KS4 Science Subject overview

Subject Rationale (Intent) linked to whole school curriculum mission

In brief (no more than four sentences)

The Science curriculum at St Edmund's is designed to bring science to everyday life, answering questions like 'why do apples fall from trees' or 'how are vaccines developed'? We want learners to be naturally inquisitive, independent and critical in their thinking. This will enable them to develop the substantive and disciplinary knowledge required to understand the world around them. We want to impart a love of the subject and for our students to use science to improve their own lives and the lives of others.

Additional details

Science programmes of study: key stages 1 and 2

KS2:
Science skills: Working scientifically - practical scientific skills including asking relevant question, using scientific enquiry; setting up practical investigations; comparative and fair testing, taking and recording measurements using a range of equipment and in a variety of ways (tables / graphs / labelled diagrams); reporting on findings, drawing conclusions and suggest improvements; use scientific evidence to answer questions.

Physics: Forces, Electricity, Light, Sound, Magnetism, Earth and Space

Chemistry: Rocks, states of matter (s,l,g, changes of state, water cycle, rate of evaporation) Properties and changes of materials (physical properties, separation of materials, chemical changes)

Biology: Plants, animals, including humans , living things and their habitats, evolution and inheritance.

YEAR 9			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Energy** • **energy stores and transfers** • **kinetic and potential energy** • **efficiency** • **power** • **thermal energy transfer** • **energy resources** **Cell Biology (Cell structure)** • **Plant and animal cells** • **Eukaryotes and prokaryotes** • **Cell specialisation** • **Microscopy** • **Required Practical: Using a light microscope to observe, draw and label cells** **Atomic Structure and the**	**Energy** An understanding of energy allows us to understand not only physical but biological and chemical processes. Reducing energy usage and switching to renewables is vital to the survival of our planet. In the KS3 energy unit students learnt about the 8 energy sources and how to describe energy transfers. Students will now be introduced to the equations for kinetic and potential energy, power and efficiency. They will evaluate renewable and non-renewable energy sources comparing their current use, reliability and environmental impact **Cell Biology** Cells are the basic unit of all forms of life so an understanding of cell biology is integral to the study of biology as a whole as well as developing an appreciation of the complexity of all forms of life and the processes required for survival. Students will have already encountered the structures of plant and animal cells as well as some unicellular organisms, they will also have had the opportunity to use a microscope and practice related mathematical skills as part of the KS3 cells unit. Throughout this topic students will revisit key concepts related to cell structure, specialisation and transport processes. Students will be introduced to converting units on a biological scale, the use of the magnification equation, cell division by mitosis, stem cell technology and the transport processes of osmosis and active transport. They will have opportunities to develop their practical skills as well as spend time evaluating the use of stem cell technology in the treatment of disease from both a scientific and ethical perspective. **Atomic Structure and the Periodic Table** This module of study starts with the structure of atoms, as the building blocks of	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	Periodic Table ● **Atoms, elements and compounds** ● **Development of models of the atom** ● **Sub atomic particles and electron configuration** ● **Development of the Periodic Table** ● **Metals and non-metals** ● **Group 1 and Group 7** ● **Mixtures**	matter and a crucial concept in chemistry. It builds upon the foundations laid in Years 7 and 8, that atoms are the smallest part of elements that can exist, and develops the pupils' understanding of sub-atomic particles, including how electrons are structured within an atom. This will be important for the next topic on bonding. The history of the development of the model of the atom and the development of the Periodic Table will be explored. Properties of different substances will be identified and explained, including metals and non-metals, Group 1 and halogens. This knowledge will underpin further topics such as bonding and chemical changes.	
Term 1:2	**Energy** **Atomic Structure and the Periodic Table cont.** **Cell Biology (Cell Structure and Cell Division)** ● **Cell differentiation** ● **Mitosis & the cell cycle** ● **Stem cells** ● **Therapeutic cloning** **Bonding, structure and the properties of matter** ● **States of matter** ● **Ions and ionic bonding** ● **Covalent bonding** ● **Properties of ionic and simple covalent compounds** ● **Giant covalent structures** ● **Allotropes of carbon** ● **Metallic bonding** ● **Nanotechnology**	**Bonding, structure and the properties of matter** Having built an understanding of the structure of atoms, pupils will apply this to describe different types of bonding and structure and explain how this affects the properties of different substances. They will learn, for example, why diamond is hard and doesn't conduct electricity, whereas graphite is slippery and does conduct electricity - even though both are made only of carbon. They will find out about recent developments in the field of nanotechnology, and how these can impact our lives	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	(Chemistry only)		
Term 2:1	**Electricity** ● **circuits, current and charge** ● **potential difference and resistance** ● **current-voltage characteristics** ● **factors affecting resistance** ● **LDRs and thermistors** ● **series and parallel circuits** ● **ac and dc** ● **mains electricity** ● **National Grid** ● **power** **Cell Biology (Transport processes)** ● **Diffusion** ● **SA:Volume (ratio)** ● **Exchange surfaces** ● **Osmosis** ● **Required practical** ● **Active Transport** **Bonding, structure and the properties of matter cont** **Quantitative Chemistry** ● **Conservation of mass and balancing equations** ● **Relative formula mass** ● **Mass changes when**	**Electricity** We rely heavily on electricity in our everyday lives. Learning about our domestic use, electrical safety and how electrical components behave allows us to develop an understanding of what is happening in the world around us. This unit builds on the Year 8 Electricity where students were introduced to circuit components, current, charge, resistance and potential difference. In this unit students will investigate current-voltage characteristics, Ohm's Law and factors affecting resistance before learning about electricity transmission, domestic electricity and electrical safety. **Quantitative Chemistry** Quantitative chemistry is an area of chemistry that allows us to calculate known quantities of materials. It requires and further develops mathematical calculation skills including ratios, converting units and substituting values into an equation to work out an unknown. Pupils will learn how to balance a chemical equation using the law of conservation of mass. Disciplinary skills will be developed through practical work involving making observations of chemical reactions. This topic will be developed further if students progress to study Chemistry at KS5, where calculating amounts of substance is a fundamental skill.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	reactant or product is a gas ● **Moles (HT)** ● **Amount of substance (HT)** ● **Limiting reactants (HT)** ● **Concentration of solutions**		
Term 2:2	**Electricity** **Organisation in animals** ● **Principles of organisation** ● **Human digestive system** ● **Required Practical: Use qualitative reagents to test for a range of biological molecules**	**Organisation in Animals** This unit builds on the concepts covered- at both KS3, in the units of body systems and health and lifestyle, as well as KS4, in the Cell Biology unit. Students will develop their understanding of the organisation of an organism within the context of the digestive system and respiratory system as well as the importance of transport systems to allow substance to be moved around an organism quickly to ensure survival. Principles established in this unit are revisited throughout the remainder of the course with students studying further organ systems in the later topic of homeostasis. Students will have opportunities to develop practical skills through carrying out required practical as well as building their mathematical skills including calculating a mean and graphical representation of data.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Particle model** ● **states of matter** ● **changing state** ● **specific heat capacity** ● **specific latent heat** ● **density** ● **pressure and temperature in gases** **Organisation in Animals** ● **Enzymes** ● **Required practical: investigate the effect of pH on the rate of reaction of amylase enzymes** **Quantitative Chemistry cont.**	**Particle model** An understanding of the particle model allows us to explain everyday phenomena such as evaporation and condensing. This unit links to the KS3 Particles unit where students were introduced to the particle model of matter and the properties of solids, liquids and gases. In this unit students will learn about internal energy, specific latent heat and the behaviour of gases.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

Term 3:2	**Particle model** **Organisation in Animals** ● **The heart and blood its vessels** ● **Blood vessels** ● **Blood** ● **The lungs** **Quantitative Chemistry cont.**		Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

YEAR 10 Trilogy			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Respiration (Bioenergetics)** ● **Aerobic respiration** ● **Anaerobic respiration** ● **Response to exercise** ● **Metabolism** **Chemical Changes** ● **Reactivity series** ● **Extraction of metals** ● **Oxidation and reduction (HT)** ● **Reactions of metals and acids** ● **Neutralisation of acids** ● **Soluble salts (required practical)** ● **pH scale**	**Respiration** The concept of respiration was introduced in KS3 as part of the biological processes module. As part of the GCSE Biology topic of Bioenergetics the study of respiration allows students to understand one of the most important biochemical reactions that takes place in living organisms. In this topic they will look at the different types of respiration and then relate this to how the body responds to exercise.There are links in this topic to aspects covered in cell biology and organisation in animals **Chemical Changes** Knowing about different chemical changes means that we can predict exactly what new substances will be formed in a reaction, and use this knowledge to develop a wide range of different materials and	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	• **Strong and weak acids (HT)** • **Process of electrolysis** • **Electrolysis of molten ionic compounds** • **Using electrolysis to extract metals** • **Electrolysis of an aqueous solution (required practical)** **Atomic Structure** • **History of the atom** • **Rutherford's alpha particle scattering experiment** • **background radiation** • **properties of alpha, beta and gamma radiation** • **half life** • **decay equations** • **dangers of radiation**	processes. It also helps us 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 topic recalls learning in Years 7 and 8 about different chemical reactions and will apply concepts from Year 9 topics on atoms and bonding. Disciplinary knowledge will be developed through practical work, including electrolysis and making soluble salts. **Atomic Structure** The understanding of the structure of the atom allows us to understand radioactive decay and nuclear fission and fusion. We need to appreciate that radioactive decay can be both harmful and beneficial and understand how it can be used productively in medicine and electricity generation. This unit builds on the idea of matter from KS3, where students describe the structure of the atom and name its constituent parts and also reinforces the KS4 Chemistry Atomic Structure unit. In this unit students will learn what happens to the nucleus when radioactive particles are emitted and how radiation is constantly all around us and the dangers of contamination and irradiation	
Term 1:2	**Forces** • **scalars and vectors** • **resolving forces** • **mass, weight and gravitational fields** • **Hooke's Law** • **Speed and acceleration** • **distance-time and velocity time graphs** • **acceleration** • **terminal velocity** • **Newton's Laws** • **stopping distance** • **momentum**	**Forces** An understanding of forces is fundamental to explaining how machines work and how structures are designed and built. This unit builds on the KS3 units of forces and motion and pressure and shows how forces are vital in machines and structures. Students should be able to name force types, calculate simple resultant forces and understand the features of a distance time graph. In this unit they will draw and analyse distance -time and velocity-time graphs and use and apply Newton's Laws of motion to solve problems. Students will investigate Hooke's Law and link this to the behaviour of springs in everyday engineering applications.They will then consider the importance of forces and speed when applied to the stopping distance of a vehicle and the principle of conservation of momentum.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	Organisation in plants ● **Plant tissues** ● **Plant organs** ● **Plant transport systems** ● **Transpiration & translocation** **Energy Changes** ● **Exothermic and endothermic reactions** ● **Energy profile diagrams for reactions** ● **Energy change in reactions (HT)** ● **Measuring temperature change of a reaction (required practical)**	**Energy Changes** Energy changes are an important part of chemical reactions.The interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. This topic builds upon KS3 work on particles and reactions, and the KS4 chemical changes topic. It requires mathematical skills in using data to calculate energy changes. In this topic we will develop practical skills in measuring temperature changes of reactions. **Organisation in plants** Building on the study of living organisms at KS2, cells and systems at KS3 and preceding units of the KS4 curriculum students will develop their understanding of the organs and organ systems in plants and how transport in plants is dependent upon the environmental conditions to ensure that leaf cells are provided with the raw materials for photosynthesis.here are opportunities for the development of mathematical skills as students are required to translate information between graphical and numerical forms, plot and draw appropriate graphs, selecting appropriate scales for axes as well as extracting and interpreting information from graphs, charts and tables.	
Term 2:1	**Forces** **Photosynthesis (Bioenergetics)** ● **Photosynthetic reaction** ● **Rate of photosynthesis & limiting factors** ● **Greenhouses (HT)** ● **Required practical: Investigate the effect of light intensity on the rate of photosynthesis** ● **Uses of glucose from photosynthesis** **Energy Changes cont**	**Photosynthesis** The concept of photosynthesis was introduced in KS3 as part of the biological processes module. As part of the GCSE Biology topic of Bioenergetics the study of photosynthesis allows students to understand another of the most important biochemical reactions that take place in living organisms. Students will explore how plants harness the Sun's energy in photosynthesis in order to make food as well as liberating oxygen which has built up over millions of years in the Earth's atmosphere. This unit not only has links to the ecology module studied in year 7 but also to the chemistry of the atmosphere unit in the GCSE Chemistry specification.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

Term 2:2	**Forces** **Non-Communicable Disease** ● **Health issues** ● **The effect of lifestyle on non-communicable diseases** ● **Coronary heart disease** ● **Cancer** **Chemistry of the Atmosphere** ● **Evolution of the atmosphere** ● **Greenhouse effect and global warming** ● **Atmospheric pollutants**	**Non-Communicable Disease** Students will explore the relationship between health and disease building on the KS3 unit Healthy Lifestyle. They will develop their understanding of the risk factors linked to the development of non-communicable diseases, their interactions and the human and financial cost of non-communicable disease on the individual, local community, a nation and globally. There are many opportunities for students to develop mathematical skills particularly linked to the interpretation of information presented in a range of formats, evaluating this data as well as developing an understanding of the principles of sampling as applied to scientific data (there are potential links to the study of sociology and psychology) **Chemistry of the Atmosphere** The Earth's atmosphere is dynamic and forever changing. We will learn that the causes of these changes are sometimes man-made and sometimes part of many natural cycles. We will explore the problems caused by increased levels of air pollutants and the solutions that help to reduce the impact of human activity. For geography students, this builds upon their learning in Year 9 about climate change and will enhance their KS4 studies on UK environmental challenges (term 3:2) and their Year 11 work on environmental threats to our planet. Understanding our use of resources supports St Edmund's curriculum mission for pupils' to have an understanding of social justice and action, helping them to understand the threats and possible solutions to protect the environment and quality of life on our planet for all.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Waves** ● **longitudinal and transverse waves** ● **waves in solids and liquids** ● **electromagnetic spectrum** ● **applications of electromagnetic waves** ● **infra-red radiation**	**Waves** Mobile phones, the internet and bluetooth all rely on the principle of energy transfer by waves. This unit builds on the Year 7 units light and sound where longitudinal and transverse waves and basic wave terms are introduced. In this unit students will investigate waves using a ripple tank and be introduced to the electromagnetic spectrum and the uses of its	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	Infection and Response ● **Pathogens** ● **Communicable (infectious) disease case studies** ● **Human defence systems** ● **Vaccination** ● **Antibiotics and painkillers** ● **Discovery and development of drugs** **Rate and Extent of Chemical Reactions** ● **What affects the rates of reactions** ● **Effects of catalysts** ● **Effects of concentration (required practical)** ● **Effects of temperature (required practical)** ● **Effects of surface area** ● **Reversible reactions** ● **Dynamic equilibrium**	constituent parts. **Infection and Response (Communicable disease)** Students learn about the causes and treatments of diseases caused by pathogens. They are introduced to a range of specific diseases caused by different pathogens and build upon knowledge of specialised cells to explain how the human body responds to infection. They will also learn about how diseases spread in a community and how this can be prevented particularly through the use of vaccination and herd immunity. Students will be introduced to the concept of antibiotic resistance that is revisited in year 11 when it is used as a model for the study of evolution by natural selection. They will also be introduced to how new drugs are discovered and developed through clinical trials. **Rate and Extent of Chemical Reactions** Chemical reactions can occur at different rates and there are many variables that can speed them up or slow them down. We will learn about these factors, including through practical investigations. 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, and so this topic builds upon prior knowledge from earlier KS4 topics. Mathematical skills are important in this topic, including drawing and interpreting graphs, drawing tangents to curves and calculating means.	
Term 3:2	**Waves** **Homeostasis and Response** ● **Principles of homeostasis** ● **Nervous system structure and function** ● **RP: plan and carry out an investigation into the effect of a factor on human reaction time**	**Homeostasis** Homeostasis is the regulation of the internal environment of an organism. Cells can only survive within narrow physical and chemical limits, requiring a constant temperature and pH as well as dissolved nutrients and water. This builds upon students' study of enzymes towards the start of the GCSE course as well as the key concepts linked to cells and organisation that run through the whole biology curriculum. Homeostasis relies on control systems that constantly monitor and respond to changes in the internal and external	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

	Rate and Extent of Chemical Reactions cont.	environment through both nervous and hormonal control mechanisms. Students will have previously encountered the changes that occur in puberty including the menstrual cycle as well as the stages of human development in the KS3 reproduction unit and in SRE lessons. There are opportunities to develop mathematical skills when investigating the effect of a factor on human reaction time as well as the continued need to translate, interpret and evaluate data represented in graphs, charts and tables.	

YEAR 11 Trilogy			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Homeostasis and Response** ● **Human endocrine system** ● **Control of blood glucose concentration** ● **Diabetes** ● **Hormones in human reproduction** ● **Controlling fertility** **Electromagnetism** ● **magnets and magnetic fields** ● **electromagnets** ● **the motor effect** **Organic Chemistry** ● **Alkanes and alkenes** ● **Combustion of hydrocarbons** ● **Fractional distillation** ● **Cracking**	**Electromagnetism** A knowledge of magnetic fields is fundamental to understanding how the electric motors inside devices live electric vehicles work. The combination of a magnetic field and a moving wire is the basis of electricity generation in a power station. This unit builds from the Year 8 electricity and magnetism unit where students gained a knowledge of magnet poles, magnetic materials and electromagnets. Students will learn about the catapult motor field and investigate electromagnets. **Organic Chemistry** This branch of chemistry is about carbon compounds and is so important because it includes fossil fuels, which are a major source of feedstock for the petrochemical industry, and the manufacture of many useful manufactured materials such as pharmaceuticals, perfumes and flavourings, dyes and detergents. We will investigate the properties of different hydrocarbons including how they react. It follows on from learning about the impacts of fossil fuels on the atmosphere in Year 10.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

Term 1:2	**Inheritance, Variation and Evolution** ● **Reproduction** ● **Meiosis** ● **DNA structure & the genome** ● **Protein synthesis** ● **Genetic inheritance** ● **Inherited disorders** **Electromagnetism** **Revision**	**Inheritance, Variation and Evolution** Students build upon previous study at KS3 of reproduction, inheritance, variation and evolution by natural selection as well as links to cells, mitosis and the cell cycle studied in the cell biology module. Students will discover the role of meiosis and mutations in producing variation and how variation leads to the evolution of species. Students will be introduced to key scientists in the field of inheritance and evolution as well as learning about how developments in scientific knowledge have led to the process of genetic engineering. Students will need to evaluate this process and selective breeding discussing the associated advantages and disadvantages including the ethical issues. There are links to the RE curriculum in the discussion of these ethical concerns as well as aspects of Catholic social teaching. There are also opportunities to develop mathematical skills linked to using ratios and probability to express genetic inheritance derived from genetic crosses using genetic diagrams.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 2:1	**Inheritance, Variation and Evolution** ● **Variation and selective breeding** ● **Genetic engineering** ● **Evolution and extinction** ● **Classification** **Chemical analysis** ● **Pure vs impure, mixtures and formulations** ● **Chromatography (required practical)** ● **Gas tests**	**Chemical analysis** We will learn about a range of qualitative tests that are used to detect specific chemicals. Forensic scientists and drug control scientists rely on such instrumental methods in their work. This will include chromatography, which was introduced in KS3 Separating Techniques. We will draw upon knowledge of the different chemicals to be tested, that has been developed throughout the chemistry course in KS3 and KS4.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

Term 2:2	**Ecology** ● **Interdependence** ● **Competition** ● **Adaptations** ● **Organisation of an ecosystem** ● **Required practical: Measuring the population size of a species in an ecosystem. Use sampling techniques to investigate the distribution of a species in an ecosystem** ● **Cycling materials - water and carbon cycles** **Revision** **Using resources** ● **Finite and renewable resources** ● **Potable and pure water** ● **Water purification (required practical)** ● **Treatment of water** ● **Phytomining and bioleaching (HT)** ● **Life cycle assessments** ● **Limited resources**	**Ecology** In this module students revisit concepts related to biological processes, ecosystems and adaptations from KS3 and previous modules of study from the GCSE specification. The Sun is the source of all energy that passes through ecosystems, harnessed by plants through photosynthesis, this energy is passed onto other organisms including humans through feeding relationships. All species live in ecosystems composed of complex communities of animals and plants which depend on each other for survival and are adapted to particular conditions. Ecosystems provide essential services that support human life and continued development however, in order for humans to continue benefiting from these services they need to engage with the environment in a sustainable way. Students will explore how humans threaten biodiversity and the natural systems that support it as well as the actions needed to ensure future health, prosperity and well-being. There are links to concepts delivered in both the chemistry and geography curriculum. There are opportunities for the development of mathematical skills in the form of sampling, data collection and interpretation. **Using resources** We will learn how 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 and disposal of these products. This will complement geography students' KS4 studies about the environmental challenges facing the UK and the planet. Understanding our use of natural resources supports St Edmund's curriculum mission for pupils' to have an understanding of social justice and action, helping them to understand the threats and possible solutions to protect the environment and quality of life on our planet for all.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

Term 3:1	**Ecology** ● **Biodiversity** ● **Waste management** ● **Land use** ● **Deforestation** ● **Global warming** **Revision**	This term is used to prepare for the GCSE exams. Exam skills are embedded throughout the course using past paper questions throughout unit and the end of unit assessments. Practical skills are revised via the required practicals.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:2	**Revision**		

YEAR 10 Biology			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Respiration** ● **Aerobic respiration** ● **Anaerobic respiration** ● **Response to exercise** ● **Metabolism**	**Respiration** The concept of respiration was introduced in KS3 as part of the biological processes module. As part of the GCSE Biology topic of Bioenergetics the study of respiration allows students to understand one of the most important biochemical reactions that takes place in living organisms. In this topic they will look at the different types of respiration and then relate this to how the body responds to exercise.There are links in this topic to aspects covered in cell biology and organisation in animals	
Term 1:2	**Organisation in plants** ● **Plant tissues** ● **Plant organs** ● **Plant transport systems** ● **Transpiration & translocation**	**Organisation in plants** Building on the study of living organisms at KS2, cells and systems at KS3 and preceding units of the KS4 curriculum students will develop their understanding of the organs and organ systems in plants and how transport in plants is dependent upon the environmental	Composite tasks, retrieval questions,self and peer assessment and end of module

		conditions to ensure that leaf cells are provided with the raw materials for photosynthesis.here are opportunities for the development of mathematical skills as students are required to translate information between graphical and numerical forms, plot and draw appropriate graphs, selecting appropriate scales for axes as well as extracting and interpreting information from graphs, charts and tables.	assessment using exam questions
Term 2:1	**Photosynthesis (Bioenergetics)** ● **Photosynthetic reaction** ● **Rate of photosynthesis & limiting factors** ● **Greenhouses (HT)** ● **Required practical: Investigate the effect of light intensity on the rate of photosynthesis** ● **Uses of glucose from photosynthesis**	**Photosynthesis** The concept of photosynthesis was introduced in KS3 as part of the biological processes module. As part of the GCSE Biology topic of Bioenergetics the study of photosynthesis allows students to understand another of the most important biochemical reactions that take place in living organisms. Students will explore how plants harness the Sun's energy in photosynthesis in order to make food as well as liberating oxygen which has built up over millions of years in the Earth's atmosphere. This unit not only has links to the ecology module studied in year 7 but also to the chemistry of the atmosphere unit in the GCSE Chemistry specification.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 2:2	**Non-Communicable Disease** ● **Health issues** ● **The effect of lifestyle on non-communicable diseases** ● **Coronary heart disease** ● **Cancer**	**Non-Communicable Disease** Students will explore the relationship between health and disease building on the KS3 unit Healthy Lifestyle. They will develop their understanding of the risk factors linked to the development of non-communicable diseases, their interactions and the human and financial cost of non-communicable disease on the individual, local community, a nation and globally. There are many opportunities for students to develop mathematical skills particularly linked to the interpretation of information presented in a range of formats, evaluating this data as well as developing an understanding of the principles of sampling as applied to scientific data (there are potential links to the study of sociology and psychology)	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Infection and Response (communicable disease)** ● **Pathogens** ● **Communicable (infectious) disease case studies**	**Infection and Response (Communicable disease)** Students learn about the causes and treatments of diseases caused by pathogens. They are introduced to a range of specific diseases caused by different pathogens and build upon knowledge of specialised cells to explain how the human body responds to	Composite tasks, retrieval questions,self and peer assessment and end of module

	• **Human defence systems** • **Vaccination** • **Antibiotics and painkillers** • **Culturing microorganisms (bio only)** • **Required practical: Investigate the effect of antiseptics or antibiotics on bacterial growth (bio only)** • **Discovery and development of drugs** • **Monoclonal antibodies (bio only)** • **Plant disease & defences (bio only)**	infection. They will also learn about how diseases spread in a community and how this can be prevented particularly through the use of vaccination and herd immunity. Students will be introduced to the concept of antibiotic resistance that is revisited in year 11 when it is used as a model for the study of evolution by natural selection. They will also be introduced to how new drugs are discovered and developed through clinical trials. In addition students of separate science go on to learn about monoclonal antibodies and the identification and treatment of diseases in plants that directly links to their previous study of photosynthesis.	assessment using exam questions
Term 3:2	**Homeostasis and Response** • **Principles of homeostasis** • **Nervous system structure and function** • **RP: plan and carry out an investigation into the effect of a factor on human reaction time** • **The brain (bio only)** • **The eye (bio only)** • **Control of body temperature (bio only)**	**Homeostasis** Homeostasis is the regulation of the internal environment of an organism. Cells can only survive within narrow physical and chemical limits, requiring a constant temperature and pH as well as dissolved nutrients and water. This builds upon students' study of enzymes towards the start of the GCSE course as well as the key concepts linked to cells and organisation that run through the whole biology curriculum. Homeostasis relies on control systems that constantly monitor and respond to changes in the internal and external environment through both nervous and hormonal control mechanisms. Students will have previously encountered the changes that occur in puberty including the menstrual cycle as well as the stages of human development in the KS3 reproduction unit and in SRE lessons. There are opportunities to develop mathematical skills when investigating the effect of a factor on human reaction time as well as the continued need to translate, interpret and evaluate data represented in graphs, charts and tables.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

YEAR 11 Biology			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Homeostasis and Response** ● **Human endocrine system** ● **Control of blood glucose concentration** ● **Diabetes** ● **The kidneys (bio only)** ● **Hormones in human reproduction** ● **Controlling fertility** ● **Plant hormones (bio only)** ● **Required practical: Investigate the effect of light and gravity on the growth of germinating seedlings (bio only)**	**Homeostasis** ● Homeostasis is the regulation of the internal environment of an organism. Cells can only survive within narrow physical and chemical limits, requiring a constant temperature and pH as well as dissolved nutrients and water. This builds upon students' study of enzymes towards the start of the GCSE course as well as the key concepts linked to cells and organisation that run through the whole biology curriculum. Homeostasis relies on control systems that constantly monitor and respond to changes in the internal and external environment through both nervous and hormonal control mechanisms. Students will have previously encountered the changes that occur in puberty including the menstrual cycle as well as the stages of human development in the KS3 reproduction unit and in SRE lessons. There are opportunities to develop mathematical skills when investigating the effect of a factor on human reaction time as well as the continued need to translate, interpret and evaluate data represented in graphs, charts and tables.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 1:2	**Inheritance, Variation and Evolution** ● **Reproduction** ● **Meiosis** ● **DNA structure & the genome** ● **Protein synthesis** ● **Genetic inheritance** ● **Inherited disorders**	**Inheritance, Variation and Evolution** Students build upon previous study at KS3 of reproduction, inheritance, variation and evolution by natural selection as well as links to cells, mitosis and the cell cycle studied in the cell biology module. Students will discover the role of meiosis and mutations in producing variation and how variation leads to the evolution of species. Students will be introduced to key scientists in the field of inheritance and evolution as well as learning about how developments in scientific knowledge have led to the process of genetic engineering and cloning. Students will need to evaluate these processes discussing the associated advantages and disadvantages including the ethical issues. There are links to the RE curriculum in the	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

		discussion of these ethical concerns as well as aspects of Catholic social teaching. There are also opportunities to develop mathematical skills linked to using ratios and probability to express genetic inheritance derived from genetic crosses using genetic diagrams.	
Term 2:1	**Inheritance, Variation and Evolution** ● **Variation and selective breeding** ● **Genetic engineering** ● **Cloning (bio only)** ● **Evolution and extinction** ● **Theory of evolution (bio only)** ● **Speciation (bio only)** ● **Classification**		Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 2:2	**Ecology** ● **Interdependence** ● **Competition** ● **Adaptations** ● **Organisation of an ecosystem** ● **Required practical: Measuring the population size of a species in an ecosystem. Use sampling techniques to investigate the distribution of a species in an ecosystem** ● **Cycling materials - water and carbon cycles** ● **Decomposition (bio only)** ● **Required practical: Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change (bio only)**	**Ecology** In this module students revisit concepts related to biological processes, ecosystems and adaptations from KS3 and previous modules of study from the GCSE specification. The Sun is the source of all energy that passes through ecosystems, harnessed by plants through photosynthesis, this energy is passed onto other organisms including humans through feeding relationships. All species live in ecosystems composed of complex communities of animals and plants which depend on each other for survival and are adapted to particular conditions. Ecosystems provide essential services that support human life and continued development however, in order for humans to continue benefiting from these services they need to engage with the environment in a sustainable way. Students will explore how humans threaten biodiversity and the natural systems that support it as well as the actions needed to ensure future health, prosperity and well-being. There are links to concepts delivered in both the chemistry and geography curriculum. There are opportunities for the development of mathematical skills in the form of sampling, data collection and interpretation as well as calculating rate of change and drawing appropriate graphs.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Ecology** ● **Biodiversity**		Composite tasks, retrieval

	• **Waste management** • **Land use** • **Deforestation** • **Global warming** • **Trophic levels (bio only)** • **Pyramids & transfer of biomass (bio only)** • **Food production and food security (bio only)** • **Biotechnology (bio only)**		questions,self and peer assessment and end of module assessment using exam questions
Term 3:2	**Revision**		

YEAR 10 Chemistry			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Chemical Changes** • **Reactivity series** • **Extraction of metals** • **Oxidation and reduction (HT)** • **Reactions of metals and acids** • **Neutralisation of acids** • **Soluble salts (required practical)** • **pH scale** • **Strong and weak acids (HT)** • **Process of electrolysis** • **Electrolysis of molten ionic compounds** • **Using electrolysis to extract metals** • **Electrolysis of an aqueous solution (required practical)**	Knowing about different chemical changes means that we can predict exactly what new substances will be formed in a reaction, and use this knowledge to develop a wide range of different materials and processes. It also helps us 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 topic recalls learning in Years 7 and 8 about different chemical reactions and will apply concepts from the earlier Year 9 topics on atoms and bonding. Disciplinary knowledge will be developed through practical work, including electrolysis and making soluble salts.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 1:2	**Chemical changes cont.**		Composite tasks,

	Energy Changes ● **Exothermic and endothermic reactions** ● **Energy profile diagrams for reactions** ● **Energy change in reactions (HT)** ● **Measuring temperature change of a reaction (required practical)**	Energy changes are an important part of chemical reactions.The interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. For example, cells and batteries use these chemical reactions to provide electricity. This topic builds upon KS3 work on particles and reactions and the KS4 chemical changes topic. It requires mathematical skills in using data to calculate energy changes. In this topic we will develop practical skills in measuring temperature changes of reactions.	retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 2:1	**Energy Changes cont.**		
Term 2:2	**Chemistry of the Atmosphere** ● **Evolution of the atmosphere** ● **Greenhouse effect and global warming** ● **Atmospheric pollutants** **Rates and extent of chemical reactions** ● **What affects the rates of reactions** ● **Effects of catalysts** ● **Effects of concentration (required practical)** ● **Effects of temperature (required practical)** ● **Effects of surface area** ● **Reversible reactions** ● **Dynamic equilibrium**	The Earth's atmosphere is dynamic and forever changing. We will learn that the causes of these changes are sometimes man-made and sometimes part of many natural cycles. We will explore the problems caused by increased levels of air pollutants and the solutions that help to reduce the impact of human activity. For geography students, this builds upon their learning in Year 9 about climate change and will enhance their KS4 studies on UK environmental challenges (term 3:2) and their Year 11 work on environmental threats to our planet. Chemical reactions can occur at different rates and there are many variables that can speed them up or slow them down. We will learn about these factors, including through practical investigations. 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, and so this topic builds upon prior knowledge from earlier KS4 topics. Mathematical skills are important in this topic, including drawing and interpreting graphs, drawing tangents to curves, calculating gradients of tangents and calculating means.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Rates and extent of chemical reactions**		Composite tasks,

	cont.		retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:2	**Revision**	This term is used to revise Paper 1. Exam skills are embedded throughout the course using past paper questions throughout unit and the end of unit assessments. Practical skills are revised via the required practicals.	

YEAR 11 Chemistry			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Organic chemistry** ● **Alkanes and alkenes** ● **Combustion of hydrocarbons** ● **Fractional distillation** ● **Cracking** ● **Reactions of alkenes** ● **Alcohols** ● **Carboxylic acids and esters** ● **Polymers** ● **Condensation polymers** ● **Biopolymers**	This branch of chemistry is about carbon compounds and is so important because it includes fossil fuels, which are a major source of feedstock for the petrochemical industry; the manufacture of many useful manufactured materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents; and naturally occurring polymers such as DNA. We will investigate the properties of different hydrocarbons including how they react. It follows on from learning about the impacts of fossil fuels on the atmosphere in Year 10.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 1:2	**Organic chemistry**		
Term 2:1	**Chemical analysis** ● **Pure vs impure, mixtures and formulations**	We will learn about a range of qualitative tests that are used to detect specific chemicals. Forensic scientists and drug control scientists rely on such instrumental methods in their work. This will include	Composite tasks, retrieval questions,self and

	• **Chromatography (required practical)** • **Gas tests** • **Flame tests** • **Testing ions** • **Sulfate ion tests** • **Halide ion tests** • **Instrumental methods of detecting elements and compounds**	chromatography, which was introduced in KS3 Separating Techniques. We will draw upon knowledge of the different chemicals to be tested, that has been developed throughout the chemistry course in KS3 and KS4.	peer assessment and end of module assessment using exam questions
Term 2:2	**Using resources** • **Finite and renewable resources** • **Potable and pure water** • **Water purification (required practical)** • **Treatment of water** • **Phytomining and bioleaching (HT)** • **Life cycle assessments** • **Limited resources**	We will learn how 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 and disposal of these products. This will complement geography students' KS4 studies about the environmental challenges facing the UK and the planet. Understanding our use of natural resources supports St Edmund's curriculum mission for pupils' to have an understanding of social justice and action, helping them to understand the threats and possible solutions to protect the environment and quality of life on our planet for all.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Using resources**		
Term 3:2	**Revision**	This term is used to prepare for the GCSE exams. Exam skills are embedded throughout the course using past paper questions throughout unit and the end of unit assessments. Practical skills are revised via the required practicals.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions

YEAR 10 Physics			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Atomic Structure** ● **history of the atom** ● **Rutherford's alpha particle scattering experiment** ● **background radiation** ● **properties of alpha, beta and gamma radiation** ● **half life** ● **decay equations** ● **dangers of radiation** ● **medical uses of radiation** ● **nuclear fission and fusion**	The understanding of the structure of the atom allows us to understand radioactive decay and nuclear fission and fusion. We need to appreciate that radioactive decay can be both harmful and beneficial and understand how it can be used productively in medicine and electricity generation. This unit builds on the idea of matter from KS3, where students describe the structure of the atom and name its constituent parts and also reinforces the KS4 Chemistry Atomic Structure unit. In this unit students will learn what happens to the nucleus when radioactive particles are emitted and how radiation is constantly all around us and the dangers of contamination and irradiation.	Composite tasks, retrieval questions, self and peer assessment and end of module assessment using exam questions
Term 1:2	**Atomic Structure**		
Term 2:1	**Forces** ● **scalars and vectors** ● **resolving forces** ● **mass, weight and gravitational fields** ● **Hooke's Law** ● **Speed and acceleration** ● **distance-time and velocity time graphs** ● **acceleration** ● **terminal velocity** ● **Newton's Laws** ● **stopping distance** ● **momentum**	An understanding of forces is fundamental to explaining how machines work and how structures are designed and built. This unit builds on the KS3 units of forces and motion and pressure and shows how forces are vital in machines and structures. Students should be able to name force types, calculate simple resultant forces and understand the features of a distance time graph. In this unit they will draw and analyse distance -time and velocity-time graphs and use and apply Newton's Laws of motion to solve problems. Students will investigate Hooke's Law and link this to the behaviour of springs in everyday engineering applications.They will then consider the importance of forces and speed when applied to the stopping distance of a vehicle and the principle of conservation of momentum.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 2:2	**Forces** ● **change in momentum**	Students will also learn about the turning action of a force at a distance and investigate the principle of moments.	Composite tasks, retrieval

	• **turning forces** • **levers and gears**		questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Forces** • **pressure in solids** • **pressure in liquids** • **atmospheric pressure** • **floating and sinking**	Students will learn in more depth about pressure in solids, liquids and gases building on the KS3 Year 8 unit motion and pressure. Practical applications of pressure at a depth and atmospheric pressure will be developed and applied.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:2	**Forces**		

YEAR 11 Physics			
TERM	**Topic sequence** **(What are you teaching?)**	**Topic sequence rationale** **(Why are you teaching this? How does it link to prior learning? Any notable links to St Edmund's curriculum mission**	**Main method of assessment?**
Term 1:1	**Waves** • **longitudinal and transverse waves** • **waves in solids and liquids** • **electromagnetic spectrum** • **applications of electromagnetic waves** • **infra-red radiation**	Mobile phones, the internet and bluetooth all rely on the principle of energy transfer by waves. This unit builds on the Year 7 units light and sound where longitudinal and transverse waves and basic wave terms are introduced. In this unit students will investigate waves using a ripple tank and be introduced to the electromagnetic spectrum and the uses of its constituent parts. Students will build on their knowledge of reflection, refraction and colour and progress to learning about earthquake waves and blackbody radiation.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 1:2	**Waves** • **reflection and refraction** • **lenses**		Composite tasks, retrieval questions,self and

	• **colour** • **sound and ultrasound** • **seismic waves** • **black body radiation**		peer assessment and end of module assessment using exam questions
Term 2:1	**Electromagnetism** • **magnets and magnetic fields** • **electromagnets** • **the motor effect** • **the generator effect** • **transformers** • **loudspeakers and headphones**	A knowledge of magnetic fields is fundamental to understanding how the electric motors inside devices live electric vehicles work. The combination of a magnetic field and a moving wire is the basis of electricity generation in a power station. This unit builds from the Year 8 electricity and magnetism unit where students gained a knowledge of magnet poles, magnetic materials and electromagnets. Students will learn about the catapult motor field, electricity generation and explain how a transformer, headphones and a loudspeaker work.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 2:2	**Electromagnetism**		Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:1	**Space** • **Formation of the solar system** • **Life cycle of a star** • **Satellites and orbits** • **Red shift and the doppler effect.**	Dark matter, dark energy and the expanding universe are concepts that astronomers are still trying to prove and explain. This unit builds on the Year 7 space topic where students were introduced to our solar system, our galaxy, the universe and its components. In this unit students will look at how stars were born, how they are powered by fusion and why they die. Red shift is explained using concepts from the KS4 waves unit and CMBR is discussed as evidence of the Big Bang theory.	Composite tasks, retrieval questions,self and peer assessment and end of module assessment using exam questions
Term 3:2	**Revision**	This term is used to prepare for the GCSE exams. Exam skills are embedded throughout the course using past paper questions throughout the unit and the end of unit assessments. Practical skills are revised via the required practicals.	