Curriculum Map
Year 12

Physics

Learning Aims and Curriculum Intent:

Students will build on the Physics covered at GCSE to further develop their skills as 'physicists'.

Students will learn the fundamental principles and concepts involved in mechanics, waves, electricity, materials, and quantum physics as well as developing their analytical and problem-solving skills. The course also develops students' reasoning, practical and experimental skills as well as scientific literacy. Y12 physics lays the foundation for further studies or careers in the field of physics.

Term	Content, Key Questions and Knowledge	Skills	Assessment
Michaelmas	• **Vectors** - Understanding scalar and vector quantities and how vectors can represent physical quantities such as displacement, velocity, force, and momentum. - Understanding how to resolve vectors into components and use them to perform calculations and how to combine vectors graphically or algebraically using components. - Solving problems involving motion, forces, and other physical phenomena using vector analysis and calculations. • **Mechanics** - Understanding the principles and laws that govern the motion and behaviour of objects. - Understanding how to describe and analyse the motion of objects, how to interpret and graph motion and use equations related to motion. - Understanding and applying Newton's laws of motion, which describe the relationship between forces and the resulting motion of objects. - Understanding how to calculate work, kinetic energy, potential energy, power and energy efficiency and understanding and applying the conservation of mechanical energy. - Understanding momentum and its conservation and how it applies to collisions and interactions between objects. - Understanding how the principles of mechanics apply to real-world phenomena and practical applications. • **Waves** - Understanding wave properties such as frequency, wavelength, speed, amplitude, time period, and that waves transfer energy and information (but not matter) by oscillations. The nature of electromagnetic and mechanical waves. - Understanding what is meant by wavefront, coherence, path difference and phase difference. - Understanding how superposition and interference occur and how they can be observed in various contexts, such as light waves and sound waves and stationary waves. • **Electricity** - Understanding electrical current, potential difference, emf and resistance; circuit laws and potential dividers. - Understanding resistivity and the nature of conductors and semi-conductors, electrical power and energy.	Mathematical - Graph plotting - Analysing d-t graphs - Using simple formulas (V=IR, E=VQ, a=Δv/Δt) in calculations - Algebra, rearranging equations Practical - Core Practical (CP) 1 - 4 - Datalogging motion experiments. - Investigate circuit rules Problem solving - Analysing projectile motion - Circuit rules - Using Explicit Practice to analyse longer problems. Research - Find out about the history of the physics of light - Methods for the CPs, expected values from the CPs. Technical literacy - Writing succinct explanations and descriptions - Using bullet points to write a logical progression of ideas - See key terminology Translating/transforming data - Taking a diagram provided in a question or problem and converting into a useable and understandable format. - Taking information provided in a question or problem and converting into a useable and understandable diagram.	Summative - End of topic tests Explicit Practice - Assessment of decoding, retrieval, analysis and feedback in problem solving Mini-quizzes - Low-stakes 10-mark multiple choice progress quizzes - Mini-tests at halfway point of each topic - Core Practical write ups

Lent	• **Materials** - Understanding the properties and forces of fluids – density, upthrust, viscosity, Stokes's Law for drag. - Understanding the properties and forces of solids – Hooke's Law, Young's modulus. • **The nature of light** - Understanding the dual nature of light as a particle and a wave and how light behaves specifically as a photon in the photoelectric effect and in atomic emission and absorption spectra. - Intensity of light both as a wave (inverse-square law) and as a rate of photons colliding with a surface. • **Light and optics** - Understanding reflection and refraction of light. Understanding light refracts because of a change of speed which leads to Snell's Law. Understanding that light can be totally internally reflected, and the conditions for this. - Understanding that electromagnetic waves can be plane polarised, and its applications.	Mathematical - Graph plotting - Analysing stress-strain graphs - Using complex formulas - (n = sin(i)/sinn(r), λ=h/p, E_k=hf - φ) in calculations - Algebra, rearranging equations Practical - Core Practical (CP) 5 - 8 - Modelling Young modulus using series and parallel springs - Investigate refraction and diffraction Problem solving - Analysing standing waves - Forces and motion in fluids - Using Explicit Practice to analyse longer problems. Research - Find out about different types of materials - Methods for the CPs, expected values from the CPs. Technical literacy - Writing succinct explanations and descriptions - Using bullet points to write a logical progression of ideas - See key terminology Translating/transforming data - Taking a diagram provided in a question or problem and converting into a useable and understandable format. - Taking information provided in a question or problem and converting into a useable and understandable diagram.	Summative - End of topic tests Explicit Practice - Assessment of decoding, retrieval, analysis and feedback in problem solving Mini-quizzes - Low-stakes 10-mark multiple choice progress quizzes - Mini-tests at halfway point of each topic - Core Practical write ups
Trinity	• **Waves** - Superposition of waves at edges and through gaps – diffraction – and how this can be explained by using the Huygen's construction. - Understanding how waves are reflected and transmitted at boundaries and how this leads to the pulse-echo technique, and its applications. • **Quantum physics** - Understanding wave-particle duality – that not only can light behave as a wave or as a particle, but that matter also has wave-like properties. - Using de Broglie's equation to relate the wavelength of a particle to its momentum. - Electron diffraction.		Summative - End of year exam Explicit Practice - Assessment of decoding, retrieval, analysis and feedback in problem solving

What consolidation looks like in this subject	Using the textbook to supplement notes and summarise them from the lesson content, using the strategy of explicit practice when solving problems (retrieval practice is built in), undertaking regular retrieval quizzes, seeking support when required, and engaging with super-curricular resources.	
Examples of Homework	Exam question packs, Isaac Physics boards, Practice in Physics problems, Core Practical write ups	
Key terminology	vector, scalar, displacement, velocity, force, momentum, mechanics, motion, work, kinetic energy, potential energy, power, efficiency, conservation, collisions, waves, frequency, wavelength, speed, electromagnetic, mechanical, wavefront, coherence, path difference, superposition, interference, light, sound, stationary waves, electrical current, potential difference, resistance, circuit laws, potential dividers, resistivity, conductor, semiconductor, fluid, density, upthrust, viscosity, Hooke's Law, Young's modulus, photon, photoelectric effect, emission, absorption spectra, intensity, polarization, reflection, refraction, Snell's Law, total internal reflection, superposition, diffraction, Huygen's construction, pulse-echo technique, quantum, wave-particle duality, de Broglie's, electron diffraction	
Super-curricular enrichment and scholarly extension	**Read:** Physics: Principles with Applications by Douglas C. Giancoli Conceptual Physics by Paul G. Hewitt The Cartoon Guide to Physics by Larry Gonick and Art Huffman A Student's Guide to Waves by Daniel Fleisch A Brief History of Time by Stephen Hawking The Elegant Universe by Brian Greene The Physics of Superheroes by James Kakalios The Fabric of the Cosmos by Brian Greene Seven Brief Lessons on Physics by Carlo Rovelli The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos by Brian Greene, The Emperor's New Mind" by Roger Penrose The Quantum Universe: Everything That Can Happen Does Happen by Brian Cox and Jeff Forshaw The Dancing Wu Li Masters: An Overview of the New Physics by Gary Zukav The Particle at the End of the Universe by Sean Carroll	**Watch:** Veritasium: https://www.youtube.com/@veritasium Crash Course Physics: https://www.youtube.com/playlist?list=PL8dPuuaLjXtN0ge7yDk_UA0ldZJdhwkoV PBS Space Time: https://www.youtube.com/c/pbsspacetime Lectures by Walter Lewin of MIT: https://www.youtube.com/@lecturesbywalterlewin.they9259 **Listen:** Naked Scientists: https://www.bbc.co.uk/sounds/brand/p001d7c7 The Infinite Monkey cage: https://www.bbc.co.uk/sounds/brand/b00snr0w Physics made simple: https://www.bbc.co.uk/sounds/brand/p033f8k0 **Visit:** The science Museum: https://www.bbc.co.uk/sounds/brand/p033f8k0 The Royal Observatory Greenwich: https://www.rmg.co.uk/royal-observatory The Royal Institution: https://www.rigb.org/ The Faraday Museum: https://www.rigb.org/visit/faraday-museum	
Useful websites	**Isaac Physics** **Physics and Maths Tutor** **A level Physics Online** **Physics Net** **Edexcel** **Revisely**	
Who can I contact?	**Head of Department**	**Mr Aspery ptsa@forest.org.uk**
	Teachers	**Dr Peters psp@forest.org.uk** **Miss Kelly vak@forest.org.uk** **Mrs Atraszkiewicz ima@forest.org.uk** **Mr Sierens aps@forest.org.uk** **Ms Hua yh@forest.org.uk**