CARR HILL HIGH SCHOOL
Commitment Aspiration Resilience Respect

Timeline	Topic	Key concepts and knowledge	Skills development	Rationale
Y9 - half term 1	Energy- Work, Heating and Cooling,	Describe that work is done and energy transferred when a force moves an object. The bigger the force or distance, the greater the work. Understand that machines make work easier by reducing the force needed. Levers and pulleys do this by increasing the distance moved, and wheels reduce friction. Understand that the thermal energy of an object depends upon its mass, temperature and what it's made of. When there is a temperature difference, energy transfers from the hotter to the cooler object. Thermal energy is transferred through different pathways, by particles in conduction and convection, and by radiation.	**Practice of tier 3 literacy include:** Calculate Data Environment Explain Identify Research Investigate **Links to careers in:** Builder Climate change sector Environmentalist Research Teacher Maintenance Designer **Development of employability skills:** Team work Numeracy Creative Informed **Development of British Values** Self-help Self-responsibility Equality **Cultural Capital** STEM Club Design a eco house Science museums	The knowledge covered in this topic allows a greater depth of understanding of previous parts of the national curriculum such as forces and particle theory. The knowledge underpins the more complex tasks as the Physics curriculum progresses such as energy transfers by heating, investigating specific heat capacity, resultant forces and work done.

	Reactions-Chemical Energy, Types of Reaction	Understand that during a chemical reaction bonds are broken (requiring energy) and new bonds formed (releasing energy). If the energy released is greater than the energy required, the reaction is exothermic. If the reverse, it is endothermic. Describe combustion as a reaction with oxygen in which energy is transferred to the surroundings as heat and light. Thermal decomposition is a reaction where a single reactant is broken down into simpler products by heating. Chemical changes can be described by a model where atoms and molecules in reactants rearrange to make the products and the total number of atoms is conserved.	Climate change Documentaries – David Attenborough **<u>Practice of tier 3 literacy include:</u>** Create Environment Ethic Compare Interpret Calculate (conservation of mass) Data **<u>Links to careers in:</u>** Mechanic/MOT tester – testing for pollutants Sports physio – sports injury packs Power station engineer Bus/train driver (electric vehicles vs fossil fuels) **<u>Development of employability skills:</u>** Problem solving Creativity (alternatives to fossil fuels) Informed **<u>Development of British Values</u>** Democracy – climate change Mutual respect – for the planet/other people/living things Equality – impact on poorer countries **<u>Cultural Capital</u>** Finding global alternatives to fossil fuels	This topic covers the fundamental basics of Chemistry as the curriculum knowledge becomes more demanding. It is underpinned by the previous topics of elements and the periodic table and chemical reactions. The skills and concepts previously acquired allow students to tackle the more complex elements of this unit and build a deeper knowledge in preparation for the developments of the Chemistry curriculum.

	Genes- Evolution and Inheritance	Describe that natural selection is a theory which explains how species evolve and why extinction occurs. Describe that biodiversity is vital to maintaining populations. Within a species variation helps against environment changes, avoiding extinction. Understand that within an ecosystem, having many different species ensures resources are available for other populations, like humans. Recall that inherited characteristics are the result of genetic information, in the form of sections of DNA called genes, being transferred from parents to offspring during reproduction. Describe that chromosomes are long pieces of DNA which contain many genes. Gametes,	Cars/MOTs – students may not know cars have to pass emissions tests Sports injury packs – may have experienced them in PE? **Practice of tier 3 literacy include:** Because Conclude Describe Evaluation (big one for GM) **Links to careers in:** Genetic screening IVF Medicine Conservation Genetic modification in medicine Counsellors **Development of employability skills:** Problem solving Communication Numeracy Digital skills **Development of British Values** Tolerance of different cultures and religions (Equity and Equality) Rule of law (around GM) Mutual respect (decisions in genetic testing/diseases) **Cultural Capital**	This topic covers the fundamental basics of Biology as the curriculum knowledge becomes more demanding. It is underpinned by the previous topics of cells, genes, organisms and ecosystems. The skills and concepts previously acquired allow students to tackle the more complex elements of this unit and build a deeper knowledge in preparation for the developments of the Biology curriculum.

		carrying half the total number of chromosomes of each parent, combine during fertilisation.	History of Charles Darwin – voyage of the Beagle – the image on the old £10 note and the significance of his findings to science Importance of Biodiversity – some students won't be aware of the intricate links between organisms Genetic modification – it's uses/ethical implications/potential uses in the future Human genome project – the wider importance of understanding migration/genetic diseases etc	
Y9 – half term 2	The Cosmos series. Standing up in the milky way Some of the things that molecules do When knowledge conquered fear A sky full of ghosts Hiding in the light	The cosmos series is an enrichment unit that widens student's breadth of knowledge and allows students to explore scientific concepts in unfamiliar contexts. Solar system, Planetary distances. Cosmic Calendar DNA Evolution Constellations Hooke's Law Scientific method	Standard Form Practical- extracting DNA from Kiwi fruit Hooke's Law practical Plotting graphs Scientific method Practical- Pin hole camera, making a spectroscope	The work on this part of the curriculum is to prepare students to work scientifically, working on skills, literacy and numeracy in preparation for the higher demand out of context aspects of the curriculum.

	Deeper, deeper, deeper still The clean room Sisters of the Sun The lost worlds of planet Earth The Electric Boy The Immortals The world set free Unafraid of the dark	Light, Visible spectrum, Spectroscopy Extremophiles, Tardigrades Carbon Cycle The age of the Earth Lead, aseptic techniques. Classifying stars. The energy from the sun to Earth Wegner, Continental drift, Plate tectonics, Evolution Motors Generators Power stations Origins of Life The Environment and man's affect Dark matter and dark energy	Practical- Using a microscope Practical- Aseptic technique Graphs Extended writing Practical-Making a motor Extended writing Extended writing Discussing, group work, Group work, Communication	
Y9 – half term 3	Cells	Recall that cells are the basic unit of all forms of life and describe the structural differences between types of cells enables them to perform specific functions within the organism.	**<u>Skill development and application</u>** Required practical on- 1. Microscopy 2. Aseptic techniques Maths skills including standard form Extended writing used to recall the steps **<u>Practice of tier 3 literacy include:</u>**	The knowledge in this unit goes into more depth the content previously taught on cells. Students use the basic microscopy skills and cells content acquired to tackle more complex ideas on cell division, specialisation and stem cells.

		Be able to calculate sizes of cells by using and rearranging the magnification equation. Understand that the differences in cells are controlled by genes in the nucleus. TRIPLE ONLY - Culturing microorganisms (can also be repeated in immunity topic)	Observe Reason Improvements Units Average Same Accurate **Links to careers in:** Cell biologist Doctor/nurse Counsellor Lab technician Embryologist Reproductive biologist Microscopy technician **Development of employability skills:** Numeracy Team work Communication Creativity Informed **Development of British Values** Rule of law Tolerance Mutual respect Individual liberty **Cultural Capital** Discussions involving organ donation. Are there any IVF babies in the class? Have students used a microscope at home? Have students experienced a hospital setting?	There are lots of cross curricular opportunities with maths such standard form and to extend their maths skills to calculate sizes of cells by using and rearranging the magnification equation.

	Atomic structure and the periodic table	Understand that the periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. Describe that the historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. Describe that the arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels. TRIPLE ONLY - describe the difference compared with Group 1 in melting points, densities, strength, hardness and reactivity with oxygen, water and halogens.	**Skill development and application** - analysing patterns in data allows students to study the periodic table and the patterns shown in relation to their chemical and physical properties. **Practice of tier 3 literacy include:** Calculate Compare Conclude Data Estimate Explain Formula Interpret Proportion similar **Links to careers in:** Analytical Chemist Physical Chemist Lab Technician Forensic Scientist **Development of employability skills:** Problem solving Communication Self-management Teamwork Numeracy Creativity **Development of British Values** Self-help Self-responsibility	This topic is underpinned by the fundamental skills and concepts taught previously on elements, the periodic table in the matter topics. As the topic progresses students are able to build a deeper understanding of elements and atomic structure and begin to link ideas together in preparation for more demanding content as the curriculum progresses. The skills in this topic build from basic concepts previously taught on chemical equations into more complex tasks such as balancing equations, calculating atomic mass.

		Exemplify these general properties by reference to compounds of Cr, Mn, Fe, Co, Ni, Cu.	**Cultural Capital** Experience of analogies/models that assist us eg London Underground Map as a representation of a real situation.	
	Energy	Understand that the concept of energy emerged in the 19th century. Describe and calculate all the changes involved in the way energy is stored when a system changes, for common situations. Be able to recall and apply the equations for calculating kinetic energy, gravitational potential energy, power, and energy efficiency. Be able to apply the equations for calculating change in thermal energy and elastic potential energy. Understand that limits to the use of fossil fuels and global warming are critical problems for this century. Describe that physicists and engineers are	**Skill development and application** Calculating specific Heat capacity allows students to build more complex maths skills. Required practical- 2. Insulating beakers Knowledge acquired on calculating specific heat capacity allows students to apply their maths skills to a practical skill and use it to collect, record and present data. **Practice of tier 3 literacy include:** Calculate Data Environment Explain Identify Research Environment **Links to careers in:** Energy companies Oil rig engineer Dietician Solar power engineer Analyst Designer	The knowledge covered during this topic underpins more complex tasks and skills required as the curriculum progresses into more difficult maths skills and equations. The concepts covered embed deeper learning by building upon previous knowledge from KS3 energy topics. This topic introduces the concept of learning, applying and rearranging equations and provides opportunities for students to embed and progress these skills.

		working hard to identify ways to reduce our energy usage.	Sales **Development of employability skills:** Team work Numeracy Creative Informed **Development of British Values** Self-help Self-responsibility Equality **Cultural Capital** Solar panels/wind farms STEM Club Power stations	
Y9 – half term 4	Cell division and movement of substances	Understand that for an organism to grow, cells must divide by mitosis producing two new identical cells. Understand that if cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells, and that this led to the development of stem cell technology which allows doctors to repair damaged organs by growing new tissue from stem cells.	**Skill development and application** Required practical 2 – osmosis practical allows students to focus on collecting, recording, presenting and analysing patterns in data. **Practice of tier 3 literacy include:** Observe Reason Improvements Units Average Same Accurate **Links to careers in:** Cell biologist Doctor/nurse Counsellor	This part of the curriculum spirals knowledge from the previous topics on cells structure and stem cells in KS3 and KS4 to tackle more difficult concepts such as the use of stem cell technology. It also has links to previous concepts of diffusion covered in the matter topic in KS3. It allows students to build a deeper knowledge and understanding of cells and cell differentiation and the incorporation of the required practical provides opportunity to embed their knowledge further.

		Describe how substances may move into and out of cells across the cell membranes via diffusion, osmosis and active transport.	Lab technician Embryologist Reproductive biologist Microscopy technician **Development of employability skills:** Numeracy Team work Communication Creativity Informed **Development of British Values** Rule of law Tolerance Mutual respect Individual liberty **Cultural Capital** Discussions involving organ donation. Are there any IVF babies in the class? Have students used a microscope at home? Have students experienced a hospital setting?	
	Bonding structure, and the properties of matter	Describe that chemists use theories of structure and bonding to explain the physical and chemical properties of materials – ionic bonding, ionic compounds, covalent bonding, metallic bonding. Understand that the analysis of structures shows that atoms can be arranged in a variety of ways,	**Skill development and application** Analysing patterns in data allows students to study the bonding and the patterns shown in relation to their chemical and physical properties. **Practice of tier 3 literacy include:** Calculate Compare Conclude Data	This part of the curriculum spirals knowledge from the previous topics on elements, particle theory and the periodic table in KS3 and KS4 to tackle more difficult concepts such as different types of bonding, formation of compounds and more complex structures.

		some of which are molecular while others are giant structures. Describe that theories of bonding explain how atoms are held together in these structures and scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.	Estimate Explain Formula Interpret Proportion similar **Links to careers in:** Chemical Analyst Brewer Chef Materials Scientist Pharmacist Engineer **Development of employability skills:** Problem solving Communication Self-management Teamwork Numeracy Creativity **Development of British Values** Self-help Self-responsibility **Cultural Capital** Experience of analogies/models that assist us eg London Underground Map as a representation of a real situation. Crystals and gemstones from outside the UK.	

	Electricity	Understand that electric charge is a fundamental property of matter everywhere. Describe that electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge. Draw, build and use circuit diagrams to construct and check series and parallel circuits that include a variety of common circuit components Describe the current (*I*) through a component depends on both the resistance (*R*) of the component and the potential difference (*V*) across the component. The greater the resistance of the component the smaller the current for a given potential difference (pd) across the component. Be able to recall and apply the equations for charge flow, potential difference, power and energy transferred. Describe how different domestic	**<u>Skill development and application</u>** Required practical's- 3. Resistance of a wire allows students to build mathematical skills by calculating resistance and collecting, recording and presenting data followed by analysing patterns. 4. V-I characteristics (diodes, filament lamp, resistors A&B) provides further opportunity for students to embed their skills on analysing patterns in data. **<u>Practice of tier 3 literacy include:</u>** Calculate Conclude Data Explain Formula Method Range **<u>Links to careers in:</u>** Energy advisor Electrician Manufacturing – electrical devices Electrical safety officer **<u>Development of employability skills:</u>** Numeracy Problem solving Self- management Team work	This part of the curriculum spirals knowledge from the previous Ks3 topics on electromagnetism in order tackle more difficult mathematical skills such as calculations for charge, potential difference, power, energy transfers and other skills such as analysing graphs. It also allows students to deepen their knowledge through out of classroom contexts such as electricity in the home and the national grid. This topic continues to embed the concept of learning, applying and rearranging equations and provides opportunities for students to progress these skills.

		appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices <u>Triple only:</u> Describe the production of static electricity through the transfer of electrons- sparking, by rubbing surfaces Describe evidence that charged objects exert forces of attraction or repulsion on one another when not in contact Draw and explain the concept of electric fields.	**<u>Development of British Values</u>** British values to be demonstrated in the over-arching culture established within the classroom and school: Self-help Self-responsibility **<u>Cultural Capital</u>** Visit to power stations e.g. Drax or wind farm Awareness of generating electricity – National grid to our homes – more awareness of this	
Y9 – half term 5	Organisms	Describe the human digestive system as one that provides the body with nutrients and the respiratory system as one that provides it with oxygen and removes carbon dioxide. Understand that both provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. To describe the causes and effects of coronary heart disease	**<u>Skill development and application</u>** Required practical- 3. Enzymes and pH allows students' progress their skills on collecting, recording and analysing patters in data 4. Food tests allows students to progress their skills in planning investigations and opportunities for extended writing **<u>Practice of tier 3 literacy include:</u>** Anomalous Because	This topic is underpinned by previous knowledge on cell structure and movement in cells covered in KS3 and KS4. It deepens previous learning by incorporating more difficult concepts such as enzyme activity, gas exchange, the heart and circulatory system. It allows students to tackle more complex tasks as the curriculum progresses into

		and understand that many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. Describe how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.	Reason Range Relationship Result Trend **Links to careers in:** Heart physiologist Cancer nurse Respiratory physiologist Food quality scientist Nutritionist Cardiologist Radiographer **Development of employability skills:** Team work Communication Informed Problem solving **Development of British Values** Tolerance Mutual respect **Cultural Capital** Do any students have asthma or know someone with asthma? Do any students have cancer or know someone with cancer? Do any students have a heart condition or know someone with a heart condition?	respiration and rates of photosynthesis.
	Bonding structure, and the properties of matter (continued)	Understand that the analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular	**Skill development and application** Analysing patterns in data allows students to study the bonding and the patterns shown in	This part of the curriculum spirals knowledge from the previous topics on elements, particle theory and the

		while others are giant structures. Describe that theories of bonding explain how atoms are held together in these structures and scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies.	relation to their chemical and physical properties. **<u>Practice of tier 3 literacy include:</u>** Calculate Compare Conclude Data Estimate Explain Formula Interpret Proportion similar **<u>Links to careers in:</u>** Chemical Analyst Brewer Chef Materials Scientist Pharmacist Engineer **<u>Development of employability skills:</u>** Problem solving Communication Self-management Teamwork Numeracy Creativity **<u>Development of British Values</u>** Self-help Self-responsibility	periodic table in KS3 and KS4 to tackle more difficult concepts such as different types of bonding, formation of compounds and more complex structures.

			Cultural Capital Experience of analogies/models that assist us eg London Underground Map as a representation of a real situation. Crystals and gemstones from outside the UK.	
	Electricity (continued)	Describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices.	**Skill development and application** **Practice of tier 3 literacy include:** Calculate Conclude Data Explain Formula Method Range **Links to careers in:** Energy advisor Electrician Manufacturing – electrical devices Electrical safety officer **Development of employability skills:** Numeracy Problem solving Self- management Team work **Development of British Values** British values to be demonstrated in the over-arching culture established within the classroom and school:	This part of the curriculum spirals knowledge from the previous Ks3 topics on electromagnetism in order tackle more difficult mathematical skills such as calculations for charge, potential difference, power, energy transfers and other skills such as analysing graphs. It also allows students to deepen their knowledge through out of classroom contexts such as electricity in the home and the national grid

			Self-help Self-responsibility **Cultural Capital** Visit to power stations e.g. Drax or wind farm Awareness of generating electricity – National grid to our homes – more awareness of this	
Y9 Half term 6	Plant tissues, organs and systems (continued)	Describe how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis.	**Skill development and application** Students can develop and deepen their skills on analysing patterns in data during this topic by using previous practical experience to interpret various experimental data. **Practice of tier 3 literacy include:** Anomalous Because Reason Range Relationship Result Trend **Links to careers in:** **Development of employability skills:** Team work Communication Informed Problem solving **Development of British Values** Tolerance Mutual respect **Cultural Capital**	This topic is underpinned by previous knowledge on cell structure and movement in cells covered in KS3 and KS4. It deepens previous learning by incorporating more difficult concepts such as gas exchange and applying the knowledge to plant systems. It allows students to tackle more complex tasks as the curriculum progresses into respiration and rates of photosynthesis.

	Quantitative Chemistry	Understand that we use quantitative analysis to determine the formulae of compounds and balance chemical equations. Describe that analysts can use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Be able to calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution Understand that by identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Be able to use chemical measurements, conservation of mass and the quantitative	**Skill development and application** This topic allows students to progress their maths knowledge in chemistry to a deeper level through the use of balancing equations and for higher tier students the use of moles in calculations. **Practice of tier 3 literacy include:** Accurate Analyse Calculate Compare Data Estimate Formula Interpret Method Percent Proportion Range Significant Technique **Links to careers in:** Chemical engineer Chef Pharmacist Lab technician Chemical analyst cleaner	This topic is underpinned by the fundamentals of chemistry covered in previous KS3 and KS4 topics on matter, reactions, atomic structure and the periodic table. The spiralling of knowledge brings in more difficult mathematical skills and allows students to tackle more challenging tasks as the curriculum progresses.

		interpretation of chemical equations. Higher tier only –Understand that chemical amounts are measured in moles, calculate moles, use moles to balance equations and explain the effect of limiting reactants.	**Development of employability skills:** Problem solving Communication Self-management Teamwork numeracy **Development of British Values** Self-help Self-responsibility **Cultural Capital** Knowledge of related careers and processes such as drug manufacture, the environment agency.	
	Particle model of matter	Explain the differences in density between the different states of matter in terms of the arrangement. Describe what is meant by internal energy and energy transfers. Be able to apply the equations for calculating the change in thermal energy and energy for change of state (latent heat). Explain how the motion of the molecules in a gas is related to	**Skill development and application** Required practical- 5. Measuring density allows students' progress their skills on collecting and recording data and apply maths skills to new equations and graphs. **Practice of tier 3 literacy include:** Calculate Compare Explain Formula Interpret Method Volume **Links to careers in:**	This topic is underpinned by the fundamentals of chemistry and physics covered in previous KS3 and KS4 topics on the particle model and changes of state. The cross curricular links between physics and chemistry allow students to deepen their knowledge and amalgamate ideas to tackle more difficult concepts such as internal energy, density and specific latent heat.

		both its temperature and its pressure **Triple only –** use the particle model to explain how increasing the volume in which a gas is contained, at constant temperature, can lead to a decrease in pressure. Calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased. Apply the equation: *pressure* × *volume* = *constant* Explain how, in a given situation eg a bicycle pump, doing work on an enclosed gas leads to an increase in the temperature of the gas.	Materials Engineer Research Scientist Product Development Scientist Product Designed Coolant Engineer **Development of employability skills:** Problem Solving Numeracy Informed **Development of British Values** British values to be demonstrated in the over-arching culture established within the classroom and school. **Cultural Capital** Those who have never used a hand pump (for tyres etc) will not have experienced it warming up with use. Can create misconceptions when teaching "work done on a gas". A good opportunity to talk about Archimedes, and to tell the story of the discovery of Archimedes' Principle, presents itself in the Eureka Can Required Practical.	