



Alcester Academy Curriculum Planning: Key Stage 4 (Year 9)

Department: Science Year Group: 9						
Term	Topic/Subject	Assessment Objectives and Knowledge acquisition	Skill building <i>Intent</i>	Wider reading to include numeracy and SMSC	SEND & PP Identify where access and learning is supported	Final assessment task and title
Autumn	B1 Cell Biology	<p>To understand the structure of eukaryotic and prokaryotic cells. Explain how subcellular structures are related to their functions. Explain how cells are specialised to carry out a particular function. To be able to explain the importance of cell differentiation. To be able to understand how microscopy technique have developed over time and how electron microscopy has increased understanding of sub-cellular structures. Triple only-to understand binary fission and how to cultivate cultures. To understand what chromosomes are and their part in the cell cycle and mitosis. To understand the capabilities of stem cells. Explain therapeutic cloning and how it can be used. To be able to explain transport in cells by diffusion, osmosis and active transport.</p>	<p>Demonstrate an understanding scale and size of cells and make order of magnitude calculation. Carry out experiments appropriately. Recognise and draw cells.</p> <p>Triple only- prepare uncontaminated culture using aseptic technique whilst investigating the action of disinfections and antibiotics.</p> <p>Recognise and interpret diagrams that model cell processes. Use of isotonic drinks and high energy drinks in sports.</p>	<p>Be able to use prefixes. Calculating magnification and be able to express answers in standard form Triple only -calculate the number of bacteria in a population after a certain time to give a mean division time. Calculate cross-sectional areas of colonies or clear areas around colonies Use percentages and simple compound measures. Wider reading around STEM cells Development of microscopes reading comprehension</p>	<p>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</p>	<p>Mitosis – description of key terms End of unit test</p>



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				<p>Evaluate the practical risks and benefits, as well as social and ethical issues, of the use of stem cell in medical research and treatments. Careers in medicine.</p>	<p>Use of TA support in lessons</p> <p>Focus on key parts of syllabus</p> <p>Use of LSU to chase parents evening appointments and follow up</p>	
Autumn	P1 Energy	<p>To understand the way energy is stored and changed when a system changes. To be able to calculate the changes in energy. To be able to explain how energy can be transferred usefully, stored or dissipated but cannot be created or destroyed.</p> <p>to be able to describe the main energy sources available and distinguish between energy resources that are renewable and non-renewable resources, compare ways that different energy resources are used, understand why some energy resources are more reliable than others, describe the environmental impact arising from the use of different energy resources, explain patterns and trends in the use of energy resources.</p>	<p>Use calculations to show on a common scale how the overall energy in a system is redistributed when the system is changed.</p> <p>To be able to calculate kinetic energy, elastic potential energy, elastic potential energy and gravitational potential energy, change in thermal energy, and specific heat capacity, power.</p> <p>To carry out an investigation to determine the specific heat capacity of one or more materials.</p> <p>Investigate thermal conductivity using rods of different materials.</p> <p>To be able to calculate efficiency. (HT only)</p>	<p>To be able to apply and recall physics equations To be able to calculate and give values as a decimal or as a percentage.</p> <p>Additional reading around efficiency of products and their impact</p> <p>Alternative energy and reducing energy wastage as an environmental and economic issue. Impact of humans on the environment.</p>		<p>Energy loss practical data End of unit test</p>



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			students should describe the ways to increase the efficiency of an intended energy transfer.			
Autumn	C1 Atomic structure	<p>To understand the terms elements, mixtures and compounds. To be able to name and place the first elements on the periodic table.</p> <p>To be able to explain what a mixture is and how it can be separated.</p> <p>To be able to explain the development of the atom model and the results or experiments that's support the theories.</p> <p>To know the relative charges of subatomic particles.</p> <p>To understand the size and mass of atoms.</p> <p>To represent the electronic structure of the first 20 atoms.</p> <p>To understand the history of the periodic table and the patterns and trends that is represented in it.</p> <p>To explain the properties and trends of group 0, group 1 and group 7 as well as trends in metals and non-metals.</p> <p>Triple only- Properties of transition metals</p>	<p>To be able to represent chemical reactions can be represented by word equations using symbols and formulae.</p> <p>(HT ONLY) write balanced half equations and ionic equations where appropriate.</p> <p>Safe use of a range of equipment to separate chemical mixtures.</p> <p>The historical context to show how and describe how scientific methods and theories develop over time.</p> <p>Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects.</p> <p>Explain how testing a prediction can support or refute a new scientific idea</p>	<p>To be able to use SI units and prefix nano, micro etc and recognise expressions in standard form.</p> <p>Additional reading around the development of the periodic table and individual elements</p> <p>Awe and wonder with regards to the complexity and scale of atomic structure and amounts of substances.</p> <p>Links can be made between science and spirituality at this stage</p> <p>Awe and wonder with regards to Energetic processes that are occurring in front of eyes but not always with explicit visual signs.</p> <p>Links to the early periodic table and the moral, social and cultural issues that hindered and/or supported</p>		<p>Describing atoms and isotopes in terms of subatomic particles</p> <p>End of unit test</p>
Autumn	C2 Structures, bonding	To know the three types of chemical bonds, ionic, covalent and metallic and to be able to explain their structure and properties.	Visualise and represent 2D and 3D forms including two	Recognise and use expressions in decimal form.		Comparing giant covalent molecules



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	and properties	<p>To explain the structure and properties of polymers and alloys. To explain how the bonding and structure are relates to the properties of substances.</p> <p>Triple Bulk and surface properties of matter including nanoparticles (chemistry only)-to know the Sizes of particles and their properties and Uses of nanoparticles</p>	<p>dimensional representation of 3D objects. Recognise substances as small molecules, polymers or giant structures from diagrams showing bonding.</p> <p>Triple- Students should be able to: given appropriate information, evaluate the use of nanoparticles for a specified purpose explain that there are possible risks associated with the use of nanoparticles.</p>	<p>Translate information between graphical and numeric form. Use ratios fractions and percentages.</p> <p>Substitute numerical values into algebraic equations using appropriate units for physical quantities.</p> <p>Make order of magnitude calculations. Calculate areas of triangles and rectangles, surface areas and volumes of cubes. Make estimates of the results of simple calculations Use and development of modern materials including alloys and things like carbon fibre</p>		<p>Magnesium and oxygen bonding End of unit test.</p>
Spring	B3 Infection and response	<p>To understand what is meant by communicable diseases and that they are caused by viruses, bacteria, protest and fungi. To be able to explain how the spread of disease can be reduced or prevented. To explain how pathogens can be spread. To be able to explain the spread and symptoms of certain viral, bacterial, fungal and protest diseases. To be able to explain the body defends itself against pathogens including white blood cells.</p>	<p>Evaluate the global use of vaccination in the prevention of disease. Understand that the results of testing and trails are published only after scrutiny by peer review.</p> <p>Biology HT – appreciate the power of monoclonal antibodies and consider any ethical issues.</p>	<p>Be able to use and interpret graphs of infection data and mortality rate Calculate and understand rates as per 100000 population Reading comprehensions around John Snow and epidemiology</p>		<p>Assessment on data handling and interpretation End of unit test.</p>



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		<p>To be able to explain how vaccination will prevent illness.</p> <p>To explain how antibiotics and painkiller are used.</p> <p>To be able to describe the process of discovery and development of potential new medicines, preclinical and clinical testing.</p> <p>Triple only and HT- to understand how monoclonal antibodies are produced and the uses of them.</p> <p>To understand how plant diseases can be detected and how identification can be made.</p> <p>To be able to describe physical and chemical plant responses.</p>	<p>Evaluate the advantages and disadvantages of monoclonal antibodies.</p> <p>The everyday application of scientific knowledge to detect and identify plants disease.</p> <p>The understanding of ion deficiencies allows horticulturist to provide optimum conditions for plants.</p>	<p>Wider reading around development of antibiotics</p> <p>How lifestyle choices can impact on health.</p> <p>Overuse of antibiotics and MRSA. Reducing spread of pathogens, including STIs.</p> <p>Discussion about drug trails and use of animals and humans</p>		
Spring	C5 Energy changes	<p>Identify exothermic and endothermic reactions from temperature changes.</p> <p>Evaluate the energy transfer of a fuel..</p> <p>. Draw simple reaction profiles (energy level diagrams).</p> <p>Use reaction profiles to identify reactions as exothermic or endothermic.</p> <p>Explain the energy needed for a reaction to occur and calculate energy changes.</p> <p>Describe the energy changes in bond breaking and bond making.</p> <p>Explain how a reaction is endothermic or exothermic overall.</p> <p>Calculate the energy transferred in chemical reactions using bond energies.</p> <p>Triple only Chemical cells and fuel cells (chemistry only) to explain how Cells and batteries and Fuel cells work and the chemistry behind it.</p>	<p>Investigate the variables that affect temperature changes in reacting solutions</p> <p>Use scientific theories and explanations to develop hypotheses.</p> <p>Plan experiments to make observations and test hypotheses</p> <p>Evaluate methods to suggest possible improvements and further investigations</p>	<p>Read scales in integers and using decimals.</p> <p>Calculate the energy change during a reaction.</p> <p>Calculate energy transferred for comparison.</p>		<p>Data around an experiment – zinc and copper sulfate</p> <p>Ammonium nitrate use</p> <p>Triple - Describe the factors that will affect a fuel cell</p> <p>End of unit test.</p>
Spring	P3 Particle model of matter	<p>Use the particle model to explain the different states of matter and differences in density.</p>	<p>Students should be able to recall and apply this equation to changes</p>	<p>The density of a material is defined by the equation:</p>		<p>Density assessment – calculating</p>



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		<p>Describe how, when substances change state, mass is conserved.</p> <p>Describe energy transfer in changes of state.</p> <p>Explain changes of state in terms of particles.</p> <p>Describe the particle model of matter.</p> <p>Understand what is meant by the internal energy of a system.</p> <p>Describe the effect of heating on the energy stored within a system.</p> <p>Describe the effect of increasing the temperature of a system in terms of particles.</p> <p>State the factors that are affected by an increase in temperature of a substance.</p> <p>Explain specific heat capacity.</p> <p>Explain what is meant by latent heat.</p> <p>Describe that when a change of state occurs it changes the energy stored but not the temperature.</p> <p>Perform calculations involving specific latent heat.</p> <p>Relate the temperature of a gas to the average kinetic energy of the particles.</p> <p>Explain how a gas has a pressure.</p> <p>Explain that changing the temperature of a gas held at constant volume changes its pressure.</p> <p>Use the particle model to explain states of matter.</p> <p>Use ideas about energy and bonds to explain changes of state.</p> <p>Explain the relationship between temperature and energy.</p>	<p>where mass is conserved.</p> <p>Students should be able to apply this equation, which is given on the Physics equation sheet, to calculate the energy change involved when the temperature of a material changes. Calculate density.</p> <p>Interpret observations and data.</p> <p>Use spatial models to solve problems.</p> <p>Plan experiments and devise procedures.</p> <p>Use an appropriate number of significant figures in measurements and calculations.</p> <p>Draw a graph of temperature against time.</p> <p>Interpret a graph of temperature against time.</p>	<p>density = mass / volume</p> $\rho = \frac{m}{V}$ <p>density, ρ, in kilograms per metre cubed, kg/m³</p> <p>mass, m, in kilograms, kg</p> <p>volume, V, in metres cubed, m³</p> <p>The following equation applies:</p> <p>change in thermal energy = mass × specific heat capacity × temperature change</p> $\Delta E = m c \Delta \theta$ <p>change in thermal energy, ΔE, in joules, J</p> <p>mass, m, in kilograms, kg</p> <p>specific heat capacity, c, in joules per kilogram per degree Celsius, J/kg °C</p> <p>temperature change, $\Delta\theta$, in degrees Celsius, °C.</p> <p>An understanding of how ideas can change in science given new evidence</p> <p>Appreciate how science can apply to every day situations</p>		<p>density of regular and irregular objects</p> <p>End of unit test.</p>
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		Triple- Pressure in gases (physics only) Increasing the pressure of a gas (physics only) (HT only)				
Spring	C7 Hydrocarbons	<p>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?</p> <p>PROPERTIES OF HYDROCARBONS What is incomplete combustion? How is the supply of petrol increased to match the demand? What is an unsaturated hydrocarbon?</p> <p>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?</p> <p>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 of the DNA structure fit together? Why are starch and cellulose known as polymers?</p>	<p>Make models of alkanes molecules using the molecular model kits</p> <p>Investigate the properties of different hydrocarbons..</p> <p>Evaluate risks both in practical science and in the wider social context Plan experiments or devise procedures to make observations and test hypothesis.</p> <p>Plan experiments or devise procedures to make observations and test hypothesis.</p>	<p>Visualise and represent two-dimensional and three-dimensional forms including 2D representations of 3D objects.</p> <p>Plot two variables from experimental or other data</p> <p>Use ratios, fractions and percentages</p> <p>Use SI units and IUPAC chemical nomenclature unless inappropriate</p> <p>Additional reading around oil spill disasters such as deep water horizon.</p> <p>use of hydrocarbons and how this impacts the environment Understand why changes to our use of hydrocarbons may be slow and the impact the governments have on this</p>		<p>Fractional distillation of</p> <p>For triple – describe the uses of polymers (related to properties)</p>



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				<p>Appreciate why petroleum companies are so influential</p> <p>Link to the impact that hydrocarbon use has on the environment</p> <p>Careers links within the petrochemicals and plastics industries</p>		
Summer	P4 Atomic structure	<p>Describe the structure of the atom.</p> <p>Describe ionisation Describe radioactive decay.</p> <p>Describe the types of nuclear radiation.</p> <p>Understand the processes of alpha decay and beta decay. Describe radioactive contamination.</p> <p>Give examples of how radioactive tracers can be used. Explain what is meant by radioactive half-life.</p> <p>Choose the best radioisotope for a task. Explain what is meant by irradiation.</p> <p>Understand the distinction between contamination and irradiation.</p> <p>Understand how ideas about the structure of the atom have changed.</p> <p>How evidence is used to test and improve models</p> <p>Triple-Hazards and uses of radioactive emissions and of background radiation (physics only)</p> <p>Background radiation</p> <p>Different half-lives of radioactive isotopes</p> <p>Uses of nuclear radiation</p> <p>Nuclear fission and fusion (physics only)</p> <p>Nuclear fusion</p>	<p>Use symbols to represent particles</p> <p>Understand nuclear equations.</p> <p>Write balanced nuclear equations</p> <p>Calculate half-life.</p> <p>Appreciate the importance of communication between scientists. Calculate radioactive half-life from a curve of best fit. Calculate the net decline in radioactivity.</p>	<p>Students should be able to recognise expressions given in standard form.</p> <p>Use graphs to calculate half life</p> <p>Additional reading around nuclear disasters such as Chernobyl</p> <p>Health and safety regarding use of lasers, tanning beds etc.</p> <p>Discovery of radioactivity (Curie etc.) – can be linked to risks of</p> <p>Dangers from use of nuclear radiation including the use of nuclear fuel for generating electricity</p> <p>Discuss the rights and wrongs of nuclear weapons</p>		<p>Half-life graph</p> <p>End of unit test.</p>
Summer	B4 Photosynthesis and	<p>Adaptations of cells and tissues in leaves allow them to photosynthesise efficiently. Stomata are adapted to</p>	<p>Required practical</p> <p>Investigate the effect of light intensity on the rate</p>	<p>Recognise and use expressions in decimal form</p>		<p>Photosynthesis required practical –</p>



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	<p>respiration (Bioenergetics)</p>	<p>control the exchange of gases. Cells and tissues in leaves, stems and roots are designed for the maximum exchange of substances in and out of the plant The useful products of photosynthesis are simple carbohydrates, for example glucose and sucrose. Different environmental factors interact to limit the rate of photosynthesis in different habitats at different times. The environment in which plants are grown can be artificially manipulated. There are two transport systems in plants: xylem transports water up the plant and phloem transports substances up and down the plant. Water movement through the plant is affected by different environmental factors. Water loss in plants is a consequence of adaptations for photosynthesis. Different factors affect the rate of diffusion in plant systems. Concentration gradients can affect the rate of photosynthesis. Substances move in and out the leaf during different processes, for example, photosynthesis, respiration and transpiration.</p>	<p>of photosynthesis using an aquatic organism such as pondweed Maths skills: Surface area to volume ratio</p>	<p>Use ratios, fractions and percentages Use an appropriate number of significant figures</p> <p>Find arithmetic means. Construct and interpret frequency tables and diagrams, bar charts and histograms</p> <p>Understand the terms mean, mode and median Understand and use the symbols: =, <, <<, >>, >, α, ~.</p> <p>Solve simple algebraic equations.</p> <p>Translate information between graphical and numeric form. Plot two variables from experimental or other data</p> <p>Wider reading around the use of plant based medicine</p> <p>Understand the roles plants play in our lives and how we can maintain and increase them Discuss the impact of deforestation</p>		<p>results and conclusion End of unit test.</p>
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				Appreciate the use of chemicals in farming and the short and long term impacts of these		
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