I can interpret information from a scientific article to explain how plant to plant communication can be used as a form of defence. • I can explain why, if a large proportion of the population is vaccinated, the spread of the pathogen is reduced. • I can apply ideas about specificity of antibodies. • I can suggest a reasoned explanation for a pattern in data. • I can explain in detail how antibiotic resistant bacteria arise. • I can explain why scientists are constantly developing new antibiotics. • I can suggest why mould naturally produces antibiotics. • I can discuss how effective herbal remedies are. • I can analyse data to evaluate the effectiveness of new antibiotics and make a reasoned decision which one to develop further. • I can describe in some detail how new medical drugs are tested and trialled for safety, effectiveness, toxicity, efficacy, and dose. • I can critically analyse the results from a double blind trial. • I can explain why the results of drug trials are published in journals. • I can explain why hybridoma cells are used to produce monoclonal antibodies. • I can explain in detail how pregnancy tests work. • I can describe how monoclonal antibodies are used to produce ELISA tests and outline how they are used. • I can explain in detail how the methods of using monoclonal antibodies to treat cancer work.

		• I can evaluate the use of monoclonal antibodies in treating cancer compared to other treatments. **<u>Biology- Bioenergetics:</u>** • I can explain how adaptations of the leaf make photosynthesis efficient. • I can explain how adaptations of the leaf make photosynthesis efficient. • I can explain why chlorophyll is needed for photosynthesis. • I can apply knowledge of enzymes to explain why a high temperature affects the rate of photosynthesis. • I can predict how the rate of photosynthesis will be affected with more than one limiting factor. • I understand and can use the inverse square law and light intensity in the context of photosynthesis. • I can explain how carnivorous plants are adapted to their environment. • I can explain how and why plants convert glucose to starch for storage. • I can explain in detail how using greenhouses can help control limiting factors and increase the rate of photosynthesis. • I can use data to comment on the cost-effectiveness of greenhouses. • I can evaluate the use of greenhouses and hydroponics in terms of economics. • I can apply understanding of respiration in new contexts. • I can explain why respiration is an exothermic reaction. • I can explain why a control is necessary in some scientific investigations. • I can explain why stores of glycogen change with exercise. • I can justify he choice of chart/graph used to display data. • I can compare and contrast anaerobic respiration in animals, plants, and microorganisms. • I can explain in detail why heart and breathing rate continue to be high for a period of time after exercise. • I can write a prediction based on scientific knowledge. • I can explain the link between protein consumption and concentration of urea • in urine. • I can evaluate information to assess credibility.
		Half term holiday
Aut2-1	November	<u>Physics Electricity:</u> • I can compare the electrical properties of protons, neutrons, electrons, and ions. • I can use the concept of electric fields to explain why charged objects interact. • I can describe how objects become charged in terms of electron transfer. • I can describe the operation of a variable resistor and a diode and their effects on current. • I can calculate the charge transferred by a steady current in a given time. • I can construct an electrical circuit and accurately measure the current. • I can calculate the potential difference. • I can calculate the resistance of a component.
Aut2-2		
Aut2-3		
Aut2-4		
Aut2-5		
Aut2-6	December	

Aut2-7		• I can measure the effect of changing the length of a wire on its resistance in a controlled experiment. • I can describe the resistance characteristics of a filament lamp. • I can describe the characteristics of diode and light-emitting diode. • I can investigate the resistance characteristics of a thermistor and a LDR. • I can find the potential difference across a component in a circuit by using the p.d. rule. • I can calculate the current in a series circuit containing more than one resistor. • I can investigate the resistance of series circuits with several components. • I can measure the p.d. across parallel circuits and explain any discrepancies. • I can describe the effect on the resistance in a circuit of adding a resistor in parallel. • I can investigate the effect of adding resistors in parallel on the size of the current in a circuit. <u>Chemistry: Quantitative Chemistry:</u> • I can use the periodic table to find the relative atomic mass of all elements. • I can calculate the relative formula mass for unfamiliar compounds when the formula is given. • I can state the units for the amount of substance. • I can explain why chemical equations must be balanced. • I can calculate the relative formula mass for one substance when the relative formula masses are given for all the other substances in a balanced symbol equation. • I can explain why chemical equations must be balanced. • I can identify the limiting reactant in a chemical reaction. • I can calculate percentage yield when the actual yield is given and the mass of the limiting reactant is given. • I can list reasons why actual yield is often lower than theoretical yield. • I can calculate the atom economy for a given chemical reaction. • I can explain why using reactions with high atom economy is important. • I can explain how concentration of a solution can be changed. • I can calculate the concentration, in mol/dm3, of a solution when the number of moles and volume in dm3 is given. • I can calculate the concentration of a solution in g/dm3 of a solution when the number of moles and volume in dm3 is given. • I can calculate a titre. • I can describe how an indicator can be used to determine the end point. • I can explain how accuracy can be improved in a titration. • I can calculate the amount of acid or alkali needed in a neutralisation reaction. • I can convert units. • I can calculate the amount in moles of gas in a given volume at room temperature and pressure.
		Christmas holiday
Spr1-1 Spr1-2	January	<u>Chemistry- Chemical changes</u>

Spr1-3		• I can describe oxidation and reduction in terms of gain or loss of oxygen. • I can write word equations for the metals listed in the reactivity series reacting with oxygen, water, and acid and balance given symbol equations.
Spr1-4		
Spr1-5		
Spr1-6	February	• I can predict observations for the metals listed in the reactivity series reacting with oxygen, water, and acid. • I can explain why a displacement reaction occurs. • I can write word equations and straightforward balanced symbol equations for displacement reactions. • I can predict observations for the metals listed in the reactivity series reacting with a different metal salt. • I can identify species that are being oxidised and reduced in a chemical reaction. • I can explain why some metals are found uncombined in the Earth's crust. • I can describe how to make a salt by reacting a metal with an acid. • I can write a balanced symbol equation to describe a reaction between a metal and sulfuric acid or hydrochloric acid. • I can identify the formula of the salt produced from the reaction between an acid and a metal. • I can describe a method to prepare a pure, dry sample of a soluble salt from an insoluble substance and a dilute acid. • I can write a balanced symbol equation to describe a reaction between a metal hydroxide or oxide and sulfuric acid or hydrochloric acid. • I can explain why the reaction between a base and a dilute acid is a neutralisation reaction. • I can describe how to make a dry sample of a salt from reacting a metal carbonate or an alkali with a dilute acid. • I can write balanced symbol equations for neutralisation reactions. • I can describe how universal indicator can be used to classify a chemical as acidic or alkaline. • I can describe how solutions can be acidic or alkali. • I can describe the relationship between alkalis and bases. • I can recall examples of strong and weak acids. • I can describe how an acid or alkali can be concentrated or dilute. • I can describe how an acid or alkali can be weak or strong. <u>Biology- Homeostasis and response:</u> • I can define homeostasis. • I can explain why internal conditions need to be maintained. • I can identify stimuli, receptors, coordination centres and effectors in examples of nervous and chemical responses. • I can describe the pathway of impulses from receptor to effector. • I can describe how information is passed along neurones. • I can evaluate a method and describe how accuracy could be increased. • I can describe how reflex actions are fast and automatic. • I can describe the events involved in a reflex action. • I can describe the function of synapses. • I can describe the function of brain structures. • I can describe how regions of the brain have been mapped to particular functions. • I can choose the correct way to display data. • I can relate the structures of the eye to their functions.

		• I can describe how the eye focuses light. • I can describe how the lens changes shape to focus on near or distant objects. • I can describe how lenses and surgery can help with long and short sightedness. • I can explain why the pituitary gland is known as a 'master gland'. • I can describe the role of hormones released by endocrine glands. • I can describe what happens when blood glucose levels become too high or too low. • I can describe the difference in the causes of Type 1 and Type 2 diabetes. • I can explain why Type 1 diabetes is treated with insulin injections. • I can explain how Type 2 diabetes can be treated by changes to diet and exercise. • I can describe how the production of insulin for people with diabetes has developed over time. • I can describe the function of adrenaline and thyroxine. • I can interpret and explain diagrams of negative feedback control. • I can compare and contrast the changes to boys and girls during puberty. • I can name the hormones involved in the menstrual cycle. • I can name the glands that produce the hormones oestrogen, progesterone, LH and FSH. • I can describe the function of the hormones that control the menstrual cycle. • I can explain how contraceptives work. • I can list the advantages and disadvantages of different contraceptives. • I can describe what is meant by infertility and suggest reasons for it. • I can describe the steps used in IVF. • I can outline the issues surrounding IVF. • I can explain why plants need tropism. • I can use diagrams and descriptions to explain how plant shoots and roots respond to light and gravity. • I can plan and carry out an investigation into the effect of light on plant growth with limited guidance. • I can state some uses of plant hormones (giberellins, ethane and auxins) in agriculture, horticulture and food industry. • I can observe the effects of plant hormones.
		Half term holiday
Spr2-1		<u>Biology: Inheritance, variation and evolution</u> • I can describe the differences between asexual and sexual reproduction. • I can describe the advantages and disadvantages of sexual and asexual reproduction. • I can design a model to show why variation is produced in offspring from sexual reproduction but not in asexual reproduction. • I can describe the processes of mitosis and meiosis. • I can explain how meiosis halves the number of chromosomes in gametes and fertilisation restores the full number. • I can solve simple probability questions. • I can describe how malarial parasites and fungi reproduce both asexually and sexually. • I can list the ways plants can reproduce asexually.
Spr2-2		
Spr2-3	March	
Spr2-4		
Spr2-5		
Spr2-6		

		• I can explain in detail how plants reproduce sexually. • I can describe the relationship between DNA, genes and chromosomes. • I can describe how the four bases make up a code. • I can design and build a model of DNA to show each part. • I can describe some of the benefits of studying the human genome. • I can explain the goal of the 100 000 genomes project. • I can explain why genome projects are costly and take a long time. • I can describe the steps involved in producing a protein inside the cell. • I can state what a mutation is. • I can explain why the correct folding of a protein is important to its function. • I can use the terms allele, dominant, recessive, homozygous and heterozygous correctly. • I can describe a phenotype when given the genotype. • I can use a Punnett square diagram to predict the outcome of a monohybrid cross using the theory of probability. • I can carry out a genetic cross to show sex inheritance. • I can use direct proportion and simple ratios to express the outcome of a genetic cross. • • I can name examples of inherited disorders, such as cystic fibrosis and polydactyly. • I can use a genetic cross to explain how inherited disorders are passed on. • I can outline the methods used to screen embryos. • I can state advantages and disadvantages of embryo screening. • I can list some examples of variation in plants and categorise as being due to genetic, environmental causes or both. • I can suggest reasons why identical twins will start to show variation as they get older. • I can use data to explain why studying identical twins helps scientists investigate which traits have genetic causes. • I can explain how a mutation may lead to a new phenotype. • I can describe the steps that take place during evolution by natural selection. • I can analyse data from an activity modelling natural selection. • I can explain the process of selective breeding. • I can explain why humans have used selective breeding. • I can explain what inbreeding is and why it is a problem in dog breeding. • I can describe the steps used in genetic engineering to produce GM organisms. • I can analyse data to describe why growing GM crops maybe be beneficial to a farmer. • Describe the benefits of reproduction using cuttings or tissue culture rather than seeds, for plant growers. • I can describe how embryo transplants are produced and why they are clones. • I can explain why the animal produced using adult cells cloning is a clone. • I can design a flow chart to describe the process of adult cell cloning. • I can list some benefits and drawbacks of adult cell cloning. • I can outline the potential benefits and risks of genetic engineering.

		• I can describe economic and ethical concerns that people may have about cloning animals. • I can discuss why Mendel's work was not recognised until after his death. • I can correctly order important discoveries in gene therapy. • I can compare and contrast Darwin's and Lamarck's theories of evolution. • I can describe the theory of inheritance of acquired characteristics proposed by jean-Baptiste Lamarck. • I can design a storyboard to highlight important events that helped Darwin develop his theory. • I can explain how finches on different islands evolved different shaped beaks by natural selection. • I can describe several reasons why most people did not accept his theory when it was first published. • I can explain why it was important that Darwin collected a variety of evidence. • I can describe the steps in the process of speciation. • I can explain why there are species living on Madagascar that share some similarities with species found elsewhere. • I can carry out research to describe other examples of speciation. • I can describe how fossils are formed. • I can describe how fossils are evidence for evolution by natural selection. • I can explain why the fossil record is not complete. • I can describe how other organisms can cause an animal or plant to become extinct. • I can suggest a hypothesis for why an organism became extinct. • I can explain how fossil diagrams show how the horse has evolved. • I can suggest the effects of an asteroid, comet or meteorite strike on Earth. • I can explain how environmental change can cause mass extinctions. • I can identify strengths and weaknesses in two different theories of mass extinction. • I can describe how antibiotic resistant bacteria evolve. • I can explain why scientists need to develop new antibiotics. • I can create an information sheet outlining important facts about antibiotic resistant bacteria to the public. • I can describe the classification system developed by Carl Linnaeus, to include the order of the taxonomic groups. • I can identify genus and species from a scientific name. • I can explain why a binomial naming system is useful. <u>Chemistry: energy changes:</u> • I can describe examples of exothermic and endothermic reactions. • I can explain, using observations from calorimetry, how to classify a reaction as exothermic or endothermic. • I can explain in detail how to carry out a calorimetry experiment. • I can explain how an energy change from a chemical reaction can be used. • I can write balanced symbol equations for familiar reactions. • I can label activation energy on a reaction profile diagram. • I can generate a specific reaction profile diagram for a given chemical reaction when its energy change is also supplied.

		• I can identify bonds broken in reactants and new bonds made in products of a reaction. • I can explain, using the particle model, how reactants become products in a chemical reaction. • I can explain why bond breaking is endothermic and bond making is exothermic. • I can define bond energy and identify all the bonds that break and are made in a chemical reaction.
	April	**Easter holiday**
Sum1-1		<u>Chemistry: Rate of reaction:</u> • I can explain how there can be different units for measuring rate of reaction. • I can calculate the mean rate of reaction. • I can calculate the rate of reaction at a specific time. • I can describe how changing the surface area changes the rate of reaction. • I can describe what the activation energy of a reaction is. • I can calculate the surface area to volume ratio. • I can use collision theory to explain how changing temperature alters the rate of reaction. • I can calculate mean rates of reaction. • I can use collision theory to explain how changing concentration or pressure alters the rate of reaction. • I can calculate mean rates of reaction. • I can explain how to change gas pressure. • I can use collision theory to explain how adding a catalyst alters the rate of reaction. • I can explain, with an example, the industrial use of a catalyst. • I can calculate the mean rate of reaction. • I can explain, using a familiar reaction, how a reaction can be reversible. • I can describe a familiar reversible reaction using a balanced symbol equation. • I can predict the observations of a familiar reversible reaction when the conditions are changed. • I can explain why the energy change in a reversible reaction is exothermic in one • direction and endothermic in the reverse direction. • I can generate balanced symbol equations for reversible reactions from information • provided. • I can make predictive observations of familiar reversible reactions when information is supplied. • I can describe how to achieve dynamic equilibrium. • I can describe how the rate of the forward reaction compares to the rate of the backward reaction in dynamic equilibrium. • I can describe Le Chatelier's Principle. • I can explain how changing conditions for a system at dynamic equilibrium affects the rate of the forward and reverse reactions. • I can predict the effect on yield of changing temperature, concentration, or pressure in a given equilibrium system. <u>Physics: Forces:</u> • I can use free body diagrams to qualitatively describe examples where several forces act on an object, and explain how that leads to a single resultant force or no force
Sum1-2		
Sum1-3	May	
Sum1-4		
Sum1-5		
Sum1-6		

		• I can use free body diagrams, and accurate vector diagrams to scale, to resolve multiple forces and show magnitude and direction of the resultant, or represent one force as two component forces at right angles • I can explain why the pressure at a point in a fluid increases with the height of the column of fluid above that point and with the density of the fluid, and calculate differences in pressure at different depths in a liquid by applying, but • I can describe upthrust in terms of a greater pressure on the bottom surface of an object than on its top surface, and so explain why the density of the fluid has an effect on the upthrust experienced by an object submerged in it • I can explain why an object floats or sinks, with reference to its weight, volume and the upthrust it experiences • I can explain, giving examples, that when an object moves in a circle at a constant speed, the direction of the object is continually changing, as is the velocity • I can calculate the speed of an accelerating object at any point by drawing a tangent to the distance-time graph and measuring its gradient • I can apply, but not recall, the equation: [v^2 – u^2 = 2as] • I can describe inertia as the tendency of objects to continue in their state of rest or of uniform motion, and inertial mass as a measure of how difficult it is to change the velocity of an object, defining it as the ratio of force over acc I can estimate the forces involved in the deceleration of road vehicles
	June	**Half term holiday**
Sum2-1 Sum2-2 Sum2-3 Sum2-4		<u>Physics: Waves:</u> • I can describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids, examples may include the effect of sound waves on the ear drum • I can explain why such processes only work over a limited frequency range and the relevance of this to the range of human hearing, which is from 20 Hz to 20 kHz • I can explain how different wavelengths of electromagnetic radiation are reflected, refracted, absorbed or transmitted differently by different substances and types of surface • I can describe that refraction is due to the difference in velocity of waves in different substances, and illustrate this using wave front diagrams • I can explain that radio waves can be produced by oscillations in electrical circuits, or absorbed by electrical circuits, inducing an alternating current with the same frequency • I can explain and apply the idea that the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted, such that when they are equal the temperature is constant, and when uneven the temperature • I can describe the temperature of the Earth as dependent on the rates of absorption and emission of radiation, and draw and interpret diagrams that show how this radiation affects the temperature of the Earth's surface and atmosphere. <u>PREPARATION FOR END OF YEAR EXAMS AND REVIEWING REQUIRED PRACTICALS.</u>
Sum2-5 Sum2-6 Sum2-7	July	