KS3 Science

Curriculum Overview 2020-2021

Core intent of the subject at key stage 3

Science has changed our lives and is vital to the world's future prosperity in such a technological age. Our students learn the essential knowledge, methods, processes and uses of science in order to be prepared for life in the modern world. Through building up a body of key knowledge and concepts, pupils will be encouraged to recognise the power of rational explanation and to inspire curiosity and a sense of excitement about natural phenomena. They will be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes. Students be used to challenge, and will become future prepared, critical thinkers. We aim to inspire and produce motivated, highly skilled scientists who are independent life- long learners and who can accurately relate complex concepts to local and world- wide contexts.

At Brine Leas School we provide a balanced science curriculum with breadth and depth in order to help students achieve. Science does not stand alone and many of the concepts taught will help support a student's understanding of other subjects such as PE, Geography, History, Phsycology and Maths. We aim to build on the KS2 foundations for understanding the world, through the specific disciplines of biology, chemistry and physics. Key concepts such as energy, cells, organisation, forces and particles thread throughout the science curriculum in a way that is both coherent and progressive. At KS3 we follow Exploring Science based on the national curriculum programme of study. This scheme, carefully develops scientific skills as well as literacy and numeracy through carefully sequenced, knowledge rich topics. Abstract ideas and challenging concepts are anchored to real world applications, careers and local contexts. Connections with career pathways are further established through wider community involvement such as organised talks and activities delivered by the local Further Educational establishment Reaseheath, and local companies such as Airproducts. We run a STEM and a Space club with the opportunity to work to awards the CREST award. Each year 8 is encouraged to use their innovation and curiosity when undertaking our inter-house 'design an alternative to plastic' competition. At KS4 we follow the national curriculum using Kerboodle as a starting point for our lessons. This is an excellent, resource rich scheme, which we adapt to suit our students and our local context. In order to provide further breadth and depth, all students care encouraged to opt for Triple Science should they wish.

Periodic review and evaluation of the Science schemes of work continue to develop and respond to our intent to develop and embed challenge, metacognition, long-term retention and scientific literacy into our curriculum. The course aims to equip our young learners with the independent study skills they need to develop to be successful in their future pathways. Lesson powerpoints provide the basis for consistent of delivery of our curriculum and structured homeworks are set to support students in their independent learning to foster a culture of hard work that leads to achievement and encourages life-long learning. Knowledge organisers and glossaries are provided at the start of topics to embed third tier vocabulary and to provide clarity of learning intent.

The main aim of our curriculum is to provide students with the key knowledge and skills to achieve well and become good scientists, with a clear understanding of the importance of science as a STEM subject in the modern world. Science is also vital for the personal development of well-rounded, informed, healthy individuals. Our curriculum supports students social, moral, spiritual and cultural development by facilitating a sense of enjoyment and fascination in learning about themselves, others and the world around them, use of imagination and creativity in their learning and encouraging a willingness to reflect on their experiences. Many topics such as genetic screening, human impact on the world, our changing atmosphere, generating electricity etc. provide the opportunity to create an interest in investigating and offering reasoned views about moral and ethical issues, and being able to understand and appreciate the viewpoints of others on these issues. Students are also encouraged to develop and use a range of social skills particularly during practical activities and project work. Science provides a platform to teach the fundamentally important biological knowledge that contributes to relationship and sex education and health and well-being. Throughout ks3 and 4 we explore key ideas address topics such as physical health and fitness, the effect of drugs, tobacco and alcohol, healthy eating, prevention of disease and adolescent bodies, sexual relationships, sexual health and contraception.
A significant focus is placed upon developing our students as accomplished practical scientists. Using the core principles of good investigative techniques and the associated maths skills. Students will experience what makes a strong and valid investigation and know how to develop their own method and carry out an investigation safely and efficiently. Building these practical skills throughout the course will enable all students to progress to A- level or science apprenticeships with a well-developed knowledge and wide experience of working scientifically. In addition to planning and carrying out an investigation the students will have to learn how to interpret and use the data or observations that they have generated. The skills that the students acquire in data analysis are invaluable as a transferable life skill. Also the ability to use calculations and determine the validity and significance of the data are wider skills that could be employed across many employment sectors. In the process of analysis they will learn to spot patterns and link that to scientific theory, again these skills are very transferable beyond a science setting.
Science at Brine Leas should be challenging, fascinating, and provide the knowledge and transferrable skills that are invaluable in preparing students for their life ahead. We aim for a large proportion of students to go on to study science further and to have science- based careers.

Assessment

Assessments tasks, quick quizzes, termly written tests

Homework

HLP, assessed tasks of topics and key words, revision, practical write ups, quick quizzes

Clubs and/or intervention

STEM club, science club, KS3/ ‘drop-in’

Parental/Carer support

Helpful sources of information

Topics taught at KS2

Science in Years 3 and 4

In Years 3 and 4, children will be encouraged to ask questions about scientific concepts and then carry out experiments to find out the answers. In doing this they will:

- learn what a 'fair test' is.
- take measurements from a range of equipment.
- gather and record data.
- report their findings orally and in writing.

Science in Years 5 and 6

In Years 5 and 6, children will continue to practise the above skills, but with more depth and precision. When carrying out experiments they will:

- understand what variables are and how to control them.
- take measurements from a range of equipment, understanding the need for repeated measures to increase accuracy.
- gather and record data using labels, classification keys, tables, scatter graphs, bar and line graphs.
- use test results to make further predictions to set up further comparative and fair tests.
- make conclusions on the test carried out, orally and in writing.

Key Stage 2 science topics year by year

Year 3 science

- Plants, including parts of plants, needs of plants and their life cycle.
- Animals, including humans, focusing on nutrition, skeletons and muscles.
- Rocks, including comparing rocks, looking at fossils and understanding how soil is made.
- Light, looking at how light is reflected, how shadows are formed and can change.
- Forces and magnets, focusing on attraction and repulsion of magnets, magnetic materials and the two poles of a magnet.

Year 4 science

- Living things and their habitats, including classifying living things and looking at changes to environments.
- Animals, including humans, focusing on eating: teeth, the digestive system and food chains.
- States of matter, including grouping materials, changing state, evaporation and condensation.
- Sound, looking at creation of sound through vibration and changes in pitch and volume.
- Electricity, including constructing a circuit and understanding conductors and insulators.

Year 5 science

- Living things and their habitats, including life cycles of a mammal, amphibian, insect and bird.
- Animals, including humans, focusing on changes from birth to old age.
- Properties and changes of materials, including dissolving, separating and reversible changes.
- Earth and space, looking at the movement of the sun, earth and moon.
- Forces, including gravity, air resistance, water resistance and friction.

Year 6 science

- Living things and their habitats, including classifying micro-organisms, plants and animals.
- Animals, including humans, focusing mainly on diet and exercise.
- Evolution and inheritance, looking at fossils, reproduction and adaptation.
- Light, looking closely at how it travels and how shadows are made.
- Electricity, analysing the function of lamps, buzzers, cells and switches.

Year 7 Overview

Term	Knowledge	Assessment	Connections to learning	Connections to future pathways
Autumn	**Organisms (Cells)** This unit starts by reminding students about the features of organisms, and then looks at organs, tissues and cells. These ideas are then built back up in order to look at organs once again, in the context of organ systems. Throughout the unit, students are encouraged to compare what we know now about the structure of organisms with what people believed in the past. The theme of Ancient Egypt helps to thread these ideas together.			
	➢ Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope ➢ The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts	➢ Baseline test, Quick Quiz (multiple choice test), model cell homework (grade assessed task) ➢ Exam–style test (extended and short response)	➢ Movement ➢ Food and nutrition ➢ Plants and photosynthesis ➢ Respiration ➢ Movement ➢ Unicellular organisms ➢ Pathogens and disease ➢ HE 3 physical health and fitness (C)	➢ Careers ➢ STEM based ➢ e.g; microbiologist, zookeeper, nutritionist, research scientist, horticulturalist, sustainability consultant, doctor, nurse ➢ Post 16 ➢ A Level Biology ➢ Agricultural and related sciences, Biological sciences, Medicine and allied subjects, Sports sciences, Veterinary sciences

	➢ The similarities and differences between plant and animal cells ➢ The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms ➢ Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety (using a light microscope and preparing light microscope slides). Literacy & Communication skills ➢ Use conventions in writing (such as ordered subheadings, ordered lists). Maths skills ➢ Use symbols for units.			
	Energy This unit uses a theme park to introduce the idea that stores of energy are needed to make most things happen. It looks at food, energy stores and transfers, and energy resources in terms of non-renewable fuels and renewable resources			
	➢ Comparing energy values of different	➢ Quick Quiz (multiple choice test),	➢ Energy and electricity ➢ food and digestion	➢ Careers

	foods (from labels) (kJ) ➢ Comparing amounts of energy transferred (J, kJ, kW hour) ➢ Fuels and energy resources ➢ Other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels ➢ Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change. ➢ Literacy & Communication skills ➢ Summarising texts. Maths skills ➢ Using ratios to compare experimental results.	➢ Exam–style test (extended and short response)	➢ plants and photosynthesis ➢ <u>HE 4 (a) Healthy eating</u> ➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u>	STEM based e.g engineer, research physicist, Astronomer, Medical Physicist visual effects, architect, doctor ➢ Post 16 A level Biology A level Chemistry A level Physics ➢ Agricultural and related sciences, Biological sciences, Medicine and allied subjects, Sports sciences, Veterinary sciences, Physical sciences, Engineering and technology
	Matter - The particle model This unit develops an understanding of the different properties of solids, liquids and gases within the context of waste management and disposal. Scientific method and ideas on experiments, observation, hypotheses and theories are discussed, leading to an understanding of the particle theory of matter. Further applications of the particle theory are investigated using the context of waste and waste disposal.			

	➢ The properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure (Chemistry) ➢ Similarities and differences, including density differences, between solids, liquids and gases (Physics) ➢ Brownian motion in gases (Physics) ➢ Differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice– water transition. (Physics) ➢ Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review ➢ Make predictions using scientific	➢ Exam–style test (extended and short response) ➢ Quick Quiz (multiple choice test)	➢ Circuits ➢ Atoms and elements ➢ Sound ➢ Mixtures and separation	➢ Careers ➢ STEM based ➢ e.g; research chemist, pharmacist, environmental chemist, investment analyst, lab technician, textile colour technician ➢ Post 16 ➢ A Level Biology ➢ A level Chemistry ➢ A level physics ➢ Biological sciences, Medicine and allied subjects, Veterinary sciences, Engineering and Technology, Physical sciences

	knowledge and understanding ➢ Present observations and data using appropriate methods, including tables and graphs. Literacy & Communication skills ➢ How scientists use language to measure and compare by applying adjectives, comparatives and superlatives. Maths skills ➢ Converting between metres and nanometres ➢ Calculating volumes using simple formulae			
	Reactions (acids and alkalis) This unit looks at acids and alkalis and how they are described using a pH number. It looks at neutralisation reactions and some of the uses, and also introduces standard hazard symbols.			
	➢ Chemical reactions as the rearrangement of atoms ➢ Representing chemical reactions using formulae and using equations ➢ Defining acids and alkalis in terms of	➢ Quick Quiz (multiple choice test), ➢ Investigating Indigestion remedies planning activity (grade assessed task) ➢ Exam–style test (extended and short response)	➢ Particles ➢ Energy ➢ Reactions of metals ➢ combustion	➢ Careers ➢ STEM based ➢ e.g; research chemist, pharmacist, environmental chemist, investment analyst, lab technician, textile colour technician ➢ Post 16 ➢ A Level Biology

	neutralisation reactions ➢ The pH scale for measuring acidity/alkalinity; and indicators ➢ Reactions of acids with alkalis to produce a salt plus water. In addition to covering a variety of Working Scientifically statements, this unit has a focus on ➢ Evaluate risks. Literacy & Communication skills ➢ Identify nouns and noun phrases ➢ Identify key points in text, pictures, charts and graphs to create titles ➢ Develop titles for text, diagrams, charts and graphs in order to present ideas and opinions clearly. Maths skills ➢ Reading and plotting line graphs ➢ Drawing bar charts.			➢ A level Chemistry ➢ Agricultural and related sciences, Biological sciences, Medicine and allied subjects, Veterinary sciences, Engineering and Technology, Physical sciences
Spring	**Energy- Circuits**			

	This unit looks at the measurement of current and how it behaves in series and parallel circuits, and at voltage and resistance. Various models for thinking about what is happening in circuits are explored, and the unit concludes by looking at how we use electricity safely.			
	➢ Electric current, measured in amperes, in circuits, series and parallel circuits and the domestic ring main ➢ Current as flow of charge ➢ Potential difference, measured in volts, battery … ratings; resistance as the ratio of potential difference (p.d.) to current measured in ohms ➢ Differences in resistance between conducting and insulating components ➢ Using physical models to help to explain phenomena ➢ Explaining why models are used ➢ Planning a fair test. Literacy & Communication skills ➢ Presenting information in tables ➢ Classifying data as qualitative or quantitative. Maths skills	➢ Quick Quiz (multiple choice test), ➢ Exam–style test (extended and short response)	➢ Energy and electricity ➢ Efficiency ➢ Cost of electricity	➢ Careers ➢ STEM based e.g.; engineer, research physicist, Astronomer, Medical Physicist visual effects, architect, ➢ Doctor. ➢ Post 16 ➢ A Level physics ➢ Computing ➢ Computer science ➢ Engineering and Technology, Computer Sciences, Physical sciences

	➢ The use of symbols when communicating science.			
	Organisms (sexual reproduction and muscles and bones) This unit explores sexual reproduction in animals, in the context of efforts being made by zoos to prevent endangered species becoming extinct. However, the central focus for learning is the human reproductive system and sexual reproduction in humans. It uses a 'fitness' theme to cover three important organ systems: the gas exchange system, the circulatory system and the locomotor system. The various effects of drugs on these systems are also considered, together with their effects on the nervous system.			
	➢ Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta. ➢ Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of	➢ Sexual reproduction comic strip (grade assessed task) ➢ Exam–style test (extended and short response) ➢ Quick quiz (multiple-choice questions)	➢ Cells ➢ Specialised cells ➢ Ecosystems ➢ Plant reproduction ➢ <u>RSE 5 (g) the facts about pregnancy and miscarriage</u> ➢ <u>HE 4 (all) physical health and fitness</u> ➢ <u>HE 5 (all) Drugs, alcohol and tobacco</u> ➢ <u>HE8 Changing adolescent bodies (all)</u>	➢ Careers STEM based e.g; microbiologist, zookeeper, research scientist, horticulturalist, sustainability consultant, doctor, nurse, physiotherapist ➢ Post 16 A Level Biology ➢ Agricultural and related sciences, Biological sciences, Medicine and allied subjects, Sports sciences, Veterinary sciences

	publishing results and peer review ➢ Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience ➢ Make predictions using scientific knowledge and understanding ➢ Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate. Literacy & Communication skills ➢ Making effective notes from text, including different ways of organising notes depending on purpose. ➢ Maths skills ➢ An understanding of number, size and scale and the quantitative			

	relationship between units ➢ Using estimations ➢ The structure and functions of the gas exchange system in humans, including adaptations to function ➢ The mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume ➢ The structure and functions of the human skeleton, to include support, protection, movement and making blood cells ➢ Biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles ➢ The function of muscles and examples of antagonistic muscles			

	➢ The impact of exercise, asthma and smoking on the human gas exchange system ➢ The effects of recreational drugs (including substance misuse) on behaviour, health and life processes. ➢ Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review ➢ Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience. ➢ Literacy & Communication skills ➢ Information can be presented in different ways to communicate scientific ideas clearly. This includes understanding			

	sentence construction in order to develop sentences that can be used as part of a fluid			
	Forces This unit revises the concepts of forces and their effects and extends students' knowledge of friction, gravity and springs. These ideas are presented using a theme of outdoor sports, such as climbing and mountain biking, to link to ideas about forces, friction and pressure.			
	➢ Forces as pushes or pulls, arising from the interaction between two objects ➢ Using force arrows in diagrams, adding forces in one dimension, balanced and unbalanced forces ➢ Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water ➢ Forces measured in newton's, measurements of stretch or	➢ Springs/Hooke's Law graph task (grade assessed task) ➢ Balanced and unbalanced forces – journey of a car task (grade assessed task) ➢ Exam–style test (extended and short response)	➢ Muscles and movement ➢ Earth and space ➢ Electromagnets ➢ fluid	➢ Careers ➢ STEM based e.g; engineer, research physicist, Astronomer, Medical Physicist visual effects, architect, doctor ➢ Post 16 ➢ A Level physics ➢ Computing ➢ Computer science ➢ Engineering and Technology, Computer Sciences, Physical sciences

	compression as force is changed ➢ Force–extension linear relation; Hooke's Law as a special case ➢ Pressure measured by ratio of force over area – acting normal to any surface ➢ Opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface ➢ Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion ➢ Change depending on direction of force and its size. ➢ The need for using standard units of measurement (including the SI system, its basic units and prefixes). Literacy & Communication skills ➢ The use of conventions when communicating science			

	➢ Taking notes from presentations and videos (including the ordering of notes). ➢ Maths skills ➢ The use of conventions when communicating science ➢ The SI system.			
Summer	**Matter (mixtures and separation, atoms, elements and compounds)** This unit revises and builds on work in KS2 on materials, specifically on mixtures, solutions and separation techniques using the context of providing clean drinking water. This provides opportunities to introduce the methods of working in a science lab, which will differ from the science learning experience that most students will have had previously. This unit uses the context of resources from the Earth and atmosphere to introduce ideas about the make-up of matter. It expands on particle theory and explains the differences between atoms, and molecules, elements and compounds. It looks at the symbols and formulae for elements and compounds. The involvement of chemical reactions in the formation and decomposition of compounds is also covered. It links these with the more abstract ideas of particle models, naming compounds and word equations.			

	➢ The concept of a pure substance ➢ Mixtures, including dissolving ➢ Differences between atoms, elements and compounds ➢ Chemical symbols and formulae for elements and compounds ➢ Combustion, thermal decomposition, oxidation and displacement reactions ➢ The varying physical and chemical properties of different elements ➢ The composition of the Earth ➢ The difference between chemical and physical changes (physics) ➢ Atoms and molecules as particles (physics) ➢ Present observations and data using appropriate methods, including tables and graphs ➢ Understand and use SI units and IUPAC (International Union of Pure and Applied	➢ Exam–style test (extended and short response) ➢ Solutions/dissolving – what happens to sugar in a cup of tea task (grade assessed task) ➢ Quick quiz (multiple choice test)	➢ Acids and alkalis ➢ Particles ➢ Metals ➢ Reactivity ➢ Periodic table	➢ Careers ➢ STEM based e.g; accountant, research chemist, pharmacist, environmental chemist, investment analyst, lab technician, textile colour technician ➢ Post 16 ➢ A level Chemistry ➢ Agricultural and related sciences, Engineering and technology, Physical sciences

	Chemistry) chemical nomenclature. ➢ Literacy & Communication skills ➢ The use of facts and opinions to inform and persuade. ➢ Maths skills ➢ Qualitative and quantitative data ➢ The use of: tables; line graphs; scatter graphs; pie charts; and bar charts. ➢ Mixtures, including dissolving ➢ Simple techniques for separating mixtures: filtration, evaporation, evaporation, distillation and chromatography. ➢ Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety. ➢ Literacy & Communication skills ➢ Use flow charts to present sequences. ➢ Appreciate that the way in which scientific ideas are presented is determined by the			

	purpose and format of the communication. ➢ Use conventions and symbols when communicating science.			
	Waves (sound) This unit looks at how sounds are made, transmitted and detected, some uses of sound and compares sound waves with waves on the surface of water.			
	➢ Waves on water as undulations which travel through water with transverse motion; these waves can be reflected, and add or cancel – superposition ➢ Frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound ➢ Sound needs a medium to travel, the speed of sound in air, in water, in solids ➢ Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone	➢ Quick Quiz (multiple choice test), ➢ Exam–style test (extended and short response)	➢ Energy ➢ Particles ➢ light	➢ Careers ➢ STEM based e.g; engineer, research physicist, Astronomer, Medical Physicist visual effects, architect, doctor sound technician ➢ Post 16 ➢ A level Physics ➢ Architecture, building and planning, Engineering and technology, Physical science, Medicine and allied subjects

	diaphragm and the ear drum; sound waves are longitudinal ➢ Auditory range of humans and animals ➢ Pressure waves transferring energy; use for cleaning and physiotherapy by ultra-sound; waves transferring information for conversion to electrical signals by microphone. ➢ Present observations and data using appropriate methods, including tables and graphs ➢ Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions. ➢ Literacy & Communication skills ➢ Ways of recalling information. ➢ Maths skills ➢ Presenting data graphically.			

	Ecosystems With a general theme about explorers, this unit looks at ecosystems and the factors that affect them. This includes the impact of human activity and the importance of biodiversity.			
	➢ The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops ➢ How organisms affect, and are affected by, their environment, including the accumulation of toxic materials ➢ Differences between species ➢ The variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation ➢ The variation between species and between individuals of the same species means some	➢ Exam-style test (extended and short response) ➢ Quick Quiz (multiple choice test) ➢ HLP (grade assessed task) (HW)	➢ Plant reproduction ➢ Respiration ➢ Photosynthesis ➢ Interdependence ➢ Environment ➢ adaptations ➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u>	➢ Careers ➢ STEM based e.g; microbiologist, zookeeper, research scientist, horticulturalist, sustainability consultant, environmental scientist ➢ Post 16 ➢ A Level Biology ➢ Agricultural and related sciences, Biological sciences, Veterinary sciences

	organisms compete more successfully, which can drive natural selection ➢ The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material. ➢ Present observations and data using appropriate methods, including tables and graphs ➢ Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions. Literacy & Communication skills ➢ Information can be presented in different ways to communicate scientific ideas clearly. This includes understanding paragraph construction in order to develop logical and fluid text that			

	communicates information clearly.			

Year 8 Overview

Term	Knowledge	Assessment	Connections to learning	Connections to future pathways
Autumn	**Food and Digestion** This unit looks at the main components in the human diet and why they are needed. The digestive system is also covered in some detail, and the idea of enzymes is introduced. **Breathing and respiration** Under the broad theme of water sports, this unit covers gas exchange in humans and other organisms, together with details of aerobic and anaerobic respiration in humans.			
	➢ Content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed ➢ Calculations of energy requirements in a healthy daily diet ➢ The tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts)	➢ Quick Quiz (multiple choice test), ➢ Food and nutrition – Journey of a cheese sandwich task (grade assessed task) ➢ Exam-style test (extended and short response)	➢ Cells ➢ Energy ➢ Muscles ➢ Matter ➢ HE 3 physical health and fitness (all) ➢ HE 4 (a) Healthy eating ➢ HE 6 Health and prevention (A,D)	➢ Careers STEM based e.g; microbiologist, Nutritionist, sports therapist ➢ Post 16 A level Biology ➢ Agricultural and related sciences, Biological sciences, Medicine and Allied subject, Sports sciences, Veterinary sciences

	➢ The role of diffusion in the movement of materials in and between cells. ➢ Apply mathematical concepts and calculate results. ➢ Literacy & Communication skills ➢ How verbs and adjectives can be used to add ‘weight’ to an opinion bias. ➢ Maths skills ➢ Use appropriate units for area measurements ➢ Calculate area for a variety of shapes, including rectangles and cuboids. ➢ Apply mathematical concepts and calculate results. Literacy & Communication skills ➢ How verbs and adjectives can be used to add ‘weight’ to an opinion bias. ➢ Maths skills ➢ Use appropriate units for area measurements ➢ Calculate area for a variety of shapes,			

	including rectangles and cuboids. ➢ The mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume ➢ The impact of exercise, asthma and smoking on the human gas exchange system ➢ The role of leaf stomata in gas exchange in plants ➢ Aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life ➢ A word summary for aerobic respiration ➢ The process of anaerobic respiration in humans and microorganisms, including fermentation, and a word summary for anaerobic respiration			

	➢ The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism. ➢ Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review ➢ Apply mathematical concepts and calculate results. Literacy & Communication skills ➢ Information can be presented in different ways to communicate scientific ideas clearly. This includes understanding how sentences can be constructed to show cause and effect. Maths skills ➢ Identify the ranges of readings in data			

	➢ Explain why data with a small range is of good quality ➢ Calculate means and explain their use ➢ Identify anomalous results in data.			
	The Periodic Table This unit uses the context of fireworks to develop students' understanding of matter, atoms and chemical and physical change. Students then look at using the trends in the periodic table to make predictions about physical and chemical properties of elements and their compounds.			
	➢ A simple (Dalton) atomic model ➢ Differences between atoms, elements and compounds ➢ Chemical symbols and formulae for elements and compounds ➢ Chemical reactions as the rearrangement of atoms ➢ Representing chemical reactions using formulae and using equations ➢ The varying physical and chemical properties of different elements ➢ The principles underpinning the	➢ Quick Quiz (multiple choice test), ➢ Exam-style test (extended and short response)	➢ Atoms and elements ➢ Reactivity ➢ metals	➢ Careers ➢ STEM based e.g; accountant, research chemist, pharmacist, environmental chemist, investment analyst, lab technician, textile colour technician ➢ Post 16 ➢ A level Chemistry ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Engineering and Technology, Physical sciences, Medicine and Allied subject, Sports sciences,

	Mendeleev periodic table ➢ The periodic table: periods and groups; metals and non-metals ➢ How patterns in reactions can be predicted with reference to the periodic table ➢ The properties of metals and non-metals ➢ The chemical properties of metal and non-metal oxides with respect to acidity. ➢ Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions ➢ Present reasoned explanations, including explaining data in relation to predictions and hypotheses ➢ Evaluate data, showing awareness of potential sources of random and systematic error.			

	➢ Literacy & Communication skills ➢ The use of sentences to explain ideas clearly. ➢ Maths skills ➢ Identify anomalous results (outliers) ➢ Identify ranges ➢ Use a variety of charts and graphs to present and analyse data.			
	Fluids This unit looks at changes of state, and then goes on to look at fluids and some of their effects, including pressure, floating and sinking, and drag.			
	➢ Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water ➢ Atmospheric pressure, decreases with increase of height as weight of air above decreases with height ➢ Pressure in liquids, increasing with depth; upthrust effects, floating and sinking	➢ Exam–style test (extended and short response), ➢ Fluids – Titanic Task (grade assessed task)	➢ Forces and motion ➢ Particles	➢ Careers ➢ STEM based e.g; engineer, research physicist, Astronomer, Medical Physicist visual effects, architect, doctor sound technician ➢ Post 16 ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and Planning, Engineering and Technology, Physical sciences, Medicine and Allied subject, Sports sciences,

	➢ Pressure measured by ratio of force over area – acting normal to any surface ➢ Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving ➢ Similarities and differences, including density differences, between solids, liquids and gases ➢ The difference between chemical and physical changes ➢ The differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density, the anomaly of ice–water transition ➢ Atoms and molecules as particles ➢ Changes with temperature in motion and spacing of particles. ➢ Apply mathematical concepts and calculate results. Literacy & Communication skills			

	➢ Use of prepositional phrases. Maths skills ➢ Apply mathematical concepts and calculate results.			
Spring	**Light** This unit revises work from KS2 on light, which is then extended to consider how light travels and what happens when it meets an object. The unit is set in the context of stage, film and illusions.			
	➢ The similarities and differences between light waves and waves in matter ➢ Light waves travelling through a vacuum; speed of light ➢ The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface ➢ Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye ➢ Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive	➢ Light - reflection (grade assessed task) ➢ Exam-style test (extended and short response)	➢ EM waves ➢ The eye	➢ Careers ➢ STEM based e.g; Optician, Light technician Fibre optic engineer etc. ➢ Post 16 ➢ A level Biology ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and Planning, Biological sciences, Engineering and Technology, Physical sciences, Medicine and Allied subject, Sports sciences, Veterinary sciences

	material in the retina and in cameras ➢ Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection. ➢ The use of conventions in scientific communication. Literacy & Communication skills ➢ Preparing effective presentations. ➢ Maths skills ➢ Measuring angles.			
	Earth and Space This unit builds on work from KS2 on the Solar System and looks at the Earth, including the seasons and the Earth's magnetic field and gravity. It also looks at the Solar System and what is beyond the Solar System. The theme is exploring the Solar System – in terms of observations and the use of models as well as via astronauts and space probes			
	➢ Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets and forces due to static electricity ➢ Magnetic poles, attraction and repulsion ➢ Magnetic fields by plotting with compass,	➢ HLP (grade assessed task) (HW) ➢ Exam-style test (extended and short response) ➢ Earth and Space – Mars Debate (grade assessed task)	➢ Space at KS4 ➢ Forces ➢ matter	➢ Careers ➢ STEM based e.g; Astronomer Astrophysics research Astronaut meteorologist ➢ Post 16 ➢ A level Physics ➢ Architecture, building and planning, Engineering and technology, Physical science,

	representation by field lines ➢ Earth's magnetism, compass and navigation ➢ Gravity force, weight = mass × gravitational field strength (g), on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only) ➢ Our Sun as a star, other stars in our galaxy, other galaxies ➢ The seasons and the Earth's tilt, day length at different times of year, in different hemispheres ➢ The light year as a unit of astronomical distance. ➢ Apply mathematical concepts and calculate results. Literacy & Communication skills ➢ Presenting arguments. ➢ Maths skills ➢ Using ratios to compare quantities ➢ Writing one number as a fraction of another			

	and converting fractions to decimals ➢ Substituting values into simple formulae and solving resulting equations ➢ Drawing line graphs and scatter graphs, and using these to draw conclusions.			
	Combustion This unit uses the context of combustion engines to cover combustion and oxidation reactions, including those of hydrocarbons, metals and non-metals. The idea of an exothermic reaction is introduced and there is also a look at the pollution of the air by the products of fossil fuel combustion. There are opportunities to discuss the impact of global warming and methods for controlling carbon dioxide emissions			
	➢ The properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure ➢ Differences between atoms, elements and compounds ➢ Chemical symbols and formulae for elements and compounds ➢ Conservation of mass changes of state and chemical reactions ➢ Chemical reactions as the rearrangement of atoms	➢ Quick Quiz (multiple choice test) ➢ Exam-style test (extended and short response)	➢ Energy ➢ Ecosystems ➢ Reactions ➢ Earth and the atmosphere	➢ Careers ➢ STEM based e.g; accountant, research chemist, pharmacist, environmental chemist, investment analyst, lab technician, textile colour technician ➢ Post 16 ➢ A level Biology ➢ A level Chemistry ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Biological sciences, Engineering and technology, Physical science,

	➢ Representing chemical reactions using formulae and using equations ➢ Combustion, thermal decomposition, oxidation and displacement reactions ➢ What catalysts do ➢ Exothermic and endothermic chemical reactions (qualitative) ➢ The carbon cycle ➢ The composition of the atmosphere ➢ The production of carbon dioxide by human activity and the impact on climate. ➢ Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate. ➢ Literacy & Communication skills ➢ Distinguish between information and explanation texts ➢ Use information and explanation texts to			Medicine and allied subjects, Sports sciences, Veterinary sciences.

	answer different types of question. ➢ Maths skills ➢ Interpreting line graphs.			
	Unicellular Organisms Under the broad theme of diseases, this unit takes a detailed look at what unicellular organisms are, the differences between different types, their problems and their uses.			
	➢ Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope ➢ The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere ➢ The similarities and differences between plant and animal cells	➢ Quick Quiz (multiple choice test) ➢ Exam-style test (extended and short response)	➢ Pathogens and disease ➢ Cells ➢ Classification ➢ <u>RSE Intimate sexual relationships, including sexual health (I,J)</u> ➢ <u>HE 6 Health and prevention (A,D)</u>	➢ Careers ➢ STEM based e.g; microbiologist, zookeeper, research scientist, horticulturalist, sustainability consultant, environmental ➢ Post 16 ➢ A level Biology ➢ Agricultural and related sciences, Biological sciences, Medicine and Allied subject, Sports sciences, Veterinary sciences

	➢ The process of anaerobic respiration in humans and microorganisms, including fermentation, and a word summary for anaerobic respiration ➢ The role of diffusion in the movement of materials in and between cells ➢ The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism ➢ The structural adaptations of some unicellular organisms ➢ The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms ➢ The carbon cycle (Chemistry). ➢ Present observations and data using appropriate methods, including tables and graphs (pie charts).			

	➢ Literacy & Communication skills ➢ Information can be presented in different ways to communicate scientific ideas clearly. This includes understanding how modal verbs are used to express certainty. ➢ Maths skills ➢ Identify pie charts ➢ Describe what a certain pie chart shows ➢ Extract simple information from pie charts ➢ Present data in pie charts ➢ Identify when to use a pie chart.			
Summer	**Rocks** This unit examines the different types of rock and the processes that bring about their formation, leading to the idea of a rock cycle that operates within a huge geological timescale. It also looks at the Earth as a source of resources and the advantages of recycling metals. The unit is set in the context of natural disasters.			
	➢ The composition of the Earth ➢ The structure of the Earth ➢ The rock cycle and the formation of igneous,	➢ Rocks – Rock Cycle task (grade assessed task) ➢ Exam-style test (extended and short response)	➢ Carbon cycle ➢ Fossils ➢ Composites at KS4	➢ Careers ➢ STEM based e.g; Architect, Geologist Palaeontologist, Materials scientist/builer ➢ Post 16 ➢ A level Chemistry

	sedimentary and metamorphic rocks ➢ Earth as a source of limited resources and the efficacy of recycling. ➢ How the scientific method is adapted for mainly observational sciences, such as geology. ➢ Literacy & Communication skills ➢ Analysing the use of emotive language and evaluating media reports. ➢ Maths skills ➢ Interpreting more complex graphs ➢ Substituting into formulae.			➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Engineering and technology, Physical science,
	Energy transfers This unit looks at energy transfers by heating in the context of homes.			
	➢ Comparing power ratings of appliances in watts (W, kW) ➢ Comparing amounts of energy transferred (J, kJ, kWh) ➢ Domestic fuel bills, fuel use and costs ➢ Heating and thermal equilibrium:	➢ Energy Transfers – investigating insulators planning task (grade assessed task) ➢ Exam-style test (extended and short response)	➢ Energy and electricity ➢ Efficiency ➢ Sound ➢ light	➢ Careers ➢ STEM based e.g; engineer, research physicist, Astronomer, Medical Physicist visual effects, architect, doctor sound technician ➢ Post 16 ➢ A level Biology ➢ A level Physics

	temperature difference between two objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference: use of insulators ➢ Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change ➢ Comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions ➢ Using physical processes and mechanisms, rather than energy, to explain the intermediate steps			➢ Agricultural and related sciences, Architecture, building and planning, Biological sciences, Engineering and technology, Physical science, Sports sciences,

	that bring about such changes. ➢ Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility. ➢ Literacy & Communication skills ➢ Using language appropriate to the audience. ➢ Maths skills ➢ Substituting values in simple formulae and solving resulting equations ➢ Understanding percentages ➢ Drawing and interpreting scale drawings ➢ Choosing and using a suitable level of accuracy for measurements. Cross-disciplinary			
	Metals and Their Uses This unit uses the context of metals used in building to review common physical properties of metals, and to introduce their main chemical properties. The idea that reactions can occur at different speeds is also illustrated and this leads to the introduction of the general reactivity series of metals.			

	➢ Chemical symbols and formulae for elements and compounds ➢ The concept of a pure substance ➢ Mixtures, including dissolving ➢ The identification of pure substances ➢ Representing chemical reactions using formulae and using equations ➢ Combustion, thermal decomposition, oxidation and displacement reactions ➢ Reactions of acids with metals to produce a salt plus hydrogen ➢ The varying physical and chemical properties of different elements ➢ The properties of metals and non-metals ➢ The order of metals and carbon in the reactivity series. ➢ Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.	➢ Metals and their Uses – investigating the reaction of metals with acid task (grade assessed task) ➢ Exam-style test (extended and short response)	➢ Chemical equations ➢ Energy ➢ neutralisation	➢ Careers ➢ STEM based e.g; accountant, research chemist, pharmacist, environmental chemist, investment analyst, lab technician, textile colour technician ➢ Post 16 ➢ A level Chemistry ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Biological sciences, Engineering and technology, Physical science,

	➢ Literacy & Communication skills ➢ The use of adjectives to accurately describe substances in science. ➢ Maths ➢ Calculating mean values and percentages ➢ Drawing and interpreting bar charts and line graphs.			
	Plants and their reproduction This unit covers reproduction in plants, both sexual and asexual, although the former is of chief importance. Classification and biodiversity are also covered. The theme that is threaded through the unit is the various uses that we have for plants.			
	➢ Plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots ➢ Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms	➢ Exam–style test (extended and short response) ➢ Quick Quiz (multiple choice test)	➢ Photosynthesis ➢ Interdependence ➢ adaptations	➢ Careers ➢ STEM based e.g; horticulturist Environmental scientist Ecologist Sustainability consultant Gardener farmer ➢ Post 16 ➢ A level Biology ➢ Agricultural and related sciences, Biological sciences, Medicine and allied subjects,

	➢ The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops ➢ The importance of plant reproduction through insect pollination in human food security ➢ Heredity as the process by which genetic information is transmitted from one generation to the next ➢ Differences between species ➢ The variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation ➢ The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material. ➢ Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods			

	and suggest possible improvements ➢ Apply sampling techniques. Literacy & Communication skills ➢ Information can be presented in different ways to communicate scientific ideas clearly. This includes understanding paragraph construction (using ideas of unity, cohesion and order) to develop logical and fluid text that communicates information clearly. ➢ Maths skills ➢ Use appropriate units for area measurements ➢ Calculate areas for squares and rectangles ➢ Use a sample to calculate an estimate of population size.			

Year 9 Overview

Term	Knowledge	Assessment	Connections to learning	Connections to future pathways
Autumn	**Variation and Plant Growth** Introduces the ideas of inheritance and evolution and reiterates the importance of plants			

	➢ Heredity as the process by which genetic information is transmitted from one generation to the next ➢ Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta ➢ A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model ➢ Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and	➢ Quick Quiz (multiple choice test) ➢ Badger assessments (grade assessed task)HLP	➢ Photosynthesis ➢ Agriculture ➢ Impact of human activity on the environment ➢ variation ➢ Genes ➢ The impact of the environment on living organisms ➢ Adaptation ➢ natural selection ➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u>	➢ Careers ➢ STEM based e.g; scientist, genetic engineer Careers in farming and agriculture ➢ Post 16 ➢ A level Biology ➢ Agricultural and related sciences, Biological sciences, Medicine and allied subjects,

	dispersal, including quantitative investigation of some dispersal mechanisms ➢ Differences between species ➢ The variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation ➢ The variation between species and between individuals of the same species means some organisms compete more successfully, which can drive natural selection ➢ Changes in the environment may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction ➢ The importance of maintaining biodiversity and the			

	use of gene banks to preserve hereditary material. ➢ Undertake basic data analysis including simple statistical techniques (probability). Literacy & Communication skills ➢ Construct convincing arguments ➢ Construct balanced arguments. Maths skills ➢ Explain what probability is ➢ Calculate probabilities and present them as fractions, decimals and percentages ➢ Calculate experimental probabilities ➢ Calculate theoretical probabilities. ➢ Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope ➢ The functions of the cell wall, cell membrane,			

	cytoplasm, nucleus, vacuole, … chloroplasts ➢ The role of diffusion in the movement of materials in and between cells ➢ Plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots ➢ The role of leaf stomata in gas exchange in plants ➢ Reproduction in plants, including … insect pollination, … seed and fruit formation … ➢ The adaptations of leaves for photosynthesis ➢ Aerobic … respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life ➢ A word summary for aerobic respiration			

	➢ The interdependence of organisms in an ecosystem, including food webs and insect-pollinated crops ➢ The importance of plant reproduction through insect pollination in human food security ➢ How organisms affect, and are affected by, their environment, including the accumulation of toxic materials ➢ The importance of maintaining biodiversity … ➢ Evaluate data, showing awareness of potential sources of random and systematic error (bias and validity). Literacy & Communication skills ➢ Develop clear sentences and paragraphs by use of appropriate emphasis, in order to present ideas and opinions ➢ Develop logical sequences of points in writing. Maths skills			

	➢ Bar chart and line graph drawing and interpretation ➢ Identifying random samples (and their use in avoiding bias).			
	Materials and reactivity Introduces the idea of synthetic substances and expands pupils knowledge and understanding of what is happening in different chemical reactions			
	➢ Chemical symbols and formulae for elements and compounds ➢ The concept of a pure substance ➢ The identification of pure substances ➢ Combustion, thermal decomposition, oxidation and displacement reactions ➢ Chemical reactions as the rearrangement of atoms ➢ Representing chemical reactions using formulae and using equations ➢ Exothermic and endothermic chemical reactions (qualitative)	➢ Exam–style test (extended and short response) ➢ Quick Quiz (multiple choice test), ➢ Badger assessments (grade assessed task)	➢ Polymers ➢ Composite materials ➢ Recycling ➢ Impact of human activity on the environment ➢ Chemical reactions ➢ Energy in reactions ➢ Extracting metals	➢ Careers ➢ STEM based e.g; industrial chemist, environmental scientist, metal industry worker, metallurgist, nanotechnologist ➢ Post 16 ➢ A level Chemistry ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Engineering and technology, Physical science, Medicine and allied subjects, Sports sciences,

	➢ Properties of ceramics, polymers and composites (qualitative) ➢ The production of carbon dioxide by human activity and the impact on climate ➢ Earth as a source of limited resources and the efficacy of recycling. ➢ Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review. Literacy & Communication skills ➢ Recognise the use of biased language in texts. Maths skills ➢ Calculating mean values and percentages ➢ Drawing and interpreting bar charts, scatter graphs and line graphs. ➢ The properties of the different states of			

	matter (solid, liquid and gas) in terms of the particle model, including gas pressure ➢ Changes of state in terms of the particle model ➢ A simple (Dalton) atomic model ➢ Chemical symbols and formulae for elements and compounds ➢ Conservation of mass in changes of state and chemical reactions ➢ Chemical reactions as the rearrangement of atoms ➢ Representing chemical reactions using formulae and using equations ➢ Combustion, thermal decomposition, oxidation and displacement reactions ➢ Energy changes on changes of state (qualitative) ➢ Exothermic and endothermic chemical reactions (qualitative). ➢ Solve problems involving percentage			

	change, including: percentage increase, decrease. Literacy & Communication skills ➢ Active and passive voice. Maths skills ➢ Calculating percentages ➢ Calculating the result of a percentage increase or decrease ➢ Calculating percentage change.			
	Forces and motion Introduces the idea of how forces can affect the movement of objects and expands on pupils Understanding of non-contact forces			
	➢ Comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with ... changes in positions in a field, in elastic distortions and in chemical compositions ➢ Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between	➢ Quick Quiz (multiple choice test) ➢ Badger assessments (grade assessed task)	➢ Speed ➢ Machines ➢ Turning forces ➢ Gravity ➢ Static electricity ➢ Magnetism and electromagnetism	➢ Careers ➢ STEM based e.g; engineer, civil engineer, product design, automotive design, space ➢ Post 16 ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Engineering and technology, Physical science, Sports sciences.

	magnets and forces due to static electricity ➢ Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge ➢ Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current ➢ Differences in resistance between conducting and insulating components (quantitative) ➢ Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects ➢ The idea of electric field, forces acting across the space			

	between objects not in contact ➢ Magnetic poles, attraction and repulsion ➢ Magnetic fields by plotting with compass, representation by field lines ➢ The magnetic effect of a current, electromagnets, D.C. motors (principles only) ➢ Gravity force, weight = mass × gravitational field strength (g), on Earth g = 10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun (qualitative only) ➢ Process data and give answers to an appropriate degree of accuracy, using significant figures and decimal places. Literacy & Communication skills ➢ Use cohesive devices to make text			

	clearer and easier to read. Maths skills ➢ Substitute into formulae and solve equations ➢ Change the subject of a simple formula.			
Spring /Summer	**Cells and transport** Expands on pupils' knowledge and understanding of different types of cell and how substances move into and out of them to KS4 level			
	➢ I can compare and contrast the magnification and resolution obtained by using light and electron microscopes. ➢ I can justify the use of an electron microscope. ➢ I can re-arrange the magnification equation and measure the size of cells. ➢ I can explain how the main structures of cells are related to their functions. ➢ I can suggest reasons why some cells do not contain all cell structures. ➢ I can compare sizes of cells using units of	➢ End of KS3 exams in Biology, chemistry and physics ➢ Required practicals x 2,end of chapter exam-style questions	➢ Microscopy ➢ Eukaryotic, Prokaryotic and specialised cells ➢ Diffusion, osmosis and active transport ➢ Cell division and differentiation ➢ Stem cells ➢ <u>HE 3 Physical health and fitness (C)</u>	➢ Careers ➢ STEM based e.g; microbiologist, medical professional, pharmacy, research biologist, zoologist, medicine, laboratory technician ➢ Post 16 ➢ A level Biology ➢ A level Chemistry ➢ Agricultural and related sciences, Biological sciences, Engineering and technology, Physical science, Medicine and allied subjects, Sports sciences, Veterinary sciences.

	length and standard form. ➢ I can explain how the main structures of prokaryotic cells are related to their functions. ➢ I can perform calculations to work out orders of magnitude. ➢ I can discuss how the structure of specialised animal cells are related to their function within the organ and whole organism. ➢ I can suggest the function of an unknown specialised cell based on its structure. ➢ I can write an effectively structured explanation of how animal cells are adapted. ➢ I can discuss how the structure of specialised plant cells is related to their function within the organ and whole organism. ➢ I can design a cell, tissue or organ to			

	perform a certain function. ➢ I can measure a root hair cell observed using a light microscope. ➢ I can explain how temperature and concentration gradient affects rate of diffusion. ➢ I can write a hypothesis using detailed scientific knowledge and explain how it could be tested. ➢ I can explain how a model shows osmosis in a cell. ➢ I can use the terms isotonic, hypotonic or hypertonic to explain the movement of water across a cell membrane. ➢ I can explain the mechanisms that lead to turgid or flaccid plant cells and plasmolysis. ➢ I can write a detailed plan independently. ➢ I can use a line graph to estimate the concentration of			

	solution inside a plant cell. ➢ I can describe how active transport takes place. ➢ I can suggest how a cell that carries out active transport is adapted to this function. ➢ I can design and evaluate a representational model to show active transport. ➢ I can link ideas about diffusion to explain how the adaptations of exchange surfaces increases their effectiveness. ➢ I can use ideas about surface area to explain the shape of a leaf. ➢ I can calculate the surface area to volume ratio of a sphere. ➢ I can explain why genetic material must be doubled during mitosis. ➢ I can explain in detail what happens at each stage of the cell cycle.			

	➢ I can use the keywords to write detailed explanations on why mitosis is an important process in living things and how characteristics are inherited. ➢ I can compare and contrast differentiation in plants and animals. ➢ I can explain why it is easier to clone a plant compared to an animal. ➢ I can explain and carry out a practical accurately and safely in order to successfully clone a plant. ➢ I can explain why embryonic stem cells are more useful for helping medical conditions. ➢ I can write a well-structured article about stem cells which has impact by the use of precise vocabulary and real-life examples. ➢ I can explain the process of therapeutic cloning organism.			

	➢ I can evaluate the use of stem cells. ➢ I can clearly communicate strong, well-researched arguments in a persuasive manner.			
	Atomic structure and the Periodic Table Introduces the idea of sub-atomic particles and how this informs the position of elements on the Period Table to KS4 level			
	➢ I can use chemical symbols of atoms to produce the chemical formulae of a range of elements and compounds. ➢ I can explain the significance of chemical symbols used in formulae and equations. ➢ I can justify in detail how mass may appear to change in a chemical reaction. ➢ I can describe unfamiliar chemical reactions with more complex balanced symbol equations, including state symbols.	➢ End of chapter exam-style questions	➢ Atomic structure ➢ Techniques for separating mixtures ➢ Sub atomic particles and their properties ➢ History of the atom ➢ Development of the Periodic table ➢ Properties of elements and trends in the periodic table	➢ Careers ➢ STEM based e.g; energy industry worker/research scientist, laboratory technician, molecular engineer, quantum physicist ➢ Post 16 ➢ A level Chemistry ➢ A level Physics ➢ Architecture, building and planning, Engineering and technology, Physical science,

	➢ I can write balanced symbol equations. ➢ I can use experimental data to explain the classification of a substance as a compound or a mixture. ➢ I can suggest an appropriate separation or purification technique for an unfamiliar mixture. ➢ I can explain in detail how multi-step separation techniques work. ➢ I can explain in detail how fractional distillation can separate miscible liquids with similar boiling points. ➢ I can evaluate separation or purification techniques for a given mixture. ➢ I can justify why the model of the atom has changed over time. ➢ I can evaluate the current model of an atom. ➢ I can use the periodic table to find atomic			

	number and mass number data and use it ➢ To determine the number of each subatomic particle in any given atom. ➢ I can recognise and describe patterns in subatomic particles of elements listed in the periodic table. ➢ I can explain why we can be confident that there are no missing elements in the first 10 elements of the periodic table. ➢ I can use the periodic table to find atomic number and mass number data and use it to determine the number of each subatomic particle in an ion. ➢ I can use SI units and prefixes to describe the size of an atom and its nucleus in standard form. ➢ I can explain why chlorine does not have a whole mass number.			

	➢ I can use the periodic table to find atomic number and determine the electronic structure for the first 20 elements. ➢ I can make predictions for how an element will react when given information on another element in the same group. I can explain how and why the ordering of the elements has changed over time. ➢ I can explain how the electronic structure of metals and non-metals affects their reactivity. ➢ I can use the periodic table to make predictions about the electronic structure and reactions of elements. ➢ I can predict the electronic structure of stable ions for the first 20 elements. ➢ I can illustrate the reactions of Group 1 metals with balanced symbol equations.			

	➢ I can explain how Group 1 metals form ions with a +1 charge when they react with non-metals. ➢ I can justify how Group 1 metals are stored and the safety precautions used when dealing with them. ➢ I can illustrate the reactions of Group 7 metals with balanced symbol equations. ➢ I can explain how Group 7 non-metals form ions with a −1 charge when they react with metals. ➢ I can explain in detail how to compare the reactivity of the Group elements. ➢ I can use electronic structure to explain the trends in physical and chemical properties of Group 1 and Group 7 elements. ➢ I can apply knowledge of reactivity of Groups 1 and 7 to suggest and explain the trend			

	in reactivity of Group 2 and 6. ➢ I can justify the use of a transition metal or its compound in terms of its chemical properties. ➢ I can suggest why Group 1 metals have different properties compared to transition metals.			
	Energy Conservation, dissipation and transfer Reiterates the idea that energy cannot be created or destroyed and expand on pupils- understanding of what can happen to energy to KS4 level			
	➢ I can describe the nature of energy stores in detail including the relationship between objects. ➢ I can explain factors that affect the size of changes in energy stores. ➢ I can represent energy changes graphically, accounting for changes in all stores. ➢ I can apply the law of conservation of energy to explain why	➢ End of chapter exam-style questions	➢ Conservation of energy and energy stores. ➢ Work, power and efficiency ➢ Electrical appliances ➢ Radiation ➢ Specific heat capacity	➢ Careers ➢ STEM based e.g; transport industry worker, mechanic, electrician, product designer, engineer, civil engineer, inventor ➢ Post 16 ➢ A level Biology ➢ A level Chemistry ➢ A level Physics ➢ Agricultural and related sciences, Architecture, building and planning, Biological sciences, Engineering and

	forces cause heating effects. ➢ I can describe closed systems and the changes to energy stores within them using the principle of conservation of energy. ➢ I can evaluate in detail experiments to investigate energy changes. ➢ I can use the principle of conservation of energy and forces to explain why objects become heated by frictional forces. ➢ I can apply the equation for work done in a wide range of contexts. ➢ I can evaluate in detail an experiment to measure work done, explaining why there is variation in the measurements. ➢ I can perform calculations using rearrangements of the gravitational potential energy store equations.			technology, Physical science, Sports sciences,

	➢ I can apply gravitational potential energy store equations in a wide range of contexts. ➢ I can account for all changes of energy during falls or increases in height, including health effects. ➢ I can perform calculations involving the rearrangement of the kinetic energy equation. ➢ I can perform calculations involving the rearrangement of the elastic potential energy equation. ➢ I can perform a wide range of calculations involving transfer of energy. ➢ I can use a wide range of energy stores and physical processes to decide on wasted and useful energy transfers. ➢ I can apply the concept of energy dissipation in a wide range of scenarios.			

	➢ I can evaluate in detail an experiment to measure the frictional forces acting on an abject. ➢ I can describe design features that can be used to improve the efficiency of an energy transfer. ➢ I can rearrange the efficiency equation to find input or total output energy. ➢ I can explain the operation of electrical devices in terms of forces and electric current. ➢ I can compare electrical devices in terms of efficiency. ➢ I can calculate the efficiency of an electrical device. ➢ I can evaluate in detail an efficiency investigation to justify conclusions. ➢ I can compare the power ratings of devices using standard form. ➢ I can apply the efficiency equation in a range of situations,			

	including rearrangement of the equation. ➢ I can combine the electrical power equation with other equations to solve complex problems. ➢ I can explain the different thermal conductivities of materials using the free electron and lattice vibration explanations of conduction. ➢ I can evaluate the results of an experiment into thermal conductivity in terms of repeatability and reproducibility of data, and the validity of conclusions drawn from the data. ➢ I can justify the choices of material involved in insulation or conduction using the concept of thermal conductivity and other data. ➢ I can explain why objects stop cooling in terms of the rate of			

	absorption and emission of radiation. ➢ I can apply the concepts of absorption and emission of IR radiation to explain why an object maintains a constant temperature. ➢ I can describe the changes in the rate of cooling of objects of different colours and temperatures. ➢ I can describe factors that affect the rate of emission of infrared radiation, including temperature and surface area. ➢ I can apply the concepts of absorption and emission of infrared radiation to explain why an object maintains a constant temperature. ➢ I can fully explain the greenhouse effect in terms of absorption, emission, and wavelengths of electromagnetic radiation.			

	➢ I can evaluate materials used for transferring energy in terms of their specific heat capacity. ➢ I can use the specific heat capacity equation to perform a wide range of calculations in unfamiliar contexts. ➢ I can evaluate in detail the results of an experiment to measure specific heat capacity. ➢ I can evaluate in detail design features used to reduce energy loss from the home. ➢ I can decide on home improvement features using payback time and savings beyond the payback time.			