KS5 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.

YEAR 12 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** **St Edmund's curriculum mission**	• **Main method of assessment?**
Term 1:1	**Particles and radiation** • **Matter and radiation** • **Quarks and leptons** • **Quantum phenomena** **Electricity** • **Electric current** • **DC circuits**	Particle Physics is at the frontiers of physics. It is about the fundamental properties of matter, radiation and energy. This unit builds on the KS4 Atomic structure unit where students learnt about the constituents of the atom and radioactive decay. In this unit students will extend their understanding of fundamental particles to include quarks and leptons. They will learn about quantum theory, the photoelectric effect, wave-particle duality and light spectra. The supply of electricity has improved our lives in many ways. The discovery of the production and measurement of electricity 200 years ago established the principles and laws which are used today to design the circuits inside every electrical device. This unit builds on the KS4 electricity unit where students investigated Ohm's Law, current-voltage characteristics and factors affecting resistance. In this unit students will learn about Kirchhoff's Laws, internal resistance and superconductors.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**
Term 1:2	**Particles and radiation** • **Matter and radiation** • **Quarks and leptons** • **Quantum phenomena** **Electricity** • **Electric current** • **DC circuits**	Particle Physics is at the frontiers of physics. It is about the fundamental properties of matter, radiation and energy. This unit builds on the KS4 Atomic structure unit where students learnt about the constituents of the atom and radioactive decay. In this unit students will extend their understanding of fundamental particles to include quarks and leptons. They will learn about quantum theory, the photoelectric effect, wave-particle duality and light spectra. The supply of electricity has improved our lives in many ways. The discovery of the production and measurement of electricity 200 years ago established the principles and laws which are used today to	**Retrieval questions, self assessment and end of topic tests using past exam questions.**

		design the circuits inside every electrical device. This unit builds on the KS4 electricity unit where students investigated Ohm's Law, current-voltage characteristics and factors affecting resistance. In this unit students will learn about Kirchhoff's Laws, internal resistance and superconductors.	
Term 2:1	**Waves and optics** ● **Waves** ● **Optics** **Materials** ● **Hooke's Law** ● **The Young Modulus**	The study of waves and optics helps us to understand many applications that we use every day as well as helping us to understand fundamental discoveries that have been made about our place in the universe. This builds on the KS4 waves unit introducing diffraction, interference and polarisation. Applications such as fibre optics and the endoscope are introduced and the investigation of the wave nature of light investigated. The study of the behaviour of materials underpin many work related areas including engineering and materials science. This section builds on the Hooke's Law section of the KS4 Forces module, introducing the Young Modulus and further investigation of the behaviour of materials under the action of tensile and compressive forces.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**
Term 2:2	**Mechanics** ● **Forces in equilibrium** ● **On the move** ● **Newton's Laws of Motion** ● **Forces and momentum** ● **Work, energy and power** **Waves and optics** ● **Waves** ● **Optics**	Understanding the principles and applications of mechanics allows engineers to design new structures and develop new materials and technologies. This builds on the KS4 Forces unit and requires students to apply their maths skills to solve problems. This unit is loathed towards the end of year 12 so there is an overlap with A level Maths Mechanics and students have had the opportunity to develop their maths skills through Year 12. The study of waves and optics helps us to understand many applications that we use every day as well as helping us to understand fundamental discoveries that have been made about our place in the universe. This builds on the KS4 waves unit introducing diffraction, interference and polarisation. Applications such as fibre optics and the endoscope are introduced and the investigation of the wave nature of light investigated.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**

Term 3:1	**Mechanics** ● **Forces in equilibrium** ● **On the move** ● **Newton's Laws of Motion** ● **Forces and momentum** ● **Work, energy and power**	Understanding the principles and applications of mechanics allows engineers to design new structures and develop new materials and technologies. This builds on the KS4 Forces unit and requires students to apply their maths skills to solve problems. This unit is loathed towards the end of year 12 so there is an overlap with A level Maths Mechanics and students have had the opportunity to develop their maths skills through Year 12.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**
Term 3:2	**Revision**	Students will spend this half term reviewing and revising all their AS level work and revision for the 2 mock papers, using past examination papers.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**

YEAR 13 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	**Circular motion and SHM** ● **Uniform circular motion** ● **Centripetal acceleration** ● **Principles of SHM** ● **Energy and SHM** ● **Forced vibrations and resonance.** **Fields** ● **Gravitational fields** ● **Electric fields** ● **Capacitors** ● **Magnetic fields** ● **Electromagnetic induction**	This unit develops the link between force and acceleration from the Year 12 mechanics unit in the context of objects in circular motion at constant speed and objects accelerating in simple harmonic motion. Throughout this section are constant links to real-world applications such as damping and resonance. This unit establishes a basis for the further study of both physics and engineering. This unit deepens students understanding the Year 12 mechanics, energy and electricity topics. Gravitational, electric and magnetic fields act at a distance and lead to the understanding of a field around an object. The differences and similarities between these fields will be studied and the effect they have on objects. The student of electric and magnetic fields lead to a knowledge and understanding of a range of applications and devices such as capacitors, ac generators and transformers.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**
Term 1:2	**Fields** ● **Gravitational fields** ● **Electric fields** ● **Capacitors** ● **Magnetic fields** ● **Electromagnetic induction** **Thermal Physics** ● **Heat and temperature** ● **Gas Laws** ● **Kinetic theory**	This unit deepens students understanding the Year 12 mechanics, energy and electricity topics. Gravitational, electric and magnetic fields act at a distance and lead to the understanding of a field around an object. The differences and similarities between these fields will be studied and the effect they have on objects. The student of electric and magnetic fields lead to a knowledge and understanding of a range of applications and devices such as capacitors, ac generators and transformers. Thermal physics looks at the relationship between heat, energy and temperature and the physical state of a substance. This was introduced in the Year 8 energy unit and built upon in the KS4 Particle Model unit. In this unit students will learn how to apply the laws of	**Retrieval questions, self assessment and end of topic tests using past exam questions.**

		mechanics to a simple model of a gas and how this is a classical example of the use of a theory to explain a law founded on experimental observations.	
Term 2:1	**Thermal Physics** ● **Heat and temperature** ● **Gas Laws** ● **Kinetic theory** **Fields** ● **Gravitational fields** ● **Electric fields** ● **Capacitors** ● **Magnetic fields** ● **Electromagnetic induction**	Thermal physics looks at the relationship between heat, energy and temperature and the physical state of a substance. This was introduced in the Year 8 energy unit and built upon in the KS4 Particle Model unit. In this unit students will learn how to apply the laws of mechanics to a simple model of a gas and how this is a classical example of the use of a theory to explain a law founded on experimental observations. This unit deepens students understanding the Year 12 mechanics, energy and electricity topics. Gravitational, electric and magnetic fields act at a distance and lead to the understanding of a field around an object. The differences and similarities between these fields will be studied and the effect they have on objects. The student of electric and magnetic fields lead to a knowledge and understanding of a range of applications and devices such as capacitors, ac generators and transformers	**Retrieval questions, self assessment and end of topic tests using past exam questions.**
Term 2:2	**Nuclear Physics** ● **Nuclear physics** ● **Nuclear energy** **Astrophysics** ● **Telescopes** ● **Surveying the stars** ● **Cosmology**	Nuclear physics builds on the Year 12 topics of the structure of the atom and particle physics. In this unit students will revisit Rutherford's alpha particle scattering experiment and the properties of the three types of radiation. They will look in depth at the random nature of radioactive decay, including the theory of radioactive decay and half life calculations. Nuclear stability links back to the decay equations from Year 12 and leads to the consideration of nuclear density. Students will then work out the energy involved in fission and fusion and how a fission reactor works. Astrophysics builds on the space and lenses topics from KS4 physics. The unit is about how astronomical measurements are made and used to develop our knowledge of astronomical objects and the still not fully understood universe we are part of. After considering the optical principles of telescopes students will learn how accurate observations and measurements have been used to develop our	**Retrieval questions, self assessment and end of topic tests using past exam questions.**

		knowledge of stars and galaxies. Students will then learn how 20th century astronomers deduced that distant galaxies are moving away from each other and consider how we know that the universe's expansion is accelerating due to dark energy.	
Term 3:1	**Nuclear Physics** ● **Nuclear physics** ● **Nuclear energy** **Astrophysics** ● **Telescopes** ● **Surveying the stars** ● **Cosmology**	Nuclear physics builds on the Year 12 topics of the structure of the atom and particle physics. In this unit students will revisit Rutherford's alpha particle scattering experiment and the properties of the three types of radiation. They will look in depth at the random nature of radioactive decay, including the theory of radioactive decay and half life calculations. Nuclear stability links back to the decay equations from Year 12 and leads to the consideration of nuclear density. Students will then work out the energy involved in fission and fusion and how a fission reactor works Astrophysics builds on the space and lenses topics from KS4 physics. The unit is about how astronomical measurements are made and used to develop our knowledge of astronomical objects and the still not fully understood universe we are part of. After considering the optical principles of telescopes students will learn how accurate observations and measurements have been used to develop our knowledge of stars and galaxies. Students will then learn how 20th century astronomers deduced that distant galaxies are moving away from each other and consider how we know that the universe's expansion is accelerating due to dark energy.	**Retrieval questions, self assessment and end of topic tests using past exam questions.**
Term 3:2	**Revision**	Students will spend this half term reviewing and revising all their A level work and revision for the 3 final papers using past examination papers.	