Alcester Academy Curriculum Planning: Key Stage 4 (Year 10)

Department: Science Year Group: 10						
Term	Topic/Subject	Assessment Objectives and Knowledge acquisition	Skill building *Intent*	Wider reading to include numeracy and SMSC	SEND & PP Identify where access and learning is supported	Final assessment task and title
Autumn	P2 Electricity	Be able to draw and interpret circuit symbols. Understand what is meant by electric current and state the equation charge flow = current X time. Know the symbols and units for each of these. Be able to explain what happens to the current in a circuit as resistance is changed. Understand this relationship as a product of voltage = current X resistance. Know the symbols and units for each of these. **Required practical**: investigate the relationship between the length of a wire and the resistance in a circuit, and combinations of resistors in series and parallel. Explain the difference between an ohmic and non-ohmic conductor. Know the I-V characteristics for a filament lamp, diode and an ohmic conductor.	Use a variety of models to solve problems, make predictions and develop scientific explanations of familiar and unfamiliar facts. Use appropriate apparatus to measure values. Plan experiments to make observations and test hypotheses. Evaluate methods and suggest possible improvements and further investigations. Present observation using appropriate methods. Present reasoned explanations including relating data to hypotheses.	Recall and apply equations. Wider reading around electrical safety in the home Issues around our use of electricity and how this can be reduced (linked to generation) Recall and apply equations. Interpret graphs Recall and apply equations. Plotting graphs.	Students are ability set Smaller groups for set 4 and 5 Careful seating plans All PP will be offered a revision guide Encourage use of HW club Content differentiation as highlighted between triple, higher and foundation Use of TA support in lessons Bespoke revision support where available	End of topic test. Comparing series and parallel circuits longer answer. Resistance in a wire practical task

		Required practical: use circuit diagrams to investigate the I-V characteristics of a diode, filament lamp and an ohmic conductor. Know the factors that affect resistance in a thermistor and a LDR. Know the application of both of these components in circuitry. Explain the design and use of a circuit to measure the resistance of a component. Understand the difference between series and parallel circuits. Understand the patterns of current, potential difference and resistance in both series and parallel circuits. Apply such knowledge to solve problems for circuits. Be able to state the voltage and frequency of UK mains. Be able to explain the difference between AC and DC. Be able to identify the three wires that make up the three-core cable in electrical appliances. State the roles of these three wires and give the approximate potential difference of each relative to one another. Explain when the three-core cable can become dangerous (connection between the live and earth wire).	Use appropriate apparatus to measure values. Plan experiments to make observations and test hypotheses. Evaluate methods and suggest possible improvements and further investigations. Present observation using appropriate methods. Present reasoned explanations including relating data to hypotheses. Explaining phenomena mathematically.	Recall and apply equations. Plotting graphs.	Use of LSU to chase parents evening appointments and follow up	

		Explain that power is related to the potential difference across it and the current through it. Recall the apply the equations: power – potential difference X current and power = (current)^2 X resistance. Know the symbols and units for all these subjects. Understand that everyday appliances are designed to bring about energy transfers. Recall and apply the equations: energy transferred = power X time and energy transferred = charge flow X potential difference. Describe the relationship between the power ratings for domestic appliances and the changes in stored energy when they are in use. Understand what the national grid is. Describe the roles of step-up transformers and step-down transformers. **Higher physics only:** state what a transformer consists of and utilise the equation: $\left[\frac{V_p}{V_s} = \frac{N_p}{N_s}\right]$ Apply the equation to the currents and power transfer involved, and relate these to the advantages and disadvantages of power transmission at high potential differences.	Utilising equations to explain phenomena.	Recall and apply equations. Mathematically represent relationships. Recall and apply equations. Recall and apply equations.		

		Physics only: ***Describe what causes static.*** ***Describe evidence of charged objects exhibiting attraction and repulsion.*** ***Draw the electric field for an isolated charged sphere. Explain an electric field.***				
Autumn	B2 Human Organisation	Understand what cells, tissues, organs and organ systems are. Describe the structure and function of the digestive system. Explain what enzymes are and how they work using the "lock and key" model. Relate the factors temperature and pH to their rate of action. To recall the sites of lipase, amylase and protease production and state their functions. To state the products of the breakdown of carbohydrates, lipids and proteins and recognise simple equations to represent these changes. Explain what bile does and how it achieves its function. **Required practical:** To carry out food tests for starch, reducing sugars, lipids and proteins. **Required practical:** To carry out an investigation into the effect that pH	Be able to convert between units. Build up an appreciation of size and scale. Mathematics improvement through enzyme rate calculations. Use appropriate apparatus to measure values. Plan experiments to make observations and test hypotheses. Evaluate methods and suggest possible improvements and further investigations. Present observation using appropriate methods.	Interpret graphs of breathing, HR etc Wider reading around transplants Calculations. Discussions around the use of transplanted organs Links to health and responsibility to maintain our own health eg diet, smoking		End of topic test. practical on enzyme activity write up sheet.

		has on amylase's ability to break down starch State and describe differences between the three type of blood vessels. Describe how to structure of these vessels relates to their function. Be able to name the different parts of the heart and explain what is meant by the double-circulatory system. Explain how the heart beat is controlled. State the three components of the blood and describe the function of each. Describe what causes coronary heart disease and evaluate the advantages and disadvantages of treating this by either use of drugs, mechanical devices or transplant. Be able to describe the differences between health and disease and the interactions between certain types of disease To outline some of the factors that may increase the risk of one developing non-communicable diseases. Describe the negative impacts that non-communicable	Safely use a microscope to observe blood cells. Evaluate different methods of treatment bearing in mind the risks associated with each. Translate disease information between different forms to identify a correlation between two variables. Interpret data about risk factors	Appreciating risk factors for illnesses. To appreciate some of the choices in life that can lead to negative health conditions. Constructing a method for the practical activity. . Promoting construction of evaluate method Interpret data on histograms, bar charts, frequency tables and scatter diagrams to study		

		diseases have at an individual, national and global level. To describe cancer as uncontrolled cell division. To explain the difference between malignant and benign tumours and explain how they can spread to form secondary tumours. To outline some of the risk factors for cancer.		incidences of diseases. Understanding the principles of sampling as applied to scientific data.		
Autumn	C4 Chemical changes	Understand that metals react with oxygen to produce metal oxides. Explain oxidation and reduction in terms of gain or loss of oxygen. Recall and describe the reactions of certain metals with dilute acids and place them in order of reactivity. Explain that the reactivity of a metal relates to its ability to form a positive ion. Deduce an order of reactivity bases on results. **Higher only:** Explain oxidation and reduction in terms of electron transfer. Write ionic equations for displacement reactions. Identify	Apply knowledge of a range of techniques, instruments, apparatus and materials to select those appropriate to the experiment. Correctly manipulate apparatus to carry out an experiment affectively. Safe use of equipment.	Forming chemical equations reinforcement. Issues of safety with use of chemicals Reactivity of metals linked to their use and extraction – conserving resources for	Issues of safety with use of chemicals Reactivity of metals linked to their use and extraction – conserving resources for future generations	End of topic test Making copper sulphate 6 mark question Making salts worksheet.

		which species are being oxidised and reduced. To know that acid and alkali yields salt and water. To be able to name the salt produced based upon the acid and the alkali used. To know that acid and carbonate yields salt and water and carbon dioxide. Use the formulae and common ions to deduce formulae of salts. To explain how soluble salts can be formed from acid and metals, metal oxides and hydroxides **Required practical:** To make an sample of a soluble salt from an insoluble oxide or carbonate. To understand what the pH scale shows and how such values can be measured in a laboratory. To understand that acids produce H^+ ions and that alkalis produce OH^- ions in solution. **Higher only:** Be able to explain why acids are considered to be strong or weak. Explain the difference between dilute and weak acids, and weak and strong acids.	se a variety of models to solve problems, make predictions and develop scientific explanations of familiar and unfamiliar facts.	future generations Forming chemical equations reinforcement. Constructing a method for the practical. Make order of magnitude calculations.		

		Explain pH value in terms of the concentration of hydrogen ions in solution and know what as the pH value decreases by 1, the hydrogen ion concentration increases by a factor of 10. Know that for a molten ionic substance, the metal is produced at the negative anode and that the non-metal is produced at the positive cathode. State when it is appropriate to use electrolysis as a method for metal extraction. Know that lots of energy is required in electrolysis. For the separation of aluminium oxide, state why mixture with cryolite is necessary. Explain why the anode muse be continually replaced. Students should be able to predict the products of the electrolysis of aqueous solutions containing a single ionic compound. **Required practical:** investigate what happens when aqueous solutions are electrolysed using inert electrodes. **Higher only:** to be able to represent oxidation and reduction reacts at the cathode and anode as half equations.		Practical method write up. Balancing equations.		

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Spring	C7 Hydrocarbons	**CRUDE OIL AND HYDROCARBONS** **to know:** How is crude oil separated? What are the hydrocarbons that make up crude oil? How does the size of hydrocarbons affect flammability? **PROPERTIES OF HYDROCARBONS** What is incomplete combustion? How is the supply of petrol increased to match the demand? What is an unsaturated hydrocarbon? ***Triple oinly*** ***ALCOHOLS AND CARBOXYLIC ACIDS How is fermentation used to make alcohol? What is the functional group of a carboxylic acid? How are carboxylic acids used to make perfumes?*** ***ADDITION AND CONDENSATION POLYMERS Why is poly(ethene) known as an addition polymer? What does the formula of a polymer tell us? Why is polyester known as a condensation polymer? AMINO ACIDS, DNA AND OTHER NATURAL POLYMERS How many functional groups do amino acids have? How do the parts***	Make models of alkanes molecules using the molecular model kits Investigate the properties of different hydrocarbons.. Evaluate risks both in practical science and in the wider social context Plan experiments or devise procedures to make observations and test hypothesis. Plan experiments or devise procedures to make observations and test hypothesis.	Visualise and represent two-dimensional and three-dimensional forms including 2D representations of 3D objects. Plot two variables from experimental or other data Use ratios, fractions and percentages Use SI units and IUPAC chemical nomenclature unless inappropriate Additional reading around oil spill disasters such as deep water horizon. use of hydrocarbons and how this impacts the environment Understand why changes to		Fractional distillation of For triple – describe the uses of polymers (related to properties)

		of the DNA structure fit together? Why are starch and cellulose known as polymers?		our use of hydrocarbons may be slow and the impact the governments have on this Appreciate why petroleum companies are so influential Link to the impact that hydrocarbon use has on the environment Careers links within the petrochemicals and plastics industries		
Spring	P6 Waves	Waves may be either transverse or longitudinal. The ripples on a water surface are an example of a transverse wave. Longitudinal waves show areas of compression and rarefaction. Sound waves travelling through air are longitudinal. Students should be able to describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels. Waves can be reflected at the boundary between two different materials. Waves can be absorbed or	Students should be able to construct ray diagrams to illustrate the reflection of a wave at a surface. Using data provided to discuss risk factors Recall and apply the wave equation Evaluate risks both in practical science and the wider societal context,	Students should be able to apply this equation which is given on the Physics data sheet Convert between units Wider reading on risks of UV and exposure to microwaves		Use of EM waves End of unit test

		transmitted at the boundary between two different materials. Students should be able to construct ray diagrams to illustrate the reflection of a wave at a surface. Students should be able to describe the effects of reflection, transmission and absorption of waves at material interfaces Students should be able to: • 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 • explain why such processes only work over a limited frequency range and the relevance of this to human hearing. Students should know that the range of normal human hearing is from 20 Hz to 20 kHz. Students should be aware that the study of seismic waves provided new evidence that led to discoveries about parts of the Earth which are not directly observable. ***(*HT only) Different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength. (HT only) Some effects, for example refraction, are due to the difference in velocity of the waves in different**	including perception of risk in relation to data and consequences. Use SI units (eg kg, g, mg; km, m, mm; kJ, J) and IUPAC chemical nomenclature unless inappropriate.	(mobile phones) Students should be able to recall and apply this equation. Use prefixes and powers of ten for orders of magnitude (eg tera, giga, mega, kilo, centi, milli, micro and nano). Interconvert units. Use an appropriate number of significant figures in calculation.		

		substances. Students should be able to construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media. (HT only) Students should be able to use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to a different medium. **(HT only) Students should be able to give brief explanations why each type of electromagnetic wave is suitable for the practical application**. ***Triple only*** *The magnification produced by a lens can be calculated using the equation: magnification = image height ob ject height Magnification is a ratio and so has no units. Image height and object height should both be measured in either mm or cm.* *Students should be able to explain: • how the colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object • the effect of viewing objects through filters or the effect on light of passing through filters • why an opaque object has a particular colour.* *Students should be able to explain: • that all bodies (objects) emit*				

		radiation • that the intensity and wavelength distribution of any emission depends on the temperature of the body. (HT only) A body at constant temperature is absorbing radiation at the same rate as it is emitting radiation. The temperature of a body increases when the body absorbs radiation faster than it emits radiation. ***(HT only) The temperature of the Earth depends on many factors including: the rates of absorption and emission of radiation, reflection of radiation into space. (HT only) Students should be able to explain how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted, using everyday examples to illustrate this balance, and the example of the factors which determine the temperature of the Earth.***				
Spring	B7 Ecology	Describe what an ecosystem is. Explain the importance of high biodiversity. Explain what is meant by a self-supporting ecosystem Identify factors that affect ecosystems. Explain changes in the distribution of species in an ecosystem.	Plan experiments to test a hypothesis. Explain the apparatus and techniques used to sample a population. Explain how a representative	Extract and interpret information from charts, Graphs and tables.	Impact of humans on the environment. Understand that some people have ethical objections to some modern intensive farming methods	Quadrats practical End of unit test

		Describe stable and unstable populations. Describe how changes in one population affect another. Explain interdependent relationships. Explain how predator–prey population cycles have cyclical changes. Describe how competition impacts on populations. Explain why animals in the same habitat are in competition. Explain interspecific and intraspecific competition. Use scientific ideas to develop a hypothesis. Develop a reasoned explanation for some data. Recall why animals have adaptations. Explain some adaptations. Identify some adaptations of plants and bacteria. Explain the importance of plant adaptations. Explain a range of plant adaptations. Recall that many materials are recycled in nature. Explain the stages in the water and decay cycles. Explain the importance of recycling materials.	sample was taken. Use surface area to volume ratios to explain some adaptations. To recognise direct proportionality in a graph. To calculate reaction rates in linear graphs. To use the gradient of a graph to calculate the rate. Recording first hand observations of organisms. Interpret and explain the processes in diagrams of the carbon cycle, the water cycle. Interpret population and food production statistics to evaluate food security. ***Triple only- Required practical activity 10: investigate the effect of temperature on the rate of decay of fresh milk***		Discussion of vegan / vegetarian diets and their effects on food chains	

		Recall that plants take in carbon as carbon dioxide. Explain how carbon is recycled. Interpret a diagram of the carbon cycle. Identify why land use has changed. Describe the effects of changing land use. Evaluate a change in land use. State the reasons for deforestation. Understand the impact of peat bog destruction and deforestation. Evaluate the destruction of peat bogs and forests. Recall what global warming is. Describe the causes of global warming. Explain how global warming impacts on biodiversity. Describe how waste production is linked to human population growth. Describe the impact of waste on ecosystems. Explain how waste impacts on biodiversity. Identify pollution levels using indicator species. Explain how indicator species measure pollution. Compare different methods of measuring pollution.	***by measuring pH change***.			

		Triple only-Impact of environmental change (biology only) (HT only) ***Content Key*** ***Trophic levels in an ecosystem (biology only)*** ***Food production (biology only***) Describe some conservation measures. Describe the impact of breeding programmes. Explain how habitats are regenerated.				
Summer	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.	Students should be able to apply this equation which is given on the Physics equation sheet. force = magnetic -ux density × current × length Safe use of electricity.			Plotting a magnetic field practical Triple – how does a loud speaker work End of unit test

		Describe how to change the speed and direction of rotation of a motor. 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				

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Summer	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).	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 forms. Use ratios, fractions and percentages		Required practical waste water sheet Comparison of glass and water milk bottles Advantages and disadvantages of recycling End of unit test

		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.		Recognise and use expressions in standard form. 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.		

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Summer	*P8 Space – triple award students 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.	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 End of unit test

		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. 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. .				