Department: *Science*						Year Group: 11
Term	Topic/Subject	Assessment Objectives and Knowledge (include differentiation)	Skills (include differentiation)	Literacy, Numeracy (including wider reading)	Personal Development (SMSC, British Values, Careers, Healthy Living, Citizenship Equality and Diversity, Preparation for next stages)	AFL/Summative Assessment
Autumn	C6 The rate and extent of chemical change	Be able to find the rate of a chemical reaction by measuring the quantity of reactant or product used in g/s or cm^3/s. (HT) use quantity of reactants in moles and rate of reaction in mol/s. Be able to draw and interpret graphs showing the quantity of product formed or reactant used up against time. Draw tangents to the curves of reaction rate graphs and use the slope of the tangent to measure the rate of reaction. (HT) calculate the gradient of a tangent to the curve on a reaction rate graph. Understand the factors which affect the rate of chemical reactions as concentrations of reactants, pressure, surface area, temperature and catalysts. Conduct a required practical to investigate how changes in concentration affect rates of reaction. Be able to explain how collision theory affects rates of reactions. Make predictions and explain the effects of changing conditions of reactions including changing the surface area to volume ratio. Be able to explain how catalysts affect the rate of reactions and explain catalytic action in terms of activation energy. Be able to identify and explain the reaction profile for a catalysed reaction. Be able to describe what a reversible reaction is. Understand energy changes in reversible reactions in terms of exothermic one direction, endothermic the opposite direction.	Safely using specified equipment and conduct practicals to measure the rate of reactions. Take accurate measurements of changes in mass or gas volume. Calculate rates of reaction from experimental data. Draw graphs from experimental data, determining slope and intersect. Conduct a practical to investigate how changes in	Using ratios, fractions and percentages. Measuring Conversion of units. Drawing and interpreting graphs. (HT) calculating gradient of a tangent. Calculate means.	Safely working with others. Understanding that in industry chemists and chemical engineers determine the effect of different variables on reaction rates to maximise the yield of product in an energy and time efficient way.	Graph question on rates of reaction Concentration 6 marker – method for practical End of Unit test

		Understand when equilibrium in a reversible reaction is reached. (HT) Be able to predict the effects of changing conditions on a system at equilibrium, applying Le Chatelier's Principle. (HT) Be able to interpret data to predict the effect of a change in concentration of a reactant or product, the change in temperature of a system and the change in pressure of a system on given reactions at equilibrium.	concentration affect reaction rate. Develop a hypothesis. Conduct a practical to investigate catalytic effects on reactions.			
Autumn	B6 Inheritance, Variation and Evolution	Understand that meiosis leads to non-identical cells being formed while mitosis leads to identical cells. Understand that sexual reproduction involves the fusion of male and female gametes and what these are in animals and plants. Be able to explain how sexual reproduction leads to a variety in offspring and asexual reproduction produces identical offspring. Be able to explain how meiosis changes the number of chromosomes in gametes. Be able to explain how fertilisation restores the number of chromosomes and how a new cell divides by mitosis to form an embryo. ***Be able to describe the advantages and disadvantages of sexual and asexual reproduction.*** ***Be able to describe how some organisms reproduce by both sexual and asexual reproduction depending on circumstances.*** Be able to describe the structure of DNA and define genome. Be able to discuss the importance of understanding the human genome project. ***Be able to describe DNA as a polymer made from four different nucleotides.*** ***Identify the four bases in DNA.*** ***(HT)Explain that the bases A and T, and C and G, are complementary*** ***(HT) Be able to recall a simple description of protein synthesis*** ***(HT) Be able to explain how the structure of DNA affects the protein made.*** ***(HT) Be able to describe how genetic variants may influence phenotype.***	Modelling behaviour of chromosomes during meiosis. ***Interpret diagrams of the structure of DNA.*** ***Model insertions and deletions in chromosomes to illustrate mutations.*** Complete Punnett square diagrams. Carry out genetic crosses. Make informed judgements about the economic, social and ethical issues concerning embryo screening given information.	Understand and use fractions and percentages. Understand and use ratio and proportion. Understand and use probability when predicting the outcomes of genetic crosses. Use information given to produce an argument for/against.	***Have an understanding of the historical developments of our understanding of the causes and prevention of malaria.*** Consider ethical issues which may arise from embryo screening and gene therapy. Understand how scientific theories change over time and can be the result of cooperation between scientists across the World. Understand how some bacteria have evolved to become antibiotic resistant and the importance therefore of	Genetic crosses assessment. 6 mark question - Speciation in a herring gul End of unit test

		(HT) Describe how mutations affect protein function. Be able to explain key terms for genetic inheritance such as gamete, chromosome, gene, dominant, recessive, genotype, phenotype, homozygous and heterozygous. Know that some characteristics are controlled by single genes but most are the result of multiple genes interacting. Be able to use direct proportion an simple ratios to express the outcome of a genetic cross. Be able to complete a Punnett square diagram and extract and interpret information from genetic crosses and family trees. (HT) Be able to use a Punnett square diagram to make predictions using the theory of probability. Understand that some disorders are inherited; polydactyly from a dominant allele and cystic fibrosis caused by a recessive allele. Be able to explain the economic, social and ethical issues concerned with embryo screening. Understand how chromosomes determine sex in humans. Recall that differences in the characteristics of individuals in a population is called variation. Understand the genetic and environmental differences leading to variation. Recall that all species of living things have evolved from simple life forms. Explain how evolution occurs through natural selection. Describe what selective breeding is, why it takes place and the problems caused by inbreeding. Be able to describe what genetic engineering is and the potential benefits and risks in agriculture and medicine. Describe how bacterial cells are engineered to produce human insulin. (HT) Be able to describe the main steps in the process of genetic engineering. ***Describe the process of cloning relating to tissue culture, cuttings, embryo transplants and adult cell cloning.*** ***Explain the evidence that led Darwin to propose the theory of evolution by natural selection.*** ***Be able to describe why the theory of evolution by natural selection was only gradually accepted and be able to compare it with other theories such as that of Jean-Baptiste Lamarck.*** ***Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection and explain the***	Use the theory of evolution by natural selection in an explanation. Explain the benefits and risks of selective breeding given appropriate information and consider the ethical issues. (HT) Interpret information about genetic engineering techniques and make informed judgements about issues concerning cloning and genetic engineering, including GM crops. (HT) Interpret information about genetic engineering techniques and make informed judgements about issues concerning cloning and genetic engineering, including GM crops.		completing courses of antibiotics. Understand ethical issues related to selective breeding but also the benefits it has in a growing population. ***Understand the benefits and risks of cloning in agriculture and medicine and the ethical issues involved.***	

		impact of these ideas on biology. ***Describe the development of our understanding of genetics including the work of Mendel.*** ***Understand why the importance of Mendel's discovery was not recognised until after his death.*** To be able to describe the evidence for evolution including fossils and antibiotic resistance in bacteria. Be able to describe what fossils are, how they have formed and how they can show how different organisms have changed as life developed on earth. Describe what extinction is and the factors that contribute to the extinction of a species. Recall that bacteria develop that are resistant to antibiotics, which is evidence of evolution. Understand the mechanism by which antibiotic resistance develops. Understand the effects of the development of antibiotic resistance on the treatment of disease. Describe how to reduce the rate of development of antibiotic resistance. Understand the requirement for, and the impact of, new antibiotics. Recognise the difficulties associated with developing new antibiotics. Describe how living things have been classified into groups using a system devised by Carl Linnaeus. Describe how new models of classification have developed. Understand the use of evolutionary trees.	***Explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections.*** ***Appreciate that the history of evolution by natural selection developed over time and from information gathered by scientists.*** Extract and interpret information from fossils. Appreciate why the fossil record is incomplete. Interpret evolutionary trees			
Autumn	P5 Forces	To understand what a scalar and vector quantity is, with examples. To describe what a force is and give examples of contact and non-contact forces. Be able to describe the interaction between pairs of objects which produce a force on each other. Be able to describe what weight is and how the force of gravity changes around the Earth. Be able to calculate the weight of an object from its mass and gravitational field strength. Know that weight is measured using a calibrated spring-	Be able to recall and apply the equation for weight. Be able to recognise and use the symbol of proportionality. Be able to recall	Apply the formula for weight with given variables. Conversion of units. Apply the formula for work done with	Engineers analyse forces when designing many machines and instruments we use every day, from road bridges, fairground rides and cars. Recent	Required practical acceleration 6 mark question - Stopping distance End of unit test

		balance. Understand what resultant force is and be able to calculate the resultant force of two forces acting in a straight line. (HT) Be able to describe examples of forces acting on an isolated object or system. (HT) Be able to use free body diagrams to describe qualitatively examples where several forces lead to resultant force on an object, including balanced forces. To understand what work done is. Recall and apply the equation for calculating work done using force and distance moved. Be able to describe the energy transfer when work is done. Be able to convert between newton-metres and joules. Be able to give examples of the forces involved in stretching, bending or compressing objects. Be able to explain why to change the shape of a stationary object more than one force has to be applied. Be able to describe the difference between elastic deformation and inelastic deformation caused by stretching forces. Know that the extension of an elastic object, such as a spring, is directly proportional to the force applied, provided the limit of proportionality is not exceeded (Hooke's law). Be able to calculate force on a spring using it's spring constant and extension. Describe the difference between a linear and non-linear relationship between force and extension. Be able to calculate a spring constant in linear cases. Be able to interpret data from an investigation between force and extension. Calculate work done in stretching a spring using the equation given for elastic potential energy. Conduct a required practical to investigate the relationship between force and extension of a spring. ***Describe the turning effect of a force about a pivot.*** ***Explain and use the principle of moments.*** ***Calculate the size of moments.*** ***Be able to explain how levers and gears transmit the rotational effects of forces.*** ***Understand a fluid is a liquid or gas.*** ***Describe the pressure in fluids and calculate the pressure at the surface of a fluid.*** ***(HT) Be able to calculate the pressure due to a column of***	and apply the equation for work done. Be able to safely demonstrate Hooke's law though practical. Be able to recall and apply the equation for force on a spring. Be able to apply the equation for elastic potential energy. Using appropriate equipment to make and record a range of measurements and observations accurately in order to investigate the relationship between force and extension of a spring. Use results to produce a graph. ***Be able to recall and apply the equation for moment of a force.*** ***Be able to recall***	given variables. Rearrange equations. Apply the formula for force on a spring with given variables. Apply the formula for elastic potential energy with given variables. ***Apply the equation for moments of a force.*** ***Apply the equation for calculating pressure at the surface of a fluid.*** ***Apply the equation for calculating pressure in a column of liquid.*** Change the subject of an equation. Substitute numerical	developments using analysis of forces include artificial limbs to make movement possible for disabled people. Understand how terminal velocity relates to parachutes.	

		liquid and the differences in pressure at different depths in a liquid. ***(HT) Be able to describe the factors which influence floating and sinking.*** ***Be able to describe a simple model of the earth's atmosphere and of atmospheric pressure.*** ***Explain why atmospheric pressure varies with height above a surface.*** To be able to express a displacement in terms of magnitude and direction. Recall that speed is a scalar quantity and typical values of speed for a person walking, running, cycling and speed for different types of transportation. Recall speed of sound is 330m/s. Be able to measure distance and time to calculate speed of objects and use the distance = speed x time equation, Recall that velocity is a vector quantity. (HT) Explain qualitatively, with examples, that motion in a circle involves constant speed but changing velocity. Be able to draw distance-time graphs from measurements and extract and interpret lines and slopes. Be able to determine speed from the gradient of a distance-time graph. (HT) Be able to calculate the speed of an accelerating object at a particular time by drawing a tangent and measuring the gradient of the distance-time graph. Be able to calculate acceleration using the equation acceleration = change in velocity/ time taken. Be able to calculate the acceleration of an object from the gradient of a velocity-time graph. Be able to apply the equation to calculate uniform acceleration. Know that an object falling freely under gravity has an acceleration of about 9.8m/s^2 Understand that eventually an object falling through a fluid will move at its terminal velocity. ***Be able to draw and interpret velocity-time graphs for objects that reach terminal velocity, and. Be able to interpret the changing motion in terms of forces acting.*** To understand and apply Newton's First Law regarding resultant forces and motion of objects. (HT) To know what inertia is.	***and apply the equation for calculating pressure at the surface of a fluid.*** ***(HT) Be able to apply the equation for calculating pressure in a column of liquid.*** Recall and apply	values into algebraic equations using appropriate units. Use ratios and proportional reasoning to convert units and compute rates. Apply the equation for calculating speed. Measure speed and distance Draw graphs of distance / time Apply the equation for calculating acceleration Draw graphs of velocity and time Find the gradient of a graph Apply the equation to calculate resultant forces		

		To understand Newton's second Law of motion regarding the acceleration of an object. Be able to recognise and use the symbol for proportionality Be able to recall and apply the equation: resultant force = mass x acceleration. (HT) be able to explain that initial mass is a measure of how difficult it is the change velocity of an abject and is defined as a ratio of force over acceleration. Be able to estimate speed, accelerations and forces and recognise the symbol for approximate value/answer To be able to carry out the required practical to investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force. Be able to describe and apply Newton's Third Law when objects interact they exert equal and opposite forces on each other. To know what the stopping distance of a vehicle is. ***Be able to estimate how the distance for a vehicle making an emergency stop varies over a range of speeds.*** ***Be able to interpret graphs relating to stopping distances.*** Know that reaction times vary between people and can be affected by tiredness, drugs, alcohol and distractions. Be able to explain how to measure human reaction times Be able to interpret and evaluate measurements to measure reaction times. Be able to evaluate the effect of various factors on thinking distance from given data.	the equation for calculating speed. Using appropriate equipment to measure distance and time accurately. Draw graphs of distance and time to calculate speed. Recall and apply the equation for calculating acceleration. Draw graphs of velocity and time to calculate acceleration. ***Calculate displacement of an object by calculating the area under a velocity-time graph*** ***Investigate the effect of air resistance on a falling object.***			

			Be able to recognise the symbol for proportionality Recall and apply the equation to calculate resultant force Recognise and use the symbol for approximate value Use appropriate equipment to make and record measurements to investigate the effect of force on acceleration			
Spring	P7 Electromagnetism	Explain what is meant by the poles of a magnet. Plot the magnetic field around a bar magnet. Describe magnetic materials and induced magnetism. Describe the Earth's magnetic field. Describe the magnetic effect of a current. Draw the magnetic field around a conducting wire and a solenoid. Describe the force on a wire in a magnetic field. Explain the meaning of magnetic flux density, B. Calculate the force on a current-carrying conductor in a magnetic field. List equipment that uses motors. Describe how motors work. Describe how to change the speed and direction of rotation of a motor.	Students should be able to apply this equation which is given on the Physics equation sheet. force = magnetic -ux density × current × length	Calculating mean Using equations to calculate the motor effect	Safe use of electricity. Potential use of maglev trains and the reduction in use of fossil fuels	Plotting a magnetic field practical Method for the electromagnet practical Triple – how does a loud speaker work End of unit test

		Explore how electricity and magnetism are connected. Describe simple uses of electromagnets. Change the subject of an equation. **Fleming's left-hand rule (HT only)** **Electric motors (HT only)** **Loudspeakers (physics only) (HT only)** **Induced potential, transformers and the National Grid (physics only)** **(HT only)** an electrical conductor moves relative to a magnetic field or if there is a change in the magnetic field around a conductor, a potential difference is induced across the ends of the conductor. If the conductor is part of a complete circuit, a current is induced in the conductor. This is called the generator effect. **Uses of the generator effect (HT only)** **Microphones (HT only)** Microphones use the generator effect to convert the pressure variations in sound waves into variations in current in electrical circuits. Students should be able to explain how a moving-coil microphone works. **Transformers (HT only)** A basic transformer consists of a primary coil and a secondary coil wound on an iron core. explain how the effect of an alternating current in one coil in inducing a current in another is used in transformers •• explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each •• calculate the current drawn from the input supply to provide a particular power output MS 3b, c Students should be able to apply this equation which				

		is given on the Physics equation sheet. •• apply the equation linking the pds and number of turns in the two coils of a transformer to the currents and the power transfer involved, and relate these to the advantages of power transmission at high potential differences				
Spring	C10 using Resources	Give examples of natural products replaced by synthetics. Give examples of products replaced by agricultural products. Distinguish between finite and renewable resources. Distinguish between potable water and pure water. Describe the differences in treatment of groundwater and salty water. Give reasons for the steps used to produce potable water. Describe how safety is managed, apparatus is used and accurate measurements are made. Recognise when sampling techniques need to be used and made representative. Explain how waste water is treated. Describe how sewage is treated. Compare the ease of treating waste, ground and salt water. Describe the process of phytomining. Describe the process of bioleaching. Evaluate alternative biological methods of metal extraction. Describe the components of a Life Cycle Assessment (LCA). Interpret LCAs of materials or products from information. Carry out a simple comparative LCA for shopping bags. Describe ways of recycling and reusing materials. Explain why recycling, reusing and reducing are needed.	Evaluate methods and suggest possible improvements and further investigations. Evaluate ways of reducing the use of limited resources. To represent information from pie charts numerically. To represent information from graphs numerically. To represent information from numerical form graphically.	Use ratios, fractions and percentages; Make order of magnitude calculations; Translate information between graphical and numeric form. Recognise and use expressions in decimal form; Use ratios, fractions and percentages; Make estimates of the results of simple calculations; Use an appropriate number of significant figures; Translate information between graphical and numerical	Metal recycling as an environmental and economic issue. Impact of humans on the environment. Recycling as an environmental and economic issue. Use of life cycle assessments in industry. Discussion of lack of potable water around the world. Human impact on the marine environment – over fishing and plastic pollution.	Required practical waste water sheet Comparison of glass and water milk bottles Advantages and disadvantages of recycling End of unit test

				forms. Use ratios, fractions and percentages Recognise and use expressions in standard form.		
Spring	P8 Space- Physics only	Describe the orbits of planets and moons in the Solar System. Distinguish between planets, dwarf planets and moons. Compare the orbital motion of moons, artificial satellites and planets in the Solar System. Describe what keeps bodies in orbit around planets and stars. Explain how for circular orbits, an object can have a changing velocity but unchanged speed. Explain why bodies must move at a particular speed to stay in orbit at a particular distance. Describe how the Sun and other stars formed. Describe the nuclear fusion reactions in the Sun. Describe the main sequence stage of a star's life cycle. Identify the forces that are in equilibrium in a stable star. Describe the life cycles of a star like the Sun and a massive star. Understand how new elements are produced by nuclear fusion inside a star. Recognise that the heavier elements are made in a supernova. Describe red-shift. Describe evidence for the expanding Universe. Understand that gravity provides the force that keeps planets and satellites in orbits. Understand that gravity is necessary at the start of a star's life cycle and to maintain equilibrium in a stable star.	Understand the scale of objects in the Universe.	Use standard form	space probes – links to engineering and technology history of lunar exploration – links to aerospace engineering Lenses in telescopes – optometry	Life cycle of a star Describe the evidence that the Universe is expanding End of unit test

		Describe how the weight of an object depends on the gravitational field strength. Recognise that that there is still much about the universe that is not understood, for example dark mass and dark energy. .				
Spring	C8 chemical analysis	Describe, explain and exemplify processes of separation. Suggest separation and purification techniques for mixtures. Distinguish pure and impure substances using melting point and boiling point data. Identify formulations given appropriate information. Explain the particular purpose of each chemical in a mixture. Explain how quantities are carefully measured for formulation. Explain how to set up paper chromatography. Distinguish pure from impure substances. Interpret chromatograms and determine R_f values. chromatography apparatus and how accurate measurements are achieved. Make and record measurements used in paper chromatography. Calculate R_f values Recall the tests for four common gases. Identify the four common gases using these tests. Explain why limewater can be used for testing CO_2. Measure distances on chromatograms. Calculate R_f values. Record R_f values to an appropriate number of significant figures. ***Triple only- Identification of ions by chemical and spectroscopic means*** ***(chemistry only) Flame test, Metal hydroxides, Carbonates, Halides, Sulfates.*** ***Instrumental methods*** ***Flame emission spectroscopy***	• Recall the tests for four common gases. • Identify the four common gases using these tests. • Explain why limewater can be used for testing CO_2. • Measure distances on chromatograms. • Calculate R_f values. Record R_f values to an appropriate number of significant figures. ***Triple only- Identification of ions by chemical and spectroscopic means*** ***(chemistry only) Flame tests An opportunity to investigate flame colours. An opportunity to make precipitates of metal hydroxides.***	Make estimates of the results of simple calculations. Use ratios, fractions and percentages. Recognise and use expressions in decimal form.	The importance of identifying chemicals in forensics and the food industry – linked to food security	Required practical chromatography Describe how to test for common gases Method for the different tests – triple only End of unit test

			Required practical 7: use of chemical tests to identify the ions in unknown single ionic compounds covering the ions from sections Flame tests to Sulfates. ***An opportunity to observe flame spectra using a hand-held spectroscope.***			