



Year 2 - Cambridge Advanced Nationals AAQ in Applied Science (Extended Certificate) CURRICULUM PLAN

INTENT

At Tavistock College, our Applied Science curriculum is academically rigorous, inclusive, and aspirational. It prepares learners for higher education, apprenticeships, and careers in science by developing confident, analytical thinkers who can apply principles of **Biology, Chemistry, and Physics** to real-world contexts.

Our intent is to ensure all learners—regardless of background—gain strong conceptual understanding, practical competence, and mathematical fluency. We also prioritise transferable skills such as problem-solving, critical thinking, and effective communication.

Curriculum Design and Sequencing

The curriculum follows a **spiral structure**, revisiting and deepening key ideas from KS3 through KS5. Foundational concepts such as cell biology, atomic structure, energy, and forces are introduced early and revisited with increasing complexity. Applied contexts are embedded throughout, linking theory to industry, health, and technology.

At KS5, learners progress through advanced topics in a logical sequence:

- **Biology:** Genetics, biochemistry, physiology, ecology.
- **Chemistry:** Organic chemistry, kinetics, equilibria, analytical techniques.
- **Physics:** Mechanics, electricity, waves, thermal and nuclear physics.

Mathematical methods and practical investigations are integrated across all units, ensuring competence in experimental design, data analysis, and evaluation.

Our Aspirations

By the end of the course, learners will demonstrate mastery of applied scientific principles, confidence in practical and analytical skills, and the curiosity to thrive in a science-driven world.

RATIONALE

Our Applied Science curriculum is designed to provide a rigorous, inclusive, and aspirational learning experience that reflects the interdisciplinary nature of modern science. The qualification integrates core principles from **Biology, Chemistry, and Physics** with practical and vocational applications, ensuring learners develop both theoretical understanding and hands-on competence.

The curriculum combines **substantive knowledge**—such as cell biology, chemical bonding, and energy transfer—with **disciplinary knowledge**, including experimental design, data analysis, and the scientific method. Lessons are structured to embed practical and theoretical learning, enabling students to apply concepts in real-world contexts and appreciate the relevance of science in healthcare, industry, and research.

Our approach builds on prior learning from earlier key stages, reinforcing essential ideas while introducing advanced concepts in a logical sequence. Core themes such as **structure and function, energy and change, and interactions between matter and forces** run throughout the course and are revisited

	with increasing complexity to support long-term retention and mastery. Mathematical skills are integrated across all units to develop confidence in data handling, calculations, and modelling. At Key Stage 5, learners are challenged to think critically and work independently. They explore contemporary scientific issues and technological developments, fostering scientific literacy and ethical awareness. Practical competence is developed through structured investigations, where students design, conduct, and evaluate experiments with precision and insight. The qualification is organised into key units that reflect the balance of theory and application: • Principles of Science introduces fundamental concepts across biology, chemistry, and physics. • Practical Scientific Procedures and Techniques develops laboratory skills and accurate data handling. • Science in the Modern World examines current applications, ethical considerations, and technological advances. • Laboratory Techniques and their Application reinforces advanced practical and analytical methods. This course prepares learners for progression into higher education, apprenticeships, or employment in science-related fields. For some, it will be the foundation of a future career; for others, their final formal study of science—but one that leaves them confident, capable, and scientifically literate.
VOCABULARY	At Tavistock College, we recognise that a strong scientific vocabulary is essential for success in the OCR Cambridge Level 3 National AAQ Extended Certificate in Applied Science. Understanding and using precise terminology enables learners to grasp complex concepts, interpret scientific texts, and communicate ideas clearly—skills that are vital for progression into higher education and science-based careers. Our approach ensures vocabulary is not an afterthought but a core part of teaching and learning. Each unit includes a carefully planned list of key terms drawn from Biology, Chemistry, and Physics, which are introduced, defined, and revisited throughout lessons. These terms are embedded in: • Topic road maps provided in the student course handbook and on Google Classroom. • Retrieval activities and assessments to reinforce understanding. • Practical work, where accurate use of language supports experimental design and data interpretation. This structured approach helps close vocabulary gaps and builds confidence in applying scientific language across contexts. Students are encouraged to use technical terms in written and verbal explanations, supporting both clarity and precision. By embedding vocabulary development into every aspect of the course, we prepare learners not only for success in their qualification but also for the demands of scientific communication in higher education and the workplace.
CULTURAL CAPITAL	At Tavistock College, we are committed to enriching students' cultural capital through the OCR Cambridge National AAQ Extended Certificate in Applied Science. Our aim is to connect classroom learning in Biology, Chemistry, and Physics to the wider world, demonstrating how science underpins modern life, drives innovation, and opens doors to diverse career pathways. Teachers actively explore careers and industries relevant to the content being studied with students, helping them understand how scientific principles apply to fields such as healthcare, pharmaceuticals, environmental science, engineering, data analysis, and emerging technologies.

	Real-world applications and global challenges are embedded throughout the course. For example: • Discussing the role of chemical analysis in forensic science. • Exploring medical imaging and diagnostic techniques in healthcare. • Considering the impact of energy production and sustainability on global policy. • Examining how physics and computing underpin communication systems in the digital age. These links help students see science not just as an academic subject, but as a gateway to solving real problems and making a positive impact on society. Students also develop the core skills needed to work scientifically, including: • Scientific attitudes – fostering curiosity, integrity, and a critical approach to evidence. • Experimental skills and investigations – through structured practical work and applied tasks. • Analysis and evaluation – interpreting data, identifying patterns, and drawing justified conclusions. • Measurement and precision – building confidence in using scientific equipment and techniques. By combining rigorous academic study with practical experience and career awareness, we ensure that learners leave this qualification with the knowledge, skills, and ambition to progress into higher education, apprenticeships, or employment in science-related fields.
LEARNING FRAMEWORK	At Tavistock College, the OCR Cambridge National AAQ Extended Certificate in Applied Science is delivered through a carefully sequenced curriculum that builds deep conceptual understanding across Biology, Chemistry, and Physics. Our approach ensures students can apply scientific principles confidently in practical and vocational contexts while developing the skills needed for progression into higher education and science-based careers. Each topic is supported by a Topic Overview (Road Map), which sets out the key content, assessment focus, and essential vocabulary. These overviews help students make meaningful connections between prior, current, and future learning, ensuring coherence and progression throughout the course. Lessons are taught by subject specialists with strong content knowledge and expertise in explaining complex scientific ideas. Teaching is underpinned by explicit instruction, where new concepts are broken down, modelled clearly, and practised extensively to secure mastery of both theoretical and practical skills. The Tavistock College Framework for Learning To ensure consistency and high-quality delivery, all staff follow our structured approach: • Retrieval Starter – Silent recall questions at the start of every lesson to strengthen long-term memory and reinforce prior learning. • Explicit Instruction – Clear, direct teaching of new content, supported by expert modelling and worked examples. • Guided Practice – Structured opportunities for students to apply new knowledge with teacher support. • Independent Practice – Time for students to consolidate learning through problem-solving and written responses.

	• Exit Routine – A final check for understanding that informs future planning and identifies misconceptions. Students regularly engage with applied tasks and past examination questions to develop confidence in interpreting data, applying knowledge in unfamiliar contexts, and constructing extended responses. Scaffolding is embedded throughout lessons, using visual aids, structured writing frames, and step-by-step modelling to support access to challenging content and build independence. By combining rigorous academic study with practical experience, we aim to ensure every student succeeds in Applied Science—developing analytical, mathematical, and investigative skills that prepare them for higher education, apprenticeships, and careers in a rapidly evolving scientific world.
PSHE OPPORTUNITIES	At Tavistock College, PSHE principles are woven throughout the OCR Cambridge National AAQ Extended Certificate in Applied Science to support the development of responsible, reflective, and scientifically literate citizens. Our aim is to ensure that students not only gain strong scientific knowledge in Biology, Chemistry, and Physics, but also understand how science influences decision-making in society and everyday life. As students progress through the course, they explore topics that naturally connect to personal, social, and ethical issues, including: • Health and Wellbeing – Through biology units on human physiology, disease prevention, and medical technologies, students consider lifestyle choices, public health, and ethical implications of scientific advances. • Environmental Responsibility – Chemistry and physics topics address sustainability, energy production, and climate change, encouraging informed discussion about global challenges and personal responsibility. • Data and Decision-Making – Learners interpret scientific data, assess risk, and evaluate evidence, developing critical thinking skills and an awareness of bias and ethical data use. • Science in Society – Units such as <i>Science in the Modern World</i> explore how scientific developments impact law, politics, and everyday life, fostering debate on issues like genetic engineering, renewable energy, and digital security. These connections help students see science as more than an academic subject—it is a foundation for making informed, responsible decisions in a world shaped by technology and innovation. By embedding PSHE principles into Applied Science, we prepare learners not only for success in their qualification but also for life beyond the classroom, equipping them with the knowledge, skills, and values needed to thrive in higher education, employment, and society.
BROADENING HORIZONS	Our science curriculum is enriched with a wide variety of experiences and opportunities to ensure memorable and exciting opportunities to enjoy science and science related topics outside of the classroom. Our STEM team offers lots of opportunities including: Code Club Robotics Game Design Challenge Rocket League on PS4 Science Live Chemistry Week British Science Week Biology, Chemistry and Chemistry Olympiads Race for the Line Science Poster Competition Forensic Week Career Links in every Road Map Famous Historical Scientist Displays Careers Presentations IOP competitions Medical and Dentistry Careers sessions Interactive Spectroscopy Sessions Weekend Revision Courses
ASSESSMENT	Assessment for the OCR Cambridge National AAQ Extended Certificate in Applied Science is designed to monitor progress, identify gaps in understanding, and inform responsive teaching. Our approach ensures students are supported and challenged throughout the course while preparing them for both externally assessed and coursework-based components.

	How Assessment Works The qualification is assessed through: • Externally Assessed (EA) units, which test core scientific principles and application across Biology, Chemistry, and Physics. • Non-Examined Assessment (NEA) units, which focus on practical skills, investigative techniques, and applied scientific contexts. Rather than using end-of-topic tests, we embed assessment into the learning process through: • Regular retrieval activities to strengthen memory and reinforce prior learning. • Knowledge checks and teacher questioning during lessons to assess understanding in real time. • Structured feedback on written work and practical tasks, ensuring students know how to improve. • Exit routines to evaluate lesson outcomes and inform next steps in planning. To develop exam and coursework skills students engage in: • Practice with past EA papers and applied tasks, building confidence in interpreting data, applying knowledge in unfamiliar contexts, and constructing extended responses. • Guided support for NEA units, including planning investigations, collecting and analysing data, and presenting findings to meet assessment criteria. This structured approach ensures assessment is purposeful, responsive, and aligned with the demands of the OCR specification. By combining formative strategies with targeted preparation for EA and NEA components, we enable all students to achieve their full potential and develop the scientific, analytical, and practical skills needed for progression.
CURRICULUM ORGANISATION	The OCR Cambridge National AAQ Extended Certificate in Applied Science is delivered by subject specialists with expertise across Biology, Chemistry, and Physics. Students receive ten hours of dedicated Applied Science teaching per fortnight, providing time for thorough coverage of theoretical content and practical skills. The curriculum is carefully sequenced to ensure coherent progression and deep understanding. Foundational concepts are introduced early and revisited as complexity increases. For example, learners study atomic structure and bonding before exploring analytical techniques, and energy principles before applying them to environmental systems and technological innovations. This logical structure allows students to make meaningful connections between topics and apply their knowledge in real-world contexts. Learning builds cumulatively, reinforcing prior knowledge while preparing students for the demands of both externally assessed units and coursework-based investigations. Progress is monitored through ongoing formative assessment, retrieval activities, and structured feedback on written and practical work. Students also use past externally assessed papers to develop confidence in interpreting data, applying knowledge in unfamiliar contexts, and refining their exam technique for EA units. Alongside this, NEA tasks are supported through guided planning, data analysis, and evaluation to meet assessment criteria.

	By combining rigorous academic study with practical experience, we ensure students develop the scientific understanding, analytical skills, and investigative competence needed for success in higher education, apprenticeships, and careers in science and related fields.
Online Learning	At Tavistock College, online learning is an integral part of our OCR A Level Biology provision, supporting independent study, consolidation, and exam preparation. We use Google Classroom as a central platform to share resources, assign tasks, and provide access to a wide range of past paper questions. Google classrooms include the following resources for every chapter: • Lessons taught in class, with some episodes recorded • revision material, • practise assessment material and exam papers • OCR exams resources, and practical and mathematical guides • Resources from save my exams and other useful resources or links to online learning platforms which support learning on the course. Students are also regularly signposted to the OCR website to access official past papers and mark schemes, helping them familiarise themselves with exam formats and expectations.

Unit F181: Science in society - Unit aim

Science has transformed the world we live in and brought about many benefits to society, raising living standards and improving peoples' health and life expectancy. Scientific knowledge enables new technologies to be developed, practical problems to be solved and informed decisions to be made. The challenges facing modern society, such as the emergence of new diseases, climate change and sustainability of natural resources, are being addressed by scientists across the world. This unit explores the work of scientists to collect, analyse and present data, using a process called the Scientific Method, to increase knowledge and address these challenges. Communication in science helps inform, educate, and raise awareness of science-related topics within society, inspiring future scientists like you so that scientific technologies continue to progress.

In this unit students will learn about the skills scientists use and the roles they perform in an international scientific community. They will examine different types of scientific data and learn how scientists use them to draw conclusions that can contribute to scientific advancement. Students will investigate what makes a scientific theory different to a scientific law by reviewing past scientific discoveries and explore current scientific developments and future challenges facing society that science will need to solve. Students will consider ways that science is communicated in the scientific and wider communities, the implications of miscommunication and the importance of communication in driving future scientific advances.

CYCLE	TOPIC	COMPOSITE IDEA / BIG IDEA / WHY IS IT IMPORTANT?	LEARNING EPISODES	COMPONENT KNOWLEDGE AND CURRICULUM LINKS
Year 12 Summer	Unit F181: Science in society	Big Idea: Understanding How Scientists Work This topic shows students that science is a dynamic, collaborative	1.1 The skills of scientists - 1.1.1 The skills scientists use to carry out research into the	To include: • Know what each skill involves and How these skills are used by scientists • Know reasons why these skills are important in science • How to recognise when scientists are employing these skills in their work

		process where scientists use specialised skills, follow a flexible scientific method, and work together across disciplines and countries to build reliable knowledge and develop new technologies. By understanding how scientific skills are applied, how the scientific method guides inquiry, and how diverse teams contribute to major discoveries, students gain a clearer picture of what scientists do, why their work matters, and how different branches of science connect to solve real-world problems.	natural world and developing new technologies	
			1.2 The Scientific Method - 1.2.1 Steps in the Scientific Method	To include: - Know the Key features of each step and the importance of each step - The reasons for the order of the steps - The role of inductive and deductive reasoning in the scientific method - How the approach to the scientific method varies in different disciplines of science
			1.2 The Scientific Method - 1.2.2 The scientific method is a non-linear process	To include: - How scientific inquiry can be cyclical and continuous - The importance of flexibility and adaptability in scientific research - Accidental scientific discoveries occur occasionally in comparison to planned research - Scientific research often involves colleagues from multiple disciplines - Observations and patterns can lead to theories that explain them and conclusions that are likely
			1.3 The Scientific Community - 1.3.1 How scientists work	To include: - Advantages and disadvantages of each type of working - Reasons why collaboration is important in scientific research - Know ways that scientists collaborate - The importance of diversity and inclusivity in a team
			1.3 The Scientific Community - 1.3.2 Successful collaborations in science	To include: - What was accomplished and how - The necessity for collaboration in these successes - Why it is important to have scientists from different disciplines working together
			1.3 The Scientific Community - 1.3.3 International Scientific Organisations	To include: - Role of international organisations in developments in science - Know why it is an advantage to have these organisations
			1.4 The role of scientists	To include: - How to recognise the different disciplines of science and the roles of scientists in them - Know why it is useful to think of science as different disciplines

				- Why it is important to consider the interconnectivity and overlap between the disciplines - The role of 'pure' and applied science and their dependence on each other
Year 13 – Autumn term	Unit F181: Science in society: Topic Area 2: Handling scientific data	Big Idea: Why Understanding Scientific Data Matters Understanding scientific data equips students with the ability to judge whether evidence is reliable, meaningful, and clearly communicated. By learning how data is classified, collected, stored, presented, and interpreted, students develop the critical skills needed to spot bias, recognise trustworthy results, appreciate inclusive research practices, and make sense of scientific information across different disciplines. This prepares them to think analytically, communicate findings effectively, and engage confidently with evidence in applied science and everyday life.	2.1 Types of scientific data	To include: - Know what each type of data looks like - How to classify data into these types - How to represent these different types of data appropriately
			2.2 Collecting scientific data	To include: - Key concepts and uses of each collection method - The types of scientific disciplines that use these methods - Advantages and disadvantages of each collection method - Know the impact of bias in data collection methods - The importance of diversity and inclusivity, where appropriate
			2.3 Storage and presentation of scientific data - 2.3.1 Storage of scientific data	To include: - Know key features and uses of each type of database - When it is appropriate to use one database type rather than another - Examples of the type of data stored in each way and why - Advantages and disadvantages of each type of database
			2.3 Storage and presentation of scientific data - 2.3.1 Representation of scientific data in graphical forms	To include: - Know key features and uses of each - Why different graphs may be used to communicate to different audiences or for different purposes - Know how to represent data in these graphical forms with accuracy
			2.4 Interpreting data	To include: - Patterns from data and graphs - Use of mathematical skills when determining patterns from data and graphs - Conclusions from data or graphs - Decisions about further investigation
	Unit F181: Science	Big Idea: Why Understanding Scientific Developments Matters	3.1 Hypothesis, theory, and law	To include: - Know definitions of the terms; Hypothesis, theory and law. - Know how to write a hypothesis and predictions - How a hypothesis may become a theory

		Understanding scientific developments helps students see how scientific ideas grow, change, and influence society. By exploring how hypotheses become theories or laws, how new technologies drive progress, and how limitations, risks, funding, and ethical considerations shape research, students learn to evaluate scientific claims with confidence and awareness. This topic builds their ability to judge the reliability of scientific explanations, recognise the impact of emerging technologies, and appreciate the social, moral, economic, and environmental factors that guide scientific decision-making in the real world.		- How the term theory is used in science and in everyday language - The role of assumptions, estimations and approximations in science
			3.1.2 Scientific theory vs scientific law	To include: - Know how a law is different from a theory - Both theories and laws require evidence and can be open to change and revision
			3.2 Using new technologies in science	To include: - Key concepts of each type of new technology - Advantages of the new technologies to further scientific development - How scientific disciplines might be supported by these technologies
			3.2.2 Limitations and risks of new technologies in society	To include: - Impacts on people, money, security and the environment - How to identify the limitations and risks - How judgements are made about the use of these new technologies
			3.3 Implications and limitations of scientific developments - 3.3.1 Considerations for scientific developments	To include: - Know the importance of funding in science - The role of private companies, charitable foundations or governments in scientific research - Factors that affect research that is carried out - How scientists receive funding for research - What issues might arise and how they are classified as social, ethical or moral issues
			3.3 Implications and limitations of scientific developments - 3.3.2 Contemporary issues that science will need to solve in the future	To include: - Know key concepts of these main issues - What scientific disciplines will be necessary to solve these issues - Social, ethical, and moral issues arising - Economic and environmental considerations
	Unit F181: Science in society.	Big Idea: Why Communicating Science Matters Understanding how science is communicated helps students judge whether information is	4.1 Methods of communication - 4.1.1 Communicating science to the public using the media	To include: - Know key features of each media and the target audiences of each media - Advantages and disadvantages of communicating using each media - Language, structure, and images used for engagement of target audience - How to assess the effectiveness of a source of information in providing accurate

		accurate, trustworthy, and responsibly presented. By exploring how science is shared with the public and between experts, how peer review strengthens reliability, how plagiarism undermines integrity, and how organisations use evidence to guide decisions, students learn to navigate scientific information with confidence. This topic also builds awareness of misinformation, disinformation, and bias, helping students recognise when science is misrepresented and why scientific literacy is essential for informed citizenship. Ultimately, it equips them to communicate evidence clearly, avoid bias, and engage thoughtfully with scientific issues that shape society.		information and being engaging • Know how to assess the validity of a source of information
			4.1 Methods of communication - 4.1.2 Communicating science between experts	To include: • Know why it is important for experts within scientific disciplines to engage with each other • Know why it is important for experts across scientific disciplines to engage with each other • Key features of each type of communication • Know steps in the process of peer review and Why peer review is important • How the process of peer review increases reliability and validity of published information
			4.2 Plagiarism	To include: • Know definition of each type of plagiarism • When each type of plagiarism could occur • Why people plagiarise and why it matters • How to avoid plagiarism and the potential consequences of plagiarism
			4.3 Using science to inform decision making	To include: • Know how organisations use scientific information and data • Aims and objectives of these types of organisations • The importance of these organisations in influencing public opinion • The importance of these organisations in future scientific advancement
			4.4 Problems with communicating science - 4.4.1 Public trust in the scientific community and developments	To include: • Know how to differentiate between misinformation and disinformation • How to identify potential misinformation and disinformation in science • Why science might be misrepresented • Different ways science can be misrepresented • Possible causes of misinformation • Sources of misinformation • Know definition of scientific literacy • Why it is important for all citizens in society to be scientifically literate • How scientists can improve communication with citizens about developments and research
			4.4 Problems with communicating	To include: • Contrast in how the term bias is used in science and in everyday language

			science - 4.4.2 Bias in science communication	• Key ideas about each type of bias in science communication • Possible consequences of bias in science communication • Know how to avoid bias in science communication
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Unit F184: Environmental studies – Unit Aim

Human activity has significant impact on the environment and the species living within it. This unit explores ecosystems and biodiversity, how ecosystems are managed and the conservation strategies used in their management. The unit also considers the strategies for managing domestic and industrial waste.

In this unit students will learn to use primary and secondary data to study ecosystems and develop the skills to carry out in situ fieldwork investigations to survey an area using different sampling techniques. Students will learn about the different surveys available for studying the environment and how in situ and ex situ conservation strategies are used to protect species and their environments. Students will learn how to use online information to learn about biodiversity and compare different ecosystems and will have the skills to research some of the strategies used to monitor and treat waste products in places such as landfill sites and water courses.

CYCLE	TOPIC	COMPOSITE IDEA / BIG IDEA / WHY IS IT IMPORTANT?	LEARNING EPISODES	COMPONENT KNOWLEDGE AND CURRICULUM LINKS
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Year 12 Summer 2

Topic Area 1: Ecosystems and biodiversity	Big Idea: Why Understanding Ecosystems and Biodiversity Matters Understanding ecosystems and biodiversity helps students appreciate how living things interact, adapt, and depend on one another, and why these relationships are essential for the health of the planet. By exploring different ecosystems, the factors that shape them, and the levels of biodiversity within them, students learn how habitats support species, how conservation protects vulnerable and endemic organisms, and how sustainable management secures vital natural resources. This topic also develops their ability to evaluate real-world case studies, recognise the importance of genetic diversity, and understand how ecological knowledge informs medicine, agriculture, design, and environmental decision-making. Ultimately, it equips students to think critically about the natural world and the challenges involved in protecting it.	1.1.1 What an ecosystem is	To include: - Ecosystems range in size and are dynamic - Organisms engage in complex interactions with their environment - The composition of an ecosystem is affected by abiotic factors and biotic factors - The role of interdependence in an ecosystem
		1.1.2 Types of ecosystem	To include: - Different terrestrial ecosystems - Different aquatic ecosystems - Abiotic and biotic factors common to these ecosystems - How adaptations of different species enable them to live and survive in different ecosystems
		1.2.1 Levels of biodiversity	To include: - Species diversity as a measure of species richness and species evenness - Ecosystem diversity as a measure of the range of ecosystems in a specific area
		1.3.1 Importance of ecosystems	To include: - Provision of specific habitats and niches for different species - Why ecosystem conservation is particularly important to endemic species - How sustainable habitat management can secure future supplies of natural resources, such as wood and food - The role of biomimetics in design and manufacture
		1.3.2 Importance of maintaining biodiversity	To include: - Why healthy, biodiverse ecosystems are important - The use of wildlife and plant life as pest control or sources of new medicines - The role of genetic diversity as a source for improving agricultural crops - How to identify keystone and foundation species
		1.4.1 Case studies as a unique source of information	- The advantages of a case study over other forms of scientific research in informing developments - How to select appropriate case studies to support research and decision making - How to evaluate the relevance, limitations, and methodologies used by a case study about an ecosystem or development
	Topic 2	2.1 Impact of human activities -	To include:

		Big Idea: Why Understanding Human and Natural Impacts on Ecosystems Matters Understanding how human activity and natural events affect ecosystems helps students recognise the pressures that threaten biodiversity and environmental stability. By examining changes in land use, species exploitation, invasive species, pollution, disease, and natural disasters, students learn how these factors disrupt habitats, food webs, and population balance. This topic builds their ability to identify risks, understand the consequences of human choices, and appreciate why some species and ecosystems are especially vulnerable. Ultimately, it equips students with the knowledge needed to evaluate environmental challenges, consider sustainable solutions, and make informed decisions about protecting the natural world.	2.1.1 Change of land use	- How the need for more food and more housing due to increasing human population leads to change of land use - How change of land use has impacts on biodiversity and the environment
			2.1 Impact of human activities - 2.1.2 Species exploitation and eradication	To include: Historical, cultural and economic reasons for direct and deliberate destruction of populations of animal and plant life
			2.1 Impact of human activities - 2.1.3 Introduction of alien species	To include: - The difference between native and invasive species - How invasive species are introduced into the environment and how they impact native species - Why the introduction of domestic pets impacts biodiversity, including food webs and predator-prey relationships - How trade in exotic species causes imbalance in the food webs and reduces biodiversity - How intensive farming impacts the environment
			2.1 Impact of human activities - 2.1.4 Pollution	To include: - Origins and effects of different types of pollution on ecosystems and biodiversity - Wider impacts on society - The difference between point source and non-point source pollution - General ways to mitigate pollution and the reasons why pollution continues
			2.2 Impact of natural events - 2.2.1 Disease	To include: - How disease affects population numbers and ecosystems - Why species with small gene pools or small populations are more at risk
			2.2 Impact of natural events - 2.2.2 Earth events	To include: How natural disasters affect biodiversity and the environment
	Topic Area 3: Waste	Big Idea: Why Understanding Waste Management Matters Understanding waste management helps students recognise how everyday human activities affect	3.1.1 Processing domestic waste in the UK	To include: - Different types of solid domestic waste and how it is collected and distributed - What happens to waste in landfill sites including: - Different routes for different types of waste - Possible environmental damage

		ecosystems, resources, and environmental health. By exploring how domestic, industrial, and sewage waste is processed, sorted, recycled, or disposed of, students learn why responsible waste handling is essential for protecting biodiversity, reducing pollution, and preventing long-term environmental damage. This topic also develops awareness of the advantages and limitations of different waste-management strategies, including recycling, landfill use, and industrial controls, and highlights how sustainable choices and financial incentives can reduce harm. Ultimately, it equips students to think critically about how society manages waste and how informed decisions can support a cleaner, safer, and more sustainable future.		- Monitoring waste gases produced - What happens to items recycled by households including: - Methods for sorting different recyclable materials - Routes taken by different materials - How new products are made - What happens to exported waste including: - Waste shipped to other countries in containers - Advantages and disadvantages of different methods of dealing with domestic waste
			3.1.2 Processing sewage	To include: - What happens to domestic wastewater once it leaves homes and businesses - What happens to wastewater from treatment plants - What happens to waste water from septic tanks
			3.2 Dealing with industrial waste	To include: - How different types of industrial waste need specific disposal to prevent environmental damage and impact on biodiversity - Advantages and disadvantages of: - Reduce, reuse, recycle strategy - Financial incentives
Year 13 Autumn term	Topic Area 4: Environmental management and conservation	Big Idea: Why Environmental Management and Conservation Matter Understanding environmental management and conservation helps students see how scientific knowledge, policy, business practice, and community responsibility work together to protect ecosystems and support sustainable development. By learning how environmental surveys are carried out, how governments and businesses manage natural resources, how legislation and education shape environmental	4.1.1 Types of environmental survey	To include: - Why environmental surveys are needed - The importance of ecological monitoring in conservation planning - How different types of surveys can be carried out - Which survey to use depending on nature of development and location in the country - Which methods are used for obtaining qualitative and quantitative data - Data analysis and calculations, including to show correlation such as Spearman's rank correlation coefficient
			4.2.1 Environmental management methods	To include: - Role of education and social responsibility in protecting the environment - Role of laws and legislation in protecting the environment - Role of governments in managing environments - Role of businesses in managing environments

		behaviour, and how barriers to effective management can be identified and addressed, students gain the tools to evaluate real-world environmental decisions. This topic also builds awareness of conservation strategies, both in situ and ex situ, and why choosing the right approach is essential for protecting species and habitats. Ultimately, it equips students to think critically about how environments are monitored, managed, and safeguarded for the future.	4.2.2 Role of governments in managing environments	To include: • How environmental regulations are enforced • How public awareness is raised, including through the use of education • How agencies, authorities, policies and legislation can be used to ensure human needs are met sustainably
			4.2.3 Role of businesses in managing environments	To include: • How to create EMSs and EIAs • Who is required to have EMSs and EIAs • The role of case studies and stakeholders in writing EIAs • Why EMSs and EIAs are important to managing an environment and protecting an ecosystem • Advantages to organisations and business in creating, implementing and monitoring EMSs and EIAs • Impacts on businesses from failing to comply with legislations and industry standards to protect the environment • The importance of sustainability and sustainable development
			4.2.4 Barriers to effective environmental management	To include: • Barriers that impact the rate of habitat and biodiversity loss • Why different barriers for managing an environment exist and how these barriers prevent effective management of that environment or ecosystem • How to identify these barriers from a case study or other information • Ways in which these barriers may be addressed in the sustainable management of an environment
			4.3 Conservation strategies - 4.3.1 in situ conservation and 4.3.2 ex situ conservation	To include: • How to select appropriate in situ conservation methods • Advantages and disadvantages of in situ conservation methods • How to select appropriate ex situ conservation methods • Advantages and disadvantages of ex situ conservation methods
	Topic Area 5:	Big Idea: Why Fieldwork Skills Matter Understanding fieldwork equips students with the practical skills needed to investigate real	5.1.1 Location Analysis	To include: • How to use maps and databases to find information about a potential location of fieldwork • How to find out about monthly and yearly weather patterns for a potential location • How to decide if the data is reliable and relevant

		environments, collect reliable data, and make informed ecological decisions. By learning how to analyse locations, measure abiotic factors, use appropriate sampling techniques, assess risks, and carry out meaningful data analysis, students develop the ability to gather high-quality evidence and evaluate environmental conditions with accuracy. This topic also helps them understand how fieldwork supports environmental impact assessments and conservation planning, building confidence in applying scientific methods outside the classroom. Ultimately, it prepares students to work safely, think critically, and contribute to responsible environmental management.	5.2 Suitability of the environment - Measuring abiotic factors	To include: • Techniques and apparatus to collect data in situ and samples for testing in a laboratory • When to use each technique and the information it will provide about an ecosystem • How each technique is performed to collect data of sufficient quality and have minimal impact on the local environment • The limitations of techniques that can be performed in schools compared with those that are performed professionally
			5.3 Sampling techniques - 5.3.1 Population sampling	To include: • The importance of representative sampling • How to choose appropriate sampling techniques to gather data of sufficient quality for an EIA • How to avoid bias in sampling • The importance of standardisation of techniques and clear descriptions of methodologies • How to design experiments that collect statistically significant data relevant to an EIA • Strengths and weaknesses of each sampling technique • The role of species lists and the ACFOR and DAFOR scales in collecting appropriate data • The importance of when sampling should be carried, and how much to sample, to get representative data • The role of a running mean to assess representation • Using field guides, online databases and apps to identify species
			5.3 Sampling techniques - 5.3.2 Vegetation sampling	To include: • Techniques available to schools and conservationists for sampling vegetation • How to carry out different types of transects • How to select quadrat size and type • Use of density/coverage vs frequency • How to measure tree height using a clinometer • Advantages and disadvantages of each technique
			5.3 Sampling techniques - 5.3.3	To include:

			Sampling mobile organisms	• The importance of sampling mobile organisms and consistency in techniques used • Techniques available to schools and wildlife conservationists for sampling mobile organisms • How to select the appropriate techniques to gather data for an EIA • Assumptions made while sampling mobile organisms • Advantages and disadvantages of each technique
			5.4 Risk assessment	To include: • Importance of a risk assessment when carrying out fieldwork • Use of a well-designed risk assessment template • Differentiation between hazard and risk • Appreciation of hazard symbols and their meanings • How to select and interpret relevant information about hazardous chemicals • Appreciation of external factors that need to be considered, such as the public, traffic, location choice • How to explain control measures using scientific principles
			5.5 Data processing and analysis	To include: • How to carry out the calculations • How to decide the appropriate calculations and statistical analysis to use • How to design the fieldwork to ensure data of sufficient quality for statistical analysis is collected • How to interpret the results • The strengths and weakness of each statistical test
NEA Assessment - This set assignment has 5 practical tasks. It should take about 18 hours of supervised time and 8 hours of unsupervised time to complete.				

Unit F186: Medical physics – Unit Aim

This unit explores different imaging techniques used for medical diagnosis and different therapies used for medical treatment.

In this unit you will learn about the different diagnosis techniques and therapies that are used in medicine. You will apply what you learn about each technique to some specific scenarios, making decisions about the most appropriate imaging technique and types of therapies that can be used. You will suggest how the imaging and therapy techniques will need to be performed and the impact they will have on patients and professionals.

CYCLE	TOPIC	COMPOSITE IDEA / BIG IDEA / WHY IS IT IMPORTANT?	LEARNING EPISODES	COMPONENT KNOWLEDGE AND CURRICULUM LINKS
Year 13 Spring term	Topic Area 1: Application of non-ionising diagnosis techniques	Big Idea: Why Understanding the Application of Non-Ionising Diagnostic Techniques Matters Understanding how non-ionising diagnostic techniques are applied in medicine helps students appreciate how the body can be examined safely and effectively without using harmful radiation. By exploring the principles behind MRI, ultrasound, endoscopy, and ECGs, students learn how different technologies produce images or measurements, why each method is suited to particular clinical situations, and how professionals operate and interpret these systems. This topic builds awareness of the advantages, limitations, risks, and practical considerations involved in real medical diagnostics, helping students understand how physics underpins safe patient care,	1.1 Magnetic Resonance Imaging (MRI)	To include: • How an MRI scanner uses a magnetic field and radio waves to stimulate hydrogen atoms • How altering the radio frequency can distinguish between different types of tissues • Why MRI is a safe technique for visualising the entire body • Advantages and disadvantages of MRI, including the quality of the image, cost and availability • Risks to patients and staff, including noise, use of sedatives and contrast agents • Who manages the MRI machine and who produces and interprets MRIs
			1.2 Diagnostic ultrasound	To include: • The role of the transducer and boundaries between tissues in generating an image • How to decide which type of transducer to use • The relationships between frequency, gain, wavelength, penetration and resolution in producing clear images using ultrasound • The difference between anatomical and doppler • Ultrasound and its use • How to select the most appropriate ultrasound gel • Why ultrasounds are safe to use

		informed decision-making, and modern healthcare practice.		- Advantages and disadvantages of ultrasound as an imaging technique, including the quality of the image, cost and availability - Who manages the ultrasound machine and who produces and interprets ultrasounds
			1.3 Endoscopy	To include: - Modern endoscopes, including the use of non-coherent fibres and capsule endoscopy - How to decide which type of endoscopy to use - Advantages and disadvantages of endoscopy as an imaging technique, including the quality of the image, cost and availability - Risks to the patient undergoing endoscopy - Who performs endoscopies and interprets the images
			1.4 Electrocardiogram (ECG)	To include: - How the structures of the heart coordinate to create a heartbeat - Common issues with the heart detected by an ECG - Position of electrodes, their role in measuring potential difference (p.d.) and the difference between positive and negative deflections - How to identify P waves, QRS waves, and heart rate - How to interpret simple ECGs, to include irregular heart rhythms, and evidence of heart attack - Advantages and disadvantages of ECG as a diagnostic technique - How ECGs can be used to improve CT scans - Risks to the patient undergoing an ECG
	Topic Area 2: Application of ionising diagnosis	Big Idea: Why Understanding the Application of Ionising Diagnostic Techniques Matters Understanding how ionising diagnostic techniques are applied in medicine helps students appreciate how powerful imaging technologies can reveal internal structures and disease while requiring careful control to protect patients and staff. By exploring X-ray imaging, CT scans, radiopharmaceuticals, and	2.1 X-ray imaging - 2.1.1 Plain X-ray image	To include: - Optimizing settings of the X-ray tube voltage (kVp), current (mA) and exposure time (s) for image quality and safety for different types of patients - Common uses of X-ray imaging - The use of image contrast enhancement in X-ray imaging - How to position patients to optimise images and reduce artifacts - Use of collimators and filters to improve image quality - The effective radiation dose from different types of X-ray scan - Advantages and disadvantages of X-ray as an imaging technique - Safety procedures to protect patients and staff from ionising radiation - Who manages the equipment, conducts the procedure and interprets the images

		PET, students learn how these methods produce detailed images, why different techniques are chosen for different clinical needs, and how contrast media and tracers enhance diagnosis. This topic also builds awareness of radiation dose, safety procedures, legislation, and the roles of healthcare professionals involved in operating and interpreting these systems. Ultimately, it helps students understand how physics supports accurate diagnosis, risk management, and informed medical decision-making in modern healthcare.		
			2.1 X-ray imaging - 2.1.2 Computerised tomography (CT) scans and contrast media	To include: • How a CT scan is used to image the body • Advantages and disadvantages of CT imaging, including the quality of image, cost and availability • Why some patients may have both an MRI and a CT scan • Use of a contrast medium to form an image including examples such as barium meal • Risks associated with some contrast media • The effective radiation dose from CT scans • How specific health problems are diagnosed using these methods • Safety procedures to protect patient and staff from ionising radiation • Who manages the equipment, conducts the procedure and interprets the images
			2.2 Radionuclides - 2.2.1 Radiopharmaceuticals	To include: • Basic structure of the gamma camera • Function of radiopharmaceuticals in the body as a tracer • Comparison of dose level from different types, considering half-life and radiation type • How to select the type of tracer to use based on delivery method, age and health of the patient, lifestyle of the patient and its elimination from the body • Safety procedures to protect patient and staff from ionising radiation • Health and safety legislation linked to use of radioactive materials, including ARSAC • Who prescribes and administers the radiopharmaceutical, and monitors the patient • Advantages and disadvantages of radiopharmaceuticals for diagnosis, including the quality of image, cost and availability
			2.2 Radionuclides - 2.2.2 Positron emission tomography (PET)	To include: • Basic principles of a PET scan • How PET is able to visualise the body, including the role of fluorodeoxyglucose (FDG) • Why PET scans are used

				- Advantages and disadvantages of this imaging technique, including the quality of image, cost and availability - Why combining this with a CT scan is necessary to accurately locate a tumour - Safety procedures to protect patient and staff from ionising radiation - Who administers the FDG, and who performs the PET scan
	Topic Area 3: Application of ionising therapy techniques	Big Idea: Why Understanding the Application of Ionising Therapy Techniques Matters Understanding how ionising therapy techniques are applied in medicine helps students appreciate how radiation can be used safely and precisely to treat disease. By exploring external-source and internal-source radiotherapy, students learn how different types of radiation penetrate the body, how dose and delivery are controlled, and why specific treatments are chosen for particular conditions. This topic also builds awareness of risks, contraindications, safety procedures, and the roles of healthcare professionals involved in planning, administering, and monitoring treatment. Ultimately, it helps students understand how physics supports effective cancer therapy, patient safety, and informed clinical decision-making in modern healthcare.	3.1 Treatment with external source	To include: - Penetration of each type through the body - Relative energy delivered to cells from each type - Accuracy of each type in treating damaged cells/tissues and risks associated - Conditions for which different types of external source are required and contraindications - Advantages and disadvantages of these imaging techniques, cost and availability - Safety procedures to protect patient and staff from ionising radiation - Who manages the equipment and conducts the procedure
			3.2 Treatment with internal source	To include: - Types of radionuclide sources used for different treatments - The use of internal source therapy instead of external source in some situations - Conditions for which different types of internal source are required and contraindications - How to select the type of therapy, considering the dose required, retention in the body, excretion, health of the patient, delivery method and risk to bystanders - Advantages and disadvantages of these imaging techniques, cost and availability - Safety procedures to protect patient and staff from ionising radiation - Who prescribes and administers the radiotherapy, and monitors the patient
	Topic Area 4:	Big Idea: Why Understanding the Application of Non-Ionising Therapy Techniques Matters Understanding how non-ionising therapy techniques are applied in	4.1 Lasers	To include: - Properties of laser light that make it suitable for therapies - How different frequencies are used to cut, burn or repair different types of tissue selectively - Conditions or treatments for which lasers are beneficial and contraindications

		medicine helps students appreciate how light, sound, and electrical technologies can treat disease safely and precisely without using harmful radiation. By exploring laser therapies, photodynamic therapy, artificial cardiac devices, and therapeutic ultrasound, students learn how different frequencies, energies, and devices interact with tissues, why specific treatments are chosen for particular conditions, and how risks, contraindications, and dose protocols are managed. This topic also builds awareness of the benefits and limitations of each technique, the importance of patient safety, and the roles of healthcare professionals who operate and interpret these systems. Ultimately, it helps students understand how physics supports modern, non-invasive treatments that improve patient outcomes while minimising risk.		• Risks and benefits associated with each technique • Beam power required for different procedures • Why lasers are not ionising, even at high power, in terms of photon energy • Advantages and disadvantages of lasers for therapy including cost and availability • Who manages the equipment and conducts the procedure
			4.2 Photodynamic therapy (PDT)	To include: • How PDT is performed and the role of phototoxicity • Conditions for which PDT is effective and Risks and benefits associated with PDT • Advantages and disadvantages of PDT over ionising therapies • Possible side effects of PDT and comparison to ionising therapies • Who manages the equipment and conducts the procedure
			4.3 Artificial cardiac devices	To include: • Conditions for which artificial cardiac devices are appropriate and contraindications • How pacemaker and ICD can affect heart rhythm • Comparison of pacemaker and ICD • Advantages and disadvantages of each device for treating different conditions • Risks and benefits associated with artificial cardiac devices • Who manages the equipment and conducts the procedure
			4.4 Ultrasound therapies	To include: • Differences in procedure, technique and equipment compared with imaging • Conditions for which each ultrasound therapy is effective and contraindications • Required dose protocols for treating different types of condition • Risks and benefits of using different ultrasound therapies • Advantages and disadvantages of each technique for treating different conditions • Who manages the equipment and conducts the procedure
	Topic Area 5: Planning for	Big Idea: Why Understanding Diagnosis and Therapy Planning Matters Understanding how diagnosis and therapy plans are created helps students appreciate how medical decisions are structured,	5.1 Diagnosis plan	To include: • How to write a logical diagnosis plan and assess the quality of a diagnosis plan • How to create a risk assessment that is linked to a diagnosis plan • How to create a presentation of the diagnosis plan that is appropriate for healthcare professionals and other appropriate audiences • How to communicate an appropriate diagnosis plan to healthcare professionals and other appropriate audiences

		communicated, and evaluated to support safe, effective patient care. By learning how to design logical plans, assess their quality, link them to risk assessments, and present them clearly to healthcare professionals or patients, students develop the skills needed to communicate medical information responsibly. This topic also builds awareness of patient needs, costs, equipment availability, and the social, emotional, and mental health impacts of medical procedures. Ultimately, it prepares students to think critically about clinical decision-making, respond to feedback, and engage confidently with the planning processes that guide modern diagnosis and treatment.		• Why it is important to consider the needs of the patient, costs, and availability of equipment and techniques • The possible social, emotional, and mental health effects to the patient before, during, and after the diagnosis plan • How to obtain appropriate feedback on a diagnosis plan and then summarise the feedback • How to prepare for questions that may be asked by healthcare professionals and other audiences
			5.2 Therapy Plan	To include: • How to write a logical therapy plan and assess the quality of a therapy plan • How to create a risk assessment that is linked to a therapy plan • How to create a presentation of the therapy plan that is appropriate for patients and other appropriate audiences • How to communicate an appropriate therapy plan to patients and other appropriate audiences • Why it is important to consider the needs of the patient, costs, and availability of equipment and techniques • The possible social, emotional, and mental health effects to the patient before, during, and after the therapy plan • How to obtain appropriate feedback on a therapy plan and then summarise the feedback • How to prepare for questions that may be asked by healthcare professionals and other audiences
NEA Assessment - This set assignment has 4 practical tasks. It should take about 15 hours of supervised time and 8 hours of unsupervised time to complete.				