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

Department: Science Year Group: 9						
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	B1 Cell Biology	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.	Demonstrate an understanding scale and size of cells and make order of magnitude calculation. Carry out experiments appropriately. Recognise and draw cells. ***Triple only- prepare uncontaminated culture using aseptic technique whilst investigating the action of disinfections and antibiotics.*** Recognise and interpret diagrams that model cell processes. Use of isotonic drinks and high energy drinks in sports.	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 Evaluate the practical risks and benefits, as	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	Mitosis – description of key terms End of unit test

				well as social and ethical issues, of the use of stem cell in medical research and treatments. Careers in medicine.	Focus on key parts of syllabus Use of LSU to chase parents evening appointments and follow up	
Autumn	P3 Particle model of matter	Use the particle model to explain the different states of matter and differences in density. Describe how, when substances change state, mass is conserved. Describe energy transfer in changes of state. Explain changes of state in terms of particles. Describe the particle model of matter. Understand what is meant by the internal energy of a system. Describe the effect of heating on the energy stored within a system. Describe the effect of increasing the temperature of a system in terms of particles. State the factors that are affected by an increase in temperature of a substance. Explain specific heat capacity. Explain what is meant by latent heat. Describe that when a change of state occurs it changes the energy stored but not the temperature. Perform calculations involving specific latent heat. Relate the temperature of a gas to the average kinetic energy of the particles. Explain how a gas has a pressure.	Students should be able to recall and apply this equation to changes where mass is conserved. 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. Interpret observations and data. Use spatial models to solve problems. Plan experiments and devise procedures. Use an appropriate number of significant figures in measurements and calculations. Draw a graph of temperature against time.	The density of a material is defined by the equation: density = mass volume ρ = m V density, ρ, in kilograms per metre cubed, kg/m3 mass, m, in kilograms, kg volume, V, in metres cubed, m3 The following equation applies: change in thermal energy = mass× specific heat capacity × temperature change Δ E = m c Δ θ change in thermal energy, ΔE, in joules, J mass, m, in kilograms, kg specific heat capacity, c, in joules per kilogram		Density assessment – calculating density of regular and irregular objects End of unit test.

		Explain that changing the temperature of a gas held at constant volume changes its pressure. Use the particle model to explain states of matter. Use ideas about energy and bonds to explain changes of state. Explain the relationship between temperature and energy. ***Triple- Pressure in gases (physics only)*** ***Increasing the pressure of a gas (physics only) (HT only)***	Interpret a graph of temperature against time.	per degree Celsius, J/kg °C temperature change, Δθ, in degrees Celsius, °C. An understanding of how ideas can change in science given new evidence Appreciate how science can apply to every day situations		
Autumn	C1 Atomic structure	To understand the terms elements, mixtures and compounds. To be able to name and place the first elements on the periodic table. To be able to explain what a mixture is and how it can be separated. To be able to explain the development of the atom model and the results or experiments that's support the theories. To know the relative charges of subatomic particles. To understand the size and mass of atoms. To represent the electronic structure of the first 20 atoms. To understand the history of the periodic table and the patterns and trends that is represented in it. To explain the properties and trends of group 0, group1 and group 7 as well as trends in metals and non-metals. ***Triple only- Properties of transition metals***	To be able to represent chemical reactions can be represented by word equations using symbols and formulae. (HT ONLY) write balanced half equations and ionic equations where appropriate. Safe use of a range of equipment to separate chemical mixtures. The historical context to show how and describe how scientific methods and theories develop over time. Visualise and represent 2D and 3D forms including two dimensional representations of 3D objects.	To be able to use SI units and prefix nano, micro etc and recognise expressions in standard form. Additional reading around the development of the periodic table and individual elements Awe and wonder with regards to the complexity and scale of atomic structure and amounts of substances. Links can be made between science and spirituality at this stage Awe and wonder with regards to Energetic processes that are occurring in front of eyes but not always with explicit visual signs.		Describing atoms and isotopes in terms of subatomic particles End of unit test

			Explain how testing a prediction can support or refute a new scientific idea	Links to the early periodic table and the moral, social and cultural issues that hindered and/or supported		
Autumn	C2 Structures, bonding and properties	To know the three types of chemical bonds, ionic, covalent and metallic and to be able to explain their structure and properties. To explain the structure and properties of polymers and alloys. To explain how the bonding and structure are relates to the properties of substances. ***Triple Bulk and surface properties of matter including nanoparticles (chemistry only)-to know the Sizes of particles and their properties and Uses of nanoparticles***	Visualise and represent 2D and 3D forms including two dimensional representation of 3D objects. Recognise substances as small molecules, polymers or giant structures from diagrams showing bonding. ***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.***	Recognise and use expressions in decimal form. Translate information between graphical and numeric form. Use ratios fractions and percentages. Substitute numerical values into algebraic equations using appropriate units for physical quantities. 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		Comparing giant covalent molecules Magnesium and oxygen bonding End of unit test.
Spring	B3 Infection and response	To understand what is meant by communicable diseases and that they are caused by viruses, bacteria, protest and fungi.	Evaluate the global use of vaccination in the prevention of disease.	Be able to use and interpret graphs of infection data and mortality rate		Assessment on data handling and interpretation

		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. To be able to explain how vaccination will prevent illness. To explain how antibiotics and painkiller are used. To be able to describe the process of discovery and development of potential new medicines, preclinical and clinical testing. ***Triple only and HT- to understand how monoclonal antibodies are produced and the uses of them.*** ***To understand how plant diseases can be detected and how identification can be made.*** ***To be able to describe physical and chemical plant responses.***	Understand that the results of testing and trails are published only after scrutiny by peer review. **Biology HT – appreciate the power of monoclonal antibodies and consider any ethical issues.** **Evaluate the advantages and disadvantages of monoclonal antibodies.** **The everyday application of scientific knowledge to detect and identify plants disease.** **The understanding of ion deficiencies allows horticulturist to provide optimum conditions for plants.**	Calculate and understand rates as per 100000 population Reading comprehensions around John Snow and epidemiology Wider reading around development of antibiotics How lifestyle choices can impact on health. Overuse of antibiotics and MRSA. Reducing spread of pathogens, including STIs. Discussion about drug trails and use of animals and humans		End of unit test.
Spring	C5 Energy changes	Identify exothermic and endothermic reactions from temperature changes. Evaluate the energy transfer of a fuel.. . Draw simple reaction profiles (energy level diagrams). Use reaction profiles to identify reactions as exothermic or endothermic. Explain the energy needed for a reaction to occur and calculate energy changes. Describe the energy changes in bond breaking and bond making. Explain how a reaction is endothermic or exothermic overall.	Investigate the variables that affect temperature changes in reacting solutions Use scientific theories and explanations to develop hypotheses. Plan experiments to make observations and test hypotheses Evaluate methods to suggest possible improvements and further investigations	Read scales in integers and using decimals. Calculate the energy change during a reaction. Calculate energy transferred for comparison.		Data around an experiment – zinc and copper sulfate Ammonium nitrate use Triple - Describe the factors that will affect a fuel cell End of unit test.

		Calculate the energy transferred in chemical reactions using bond energies. ***Triple only Chemical cells and fuel cells (chemistry only) to explain how Cells and batteries and Fuel cells work and the chemistry behind it.***				
Spring	P4 Atomic structure	Describe the structure of the atom. Describe ionisation Describe radioactive decay. Describe the types of nuclear radiation. Understand the processes of alpha decay and beta decay. Describe radioactive contamination. Give examples of how radioactive tracers can be used. Explain what is meant by radioactive half-life. Choose the best radioisotope for a task. Explain what is meant by irradiation. Understand the distinction between contamination and irradiation. Understand how ideas about the structure of the atom have changed. How evidence is used to test and improve models ***Triple-Hazards and uses of radioactive emissions and of background radiation (physics only)*** ***Background radiation*** ***Different half-lives of radioactive isotopes*** ***Uses of nuclear radiation*** ***Nuclear fission and fusion (physics only)*** ***Nuclear fusion***	Use symbols to represent particles Understand nuclear equations. Write balanced nuclear equations Calculate half-life. Appreciate the importance of communication between scientists. Calculate radioactive half-life from a curve of best fit. Calculate the net decline in radioactivity.	Students should be able to recognise expressions given in standard form. Use graphs to calculate half life Additional reading around nuclear disasters such as Chernobyl Health and safety regarding use of lasers, tanning beds etc. Discovery of radioactivity (Curie etc.) – can be linked to risks of Dangers from use of nuclear radiation including the use of nuclear fuel for generating electricity Discuss the rights and wrongs of nuclear weapons	.	Half-life graph End of unit test.
Summer	B4 Photosynthesis and respiration	Adaptations of cells and tissues in leaves allow them to photosynthesise efficiently. Stomata are adapted to control the exchange of gases. Cells and	Required practical Investigate the effect of light intensity on the rate of photosynthesis using	Recognise and use expressions in decimal form		Photosynthesis required practical –

	(Bioenergetics)	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 ad 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.	an aquatic organism such as pondweed Maths skills: Surface area to volume ratio	Use ratios, fractions and percentages Use an appropriate number of significant figures Find arithmetic means. Construct and interpret frequency tables and diagrams, bar charts and histograms Understand the terms mean, mode and median Understand and use the symbols: =, <, <<, >>, >, ∝, ~. Solve simple algebraic equations. Translate information between graphical and numeric form. Plot two variables from experimental or other data Wider reading around the use of plant based medicine Understand the roles plants play in our lives and how we can maintain and increase them Discuss the impact of deforestation Appreciate the use of chemicals in farming and the short and long term impacts of these		results and conclusion End of unit test.
Summer	P1 Energy	To understand the way energy is stored and changed when a system changes.	Use calculations to show on a common scale how	To be able to apply and recall physics equations		Energy loss practical data

		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. 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.	the overall energy in a system is redistributed when the system is changed. 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. To carry out an investigation to determine the specific heat capacity of one or more materials. Investigate thermal conductivity using rods of different materials. To be able to calculate efficiency. (HT only) students should describe the ways to increase the efficiency of an intended energy transfer.	To be able to calculate and give values as a decimal or as a percentage. Additional reading around efficiency of products and their impact Alternative energy and reducing energy wastage as an environmental and economic issue. Impact of humans on the environment.		End of unit test
Summer	C3 Chemical Quantities	Understand what is meant by the conservation of mass in terms of no gains or loss of atoms during chemical reactions. To explain how to calculate the M_r of a compound and molecule. To calculate the M_r of both reactants and products and use this information to show that mass is conserved. To understand first, that mass appears to be gained when one of the reactants is a gas and	Use experimental methods to collect data Use provided experimental data and interpret this Carry out a variety of calculations	Carry out a variety of calculations Interpret graphs Links to making industry more efficient and conserving resources		Calculating formula mass End of Unit Test

		second, that mass appears to be lost when one of the products is a gas. Students should be able to: • Represent the distribution of results and make estimations of uncertainty. • Use the range of a set of measurements about the mean as a measure of uncertainty **Higher only:** To know that 1 mole of a substance is equal to its formula mass/ atomic mass. To know that 1 mole of equal to 6.02 X 10^{23} atoms, molecules or ions. **Higher only:** To be able to calculate the masses of reactants and products from balanced symbol equations. **Higher only:** Students should be able to balance equations given the masses of reactants and products. **Higher only:** To explain what a limiting reactant is and the effect such a limiting reactant will have on the amount of product formed. To be able to calculate concentrations, mass, and volume from the equation concentration = mass/volume. Students should know the units for all these subjects. **Higher only:** Explain how the mass of a solute and the volume of a solution is related to the concentration of the solution.		Recall and apply equations. Recall and apply equations. Using ratios, percentages and fractions. Changing the subject of an equation. Changing the subject of equations.		

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Last updated: *June 2023*