GCSE Science Trilogy

Curriculum Overview 2023-2024

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, Psychology and Maths. 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. Each lesson has a lesson ppts adapted for the group which is shared on Teams. Each powerpoint provides carefully selected activities, model answers, and opportunities for academic reading. Relevant clips to review content and show practicals and the principles of scientific enquiry are embedded into each.. Students are provided with a booklet containing a glossary of tier 3 vocabulary and lesson resources. Students are also given knowledge organisers to use in lessons and at home for self-testing, review and revision. 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 and teaching disciplinary science knowledge and skills. 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, using apparatus, techniques and taking measurements with confidence, 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, using the evidence to develop explanations.

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.

Trips and visits

Ecological sampling

Assessment

Termly exams in Biology chemistry and physics consisting of a mixture of long and short answer and multiple choice questions- 15% of questions relate to practical skills, 20% of marks available will test maths skills

Homework

Exam style questions, revision and learning, practical write ups and webquests, retrieval questions

Clubs and/or intervention

Revision sessions and homework support/science society

Parental/Carer support

Teams resources/ parent fact sheet, knowledge organisers and email communication/ SWAY

Helpful sources of information

Teams, AQA, GCSE Bitesize, Kerboodle.com and Seneca learning, GCSEpod, Oak national academy lessons

Connections to future pathways

Careers: agriculturalist/farmer, agricultural scientist, andrologist, arborist, antibody formulation scientist, analytical scientist, arborist, astrobiologist, athletic trainer, audiology, biochemist, bioethicist, biologists, biomedical scientist, bioprocessing engineer, botanists, brain surgeon, cameraman, cardiologist, civil engineering, clinical endocrinologists, clinical social worker, conservation and environmental protection, conservation biologist, counsellor, cytogeneticist, diabetic nurse, diabetologist, dietitian, doctor, dosimetrist, ecologist, education, electroneurodiagnostic technician, embryologists, endocrinologists, endocrinology specialist nurse, environmental chemist, environmental geneticist, environmental Health officer, environmental planner, environmental scientist, electrician, engineer, exercise physiologist, food science technician, forensics, forestry consultant, forestry consultant, forest scientist, forestry technician, gardeners, gastroenterologist, genetic counsellor, geneticist, genetic technologist, global health researcher, gynaecologist, horticulturalist, horticultural scientist, immunologist, industrial chemist, infertility counsellor/support advisor, irrigation engineer, IVF nurse IVF doctor, jewellers, kidney dialysis nurse, laboratory technician, medical scientist, medical technician/engineer, microbiologist, neonatal/paediatric respiratory care specialist, naturalist, neural engineering, neuroscientist, nuclear physicist, neuroanatomist, neurobiologist, neurochemist, neuroengineering, neurological surgeon, neurologist, neuroradiologist, nurse, nutritionist, oncologist, oncology nurse, ophthalmologist, optician, orthoptist, optometrist, paediatric endocrinologist, palaeontologist, paleobiologist, particle scientist, pathologist, pharmacist, physical therapist, physiotherapist, plant biochemist, plumber, psychiatrist, psychobiologist, psychologist, Public Health project manager, radiation therapist, radiographer, renal specialist, research assistant, research endocrinologist, research physicist, research scientist, respiratory therapist, sports nutritionist, sports and exercise nutrition, sports therapist, urologist, wellness coach, wildlife biologist, window cleaner, zoologist.

Future learning: A levels in biology, chemistry, environmental science, geography, mathematics, physics; vocational qualifications in engineering, health and social care and applied science; degrees in agriculture, biology, biochemistry, biomedical science, biopharmaceuticals, botany, clinical endocrinology, conservation biology, dentistry, ecological restoration environmental engineering, environmental management, forensic science, genetics, horticulture, medicine, microbiology, physics, social sciences, human nutrition, plant science, botany, respiratory therapy, optometry and visual science, paleobiology, palaeontology, taxonomy, zoology; foundation and higher apprenticeships in engineering.

Year 10 Overview

Term	Knowledge	Assessment	Connections to learning
Autumn 1	**Cell Biology, The Periodic table, bonding, energy resources , scientific and maths skills** Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. 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. This phenomenon has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells. Just because we can- does it mean we should? 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. 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 and the challenges scientists face. 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. Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. 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. The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage. Science is a set of ideas about the material world. We have included all the parts of what good science is at GCSE level: whether it be investigating, observing, experimenting or testing out ideas and thinking about them. We will encourages the development of knowledge and understanding in science through opportunities for working scientifically. Working scientifically is the sum of all the activities that scientists do and a set of skills and understanding that is critical for a workforce fit for purpose in a modern age.		

	➢ <u>Cells and Organisation</u> ➢ Microscopes ➢ Animal and Plant cells ➢ Eukaryote and prokaryotic cells ➢ Specialised cells ➢ Diffusion ➢ Osmosis ➢ Active transport ➢ Cell division ➢ Stem cells	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of term ➢ End of year 10 exam and mock exam ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3- health and digestion and cells tissues and organs- C and L health diet, food technology ➢ KS4 bioenergetics, energy changes, healthy living.
	➢ <u>Atomic Structure</u> ➢ Atoms ➢ Balancing equations ➢ Separating mixtures ➢ Distillation and chromatography ➢ History of the atom ➢ Structure or the atom ➢ Isotopes and ions ➢ Electronic structure ➢ <u>The Periodic Table-</u> ➢ Development of the periodic table ➢ Electronic structures and the periodic table ➢ Group1- the alkalis metals ➢ Group 7- the halogens ➢ Explaining trends ➢ Challenges of developing new scientific ideas	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of term ➢ End of year 10 exam and mock exam ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Atomic Structure taught in year 9 (GCSE) and KS3 -- ‘Acids and Alkalis’, ‘The particle model’, ‘Atoms, elements and molecules’, ‘The Periodic Table’, ‘Reactivity’ and ’Metals and their uses’, ➢ ‘Properties and Changes of Materials’ and ‘electricity’ KS2 ➢ SMSC – Students appreciated the social and cultural challenges faced by scientists developing the Periodic Table (4a) 2. social development

			➢ Maths/numeracy - Students should recognise trends in data supplied
	➢ <u>Energy</u> ➢ Conduction ➢ Convection ➢ Radiation ➢ Specific Heat capacity ➢ Reducing energy losses in the home ➢ <u>Energy Resources</u> ➢ Energy demands ➢ Energy from wind and water ➢ Power from the sun and earth ➢ Energy and the environment ➢ Big energy issues	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of the half term ➢ End of year 10 exam and mock exam ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Energy resources and electricity in year 7 and 9. <u>SMSC 2 The Moral Development of pupils (B,C)</u> <u>5. moral development</u>
Autumn 2	**Organisation, Bonding, structure and properties of matter, Particles at work** In Organisation we will learn about the human digestive system which provides the body with nutrients and the respiratory system tha provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn 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. Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. 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. Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. The fundamentals of electromagnetism were worked out by scientists of the 19th century. However, power stations, like all machines, have a limited lifetime. If we all continue to demand more electricity this means building new power stations in every generation – but what mix of power stations can promise a sustainable future?		
	➢ <u>Organisation and the digestive system</u> ➢ Tissues and organs ➢ The human digestive system ➢ The chemistry of food ➢ Catalysts and enzymes ➢ Factors effecting enzymes ➢ How digestions works ➢ Making digestion efficient ➢ ➢ <u>Organising plants and animals</u> ➢ The blood ➢ The blood vessels ➢ The heart ➢ Helping the heart ➢ Breathing and gas exchange ➢ Tissues and Organs ➢ Transport systems in plants ➢ Evaporation and transpiration ➢ Factors effecting transpiration	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of term ➢ End of year 10 exam and mock exam ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Year 7 topic organisation and cells, year 9 and 8 plants and photosynthesis, ➢ Yr 10 photosynthesis ➢ 3. Physical development

	➢ <u>Structure and bonding</u> ➢ States of matter ➢ Atoms and Ions ➢ Ionic Bonding ➢ Giant Ionic structures ➢ Covalent bonding ➢ Structure of simple molecules ➢ Giant covalent structures ➢ Fullerenes and graphene ➢ Bonding in metals ➢ Giant metallic structures	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Unit 1 exam at the end of term ➢ End of year 10 exam and mock exam ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Atomic Structure taught in year 9 (GCSE) and KS3 -- 'The particle model', 'Atoms, elements and molecules', 'The Periodic Table' and 'Metals and their uses', ➢ 'Properties and Changes of Materials' and 'Electricity' KS2
	➢ <u>Electrical circuits and electricity in the home</u> ➢ Current and charge ➢ Potential difference ➢ Component characteristics ➢ Series circuits ➢ Parallel circuits ➢ Alternating current ➢ Cables and plugs ➢ Electrical power and potential difference ➢ Electrical currents and energy transfer ➢ Appliances and efficiency	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ AQA end of year 10 exam- term 2 ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ Circuits and energy at KS3 ➢ KS4 Biodiversity and ecosystems and environmental chemistry <u>SMSC 2 The Moral Development of pupils (B,C)</u>

Spring 1	**Infection and response, Quantitative Chemistry, Chemical changes, Particle model of matter** Learning about the key idea of infection and response I will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics- who/what will win? Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. 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. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas. Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organising their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the Earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'. The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain!		
	➢ <u>Communicable disease and preventing infection</u> ➢ Health and disease ➢ Pathogens and disease ➢ Preventing infections ➢ Viral diseases ➢ Bacterial diseases ➢ Diseases caused by fungi and protists ➢ Human defence responses ➢ Vaccination ➢ Antibiotics and painkillers	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams	➢ KS3 Health and disease, microorganisms and drug ➢ KS4 non communicable disease and antibiotic resistance, C and L <u>HE 4 (all) physical health and fitness</u> <u>HE 5 (all) Drugs, alcohol and tobacco</u>

	➢ Discovering drugs ➢ Developing drugs	➢ In lesson retrieval quiz and multiple choice hinge questions	<u>RSE Intimate sexual relationships, including sexual health (I,J)</u>
	➢ <u>Quantitative chemistry, chemical change</u> ➢ Relative masses and moles ➢ Equations and calculations ➢ From masses to balances equations ➢ Expressing concentrations ➢ The reactivity series ➢ Displacement reactions ➢ Extracting metals ➢ Salts from metals ➢ Salts from insoluble bases ➢ Making more salts ➢ Neutralisations and the pH scale ➢ Strong and weak acids	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 ‘atoms, elements and molecules’, maths skills lessons, ‘reactivity’, ‘acids and alkalis’, ‘metals and their uses’ and ‘the particle model’. ➢ KS4 ‘Atomic Structure’ ➢ ‘Properties and Changes of Materials’ at KS2. ➢ Maths
	➢ <u>Molecules and matter</u> ➢ Density ➢ States of matter ➢ Changes of state ➢ Internal energy ➢ Specific heat capacity ➢ Gas pressure and temperature	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ AQA end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 atoms, elements and molecules, maths skills lessons, chemical reactions. ➢ KS4 Bioenergetics, ➢ Energy resources, maths,

Spring 2	**Infection and response, chemical change, atomic structure** Ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.		
	➢ <u>Non communicable disease</u> ➢ Cancer ➢ Smoking and risk of disease ➢ Diet, exercise and disease ➢ Alcohol and other carcinogens	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS4 health and disease, vaccines, muscles and bones ➢ KS4 cell cycle, drugs testing, and preventing disease, Radioactivity <u>HE 4 (all) physical health and fitness</u> <u>HE 5 (all) Drugs, alcohol and tobacco</u>
	➢ <u>Electrolysis</u> ➢ Introduction to electrolysis ➢ Changes to electrodes ➢ The extraction of aluminium ➢ Electrolysis of aqueous solutions	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 ‘atoms, elements and molecules’, maths skills lessons, 'energy’, ‘current electricity’ 'reactivity’, ‘energy transfers’ ‘combustion’ and ‘mixtures and separation’. ➢ KS4 ‘crude oil and fuels’, ‘rates and equilibrium’ and ‘using our resources’ ➢ ‘Properties and Changes of Materials’ and ‘Electricity’ KS2

			➢ GCSE Physics - 'Energy and energy resources' and 'Particles at work'
	➢ <u>Radioactivity</u> ➢ Atoms and radiation ➢ The discovery of the nucleus ➢ Changes in the nucleus ➢ Alpha, beta and gamma radiation ➢ Activity and half life	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ AQA end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 atom and elements, particles ➢ KS4 particle mode of matter, atomic structure, infection and response
Summer 1	**Bioenergetics and Energy changes** When learning about the key idea of bioenergetics we will explore how plants harness the Sun's energy in photosynthesis in order to make food. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue. Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.		

	➢ <u>Respiration and photosynthesis</u> ➢ Photosynthesis ➢ The rate of photosynthesis ➢ How plants use glucose ➢ Making the most of photosynthesis ➢ Aerobic respiration ➢ The response to exercise ➢ Anaerobic respiration ➢ Metabolism and the liver	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ Aqa end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 cells and life processes, plants growth, photosynthesis and respiration, chemical change, ecology ➢ KS4 Ecology, chemical changes, energy changes, homeostasis. <u>HE 3 physical health and fitness (all)</u> <u>HE 4 (a) Healthy eating</u> <u>HE 6 Health and prevention (A,D)</u>
	➢ <u>Energy changes</u> ➢ Exothermic and endothermic reactions ➢ Using energy transfers from reactions ➢ Reaction profiles ➢ Bond energy calculations	➢ Exam style question (Multiple choice, structured, closed short answer, and open response) homework and required practical write ups ➢ AQA end of year 10 exam- term 2 and mock exams ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 ‘atoms, elements and molecules’, maths skills lessons, 'energy’, ‘current electricity’ 'reactivity’, ‘energy transfers’ ‘combustion’ and ‘mixtures and separation’. ➢ KS4 ‘crude oil and fuels’, ‘rates and equilibrium’ and ‘using our resources’ ➢ ‘Properties and Changes of Materials’ and ‘Electricity’ KS2 ➢ GCSE Physics - ‘Energy and energy resources’ and ‘Particles at work’

Summer 2	**Complete topics from last term, mock exam, ecology** Suitable habitats for ecological sampling at this time of year. Paper 1 content complete in time for mock exams		
	➢ Ecological sampling ➢ organisms in their environment ➢ distribution and abundance	➢ required practical sheet and exam questions ➢ In lesson retrieval quiz and multiple choice hinge questions	➢ KS3 ecological processes, cells, maths skills ➢ KS4 ecology ➢ SMSC 2 The Moral Development of pupils (B,C)

Year 11 Overview

Term	Knowledge	Assessment	Connections to learning
Autumn 1	**Homeostasis and response, rates and equilibrium, forces** Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility. Students will develop their understanding of how their body works and how several conditions are treated. Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this		

	process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way. Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible.		
	➢ <u>Biological responses</u> ➢ The human nervous system ➢ Principles of homeostasis ➢ The structure and function of the nervous system ➢ Reflex actions ➢ Principles of hormonal control, glands and hormones ➢ control of blood glucose ➢ treating diabetes	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ <u>HE8 Changing adolescent bodies (all)</u> ➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u> ➢ <u>RSE Intimate sexual relationships, including sexual health (I,J)</u> ➢ KS3 cells, tissues and organs, reproduction, digestion, muscles and bones. ➢ KS4 organisation
	➢ <u>Rates and equilibrium</u> ➢ Rate if reaction ➢ Collision theory and surface area ➢ The effect of temperature ➢ The effect of concentration and pressure ➢ The effect of catalysts ➢ Reversible reactions ➢ Energy and reversible reactions ➢ Dynamic equilibrium ➢ Altering conditions	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS4 Chemistry ‘Using Our Resources’ ➢ ‘Energy changes’, ‘structure and’ bonding and particle model of matter taught in year 10 (GCSE) and KS3 - ‘The particle model’, ‘Atoms, elements and molecules’ and ‘Reactivity’ ➢ ‘Properties and Changes of Materials’ at KS2 ➢ SMSC – Students appreciate the social and

			cultural contributions of scientists such as Haber (4a) ➢ Maths/numeracy - Students should be able to present record and present data in tabular and graphical form. Students should also be able to analyse graphical data to calculate rate of reaction. ➢ Physics and biology GCSE – particle model, collision theory and factors affecting rate of reaction/photosynthesis
	➢ <u>Forces in balance</u> ➢ Vectors and scalars ➢ Forces between objects ➢ Resultant forces ➢ Centre of mass ➢ The parallelogram of forces ➢ Resolution of forces	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets r	➢ KS3 forces, floating and sinking, fluids ➢ KS4 motion

Autumn 2	**Forces, inheritance, variation and evolution, organic chemistry** When exploring the key ideas of inheritance variation and evolution we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.		
	➢ <u>Reproduction and variation and evolution</u> ➢ Types of reproduction ➢ Cell division in sexual reproduction ➢ DNA and the genome ➢ Inheritance in action ➢ More about genetics ➢ Inherited disorders ➢ Screening for genetic disorders ➢ Variation ➢ Evolution ➢ Selective breeding ➢ Genetic engineering ➢ Ethics of genetic technologies	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u> ➢ KS3 reproduction, cells, genetics and variation, health and disease. ➢ KS4 infection and response,

	➢ Crude oil and fuels ➢ Hydrocarbons ➢ Fractional distillation ➢ Burning hydrocarbon fuels ➢ Cracking hydrocarbons ➢ Chemical analysis ➢ Pure substances and mixtures ➢ Analysing chromatograms ➢ Testing for gases	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS4 Chemistry 'Our Atmosphere' and 'Earth's Resources' ➢ 'Energy changes', 'structure and bonding' and 'Atomic structure' year 10 (GCSE) and KS3 'Atoms, elements and molecules', 'Energy' 'Combustion', 'Rocks' 'Energy Transfers' and 'Reactivity' ➢ 'Properties and Changes of Materials' and 'Rocks' at KS2 ➢ SMSC – Students appreciate the social and moral impact of their activities in terms of energy and resource requirement (2b&c – The Moral Development of Pupils) ➢ Physics and biology GCSE – 'n Ecosystems and Biodiversity' and 'Energy Resources'

	➢ Motion ➢ Speed-distance time graphs ➢ Velocity and acceleration ➢ Velocity- time graphs ➢ Analysis of motion graphs ➢ Forces and acceleration ➢ Weight and terminal velocity ➢ Forces and braking ➢ Momentum ➢ Forces and elasticity	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3- forces and motion, fluids ➢ KS4 – forces in balance
Spring 1	**Evolution and Ecology, Chemical analysis, chemistry of the atmosphere, Waves** The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being. Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work. The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity. Wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves.		

	➢ <u>Genetics and evolution</u> ➢ Evidence for evolution ➢ Fossils and extinction ➢ Antibiotic resistance ➢ Classification ➢ New classification systems ➢ <u>Ecology</u> ➢ Communities ➢ Organisms in their environment ➢ Abundance and distribution review ➢ Competition in plants and animals ➢ Adaptations in plants and animals ➢ Feeding relationships ➢ Materials cycling ➢ Carbon cycle	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3, genetics and evolution, ecology, plant growth, unicellular organisms ➢ KS4 biodiversity and ecosystems
	➢ <u>The Earth's atmosphere</u> ➢ History of the atmosphere ➢ Our evolving atmosphere ➢ Greenhouse gases ➢ Global climate change ➢ Atmospheric pollutants ➢ <u>The Earth's Resources</u> ➢ Finite and renewable resources ➢ Making water safe to drink ➢ Water treatment	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u> Students appreciate the social and moral consequence of their activity ➢ KS3 'ecosystems', mixtures and separation', 'atoms elements and molecules', 'Energy', 'Energy Transfers', 'Earth and space', 'combustions' and 'Plant growth' ➢ KS4 'Crude oil and fuels' ➢ GCSE Physics 'Energy transfer by heating

			➢ GCSE Biology 'Photosynthesis', 'respiration', 'genetics and evolution' and 'biodiversity and ecosystems, ➢ KS2 - 'Earth and space', 'Plants' 'Properties and change of materials' and 'living thing and their habitats'
	➢ <u>Waves</u> ➢ The nature of waves ➢ Properties of waves ➢ Reflection and refraction ➢ More about waves ➢ Electromagnetic waves ➢ The electromagnetic spectrum ➢ Light, infrared, microwaves and radio waves ➢ Communications ➢ Ultraviolet waves, x-rays and gamma rays. ➢ X -rays in medicine	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3- light, sound ➢ KS4 - energy
Spring 2	**Ecology, Using resources, Magnetism and electromagnetism** The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.		

	Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised. Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. It means that systems that involve control or communications can take full advantage of this.		
	➢ <u>Biodiversity and ecosystems</u> ➢ The human population explosion ➢ Land and water pollution ➢ Air pollution ➢ Deforestation and peat destruction ➢ Global warming ➢ Maintaining biodiversity	➢ exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ <u>SMSC 2 The Moral Development of pupils (B,C)</u> ➢ KS3 ecosystems, unicellular organism. ➢ KS4 the earths resources
	➢ <u>The Earth's Resources</u> ➢ Extracting metals from ores ➢ Life cycle assessments ➢ Reduce, reuse, recycle	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ Use of glossary/ key definitions in lessons ➢ Teacher to highlight that any fuel that fuels such as wood, pellets and biofuels are renewable as are sourced from plants and can be replaced in the time it takes the plant to grow which in comparison to the formation of fossil fuels is very short

	➢ <u>Electromagnets and magnetism</u> ➢ Magnetic fields ➢ Magnetic fields of electric current ➢ The motor effect	➢ Exam style questions (Multiple choice, structured, closed short answer, and open response) / mock paper 2 exam/ hinge questions/ retrieval quiz, required practical sheets	➢ KS3 magnets and electromagnets, forces. ➢ KS4 electricity, energy resources.
Summer 1	**Review/Revision/Exam preparation**		