Curriculum Map
Year 13

Physics

Learning Aims and Curriculum Intent:

Students will build on the Physics covered in the previously studied curriculum further develop their skills as 'physicists'.
Students will learn the fundamental ideas involved in electric fields, magnetic fields, gravitational fields, thermal physics, mechanics, particle physics, nuclear physics, and astrophysics.

Term	Content, Key Questions and Knowledge	Skills	Assessment
Michaelmas	• **Electric Fields** - Understand what electric fields are, how key concepts of field strength, potential and force are defined in different types of electric field. - Understand what capacitance is and how capacitors are an application of uniform electric fields. - Understand the behaviour of capacitors in circuits both theoretically and practically. • **Magnetic Fields** - Understand the properties of magnetic fields are and how charge particles and current carrying conductors interact with such fields. - Understand how magnetic fields can induce an emf in conductors and the nature of this emf. • **Mechanics** - Understand how to apply the principle of conservation of momentum in 2 dimensions. - Understand the relationship between momentum and Newton's second law, the momentum of non-relativistic particle and the kinetic energy of the particle. - Understand what gives rise to particles moving in circles and how we describe/define such motion in terms of angular displacement, velocity, and acceleration. - Understand what the conditions required for an object to be undergoing simple harmonic motion and how such motion can be described. - Understand what is meant by resonance, the conditions required for an object to be resonating, and how resonance can be prevented. • **Thermal Physics** - Understand what is meant by the specific heat capacity and specific latent heat of a substance are, how they relate the energy required to change the temperature or phase of a substance, and how to measure them. - Understand what we mean by an ideal gas, how kinetic theory can be used to describe the properties of such a gas, and how this defines the properties of gases. - Understand what is meant by a black body radiator and how this theory applies in astrophysics. • **Gravitational Fields** - Understand what gravitational fields are, how key concepts of field strength, potential and force are defined in different types of gravitational field. - Understand the similarities and differences between gravitational, magnetic, and electric fields. - Understand the role that gravitational forces play in orbits.	Mathematical - Graph plotting to show variation in the properties of fields, graphs of motion for Simple harmonic motion, black body radiation curves, temperature against time data for heating a substance - Analysing d-t graphs - Using simple formulas (F=-kx, E = mL, C= Q/V) in calculations - Using exponential equations for the discharge of a capacitor. - Using inverse square laws for electric and gravitational fields - Using powers of ten prefixes - Algebra, rearranging equations - Deriving equations for centripetal force and acceleration, kinetic theory of gases. Practical - Core Practical (CP) 9 - 16 - Investigate the properties of electric fields. - Investigate simple harmonic motion. Problem solving - Analysing Hertzsprung-Russell diagrams - What happens when you have more than one capacitor in a circuit? - Using Explicit Practice to analyse longer problems. Research - Find out about different types of stars. - Find out about the uses and dangers of parts of the EM spectrum. - 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	• **Astrophysics** - Understanding our place in the universe, the nature of the universe, the objects within it and that the gravitational force behind the evolution of the universe and everything within it. - Understanding that stars change over time - they are 'born', 'live' and 'die', that there are different types of stars, and that stars can be classified by their colour/temperature. - Understand the significance of the Hubble constant in our understanding of the evolution of the universe. - Understand the limits of our understanding of the universe. • **Particle Physics** - Understand the fundamental particles and forces within the standard model. - Understand how electric and magnetic fields can be used to create and detect such particles. - Understand the conservation rules which govern process that involve the fundamental particles and forces. - Understand the equivalence of mass and energy. • **Nuclear Physics** - Understand how our understanding of the atom has changed over time and the evidence to support the nuclear model. - Understand that not all nuclei are stable, and this leads to the emission of different types of radiation. - Understand the laws which govern the emission of radiation in this way. - Understand the equivalence of mass and energy.	Mathematical - Graph plotting to show variation the relationship between recessional velocity and distance to derive a value for the Hubble constant, analysing spectra to determine the doppler shift of a galaxy, the eight fold way for mesons, binding energy per nucleon vs nucleon number, atomic number vs neutron number to analyse nuclear stability. - Using simple formulas ($v=H_0d$) in calculations - Using exponential equations for the nuclear decay. - Using powers of ten prefixes - Algebra, rearranging equations - Apply conservation laws for charge, baryon number, lepton number and momentum. Practical - CP 15 - Cloud chambers as particle detectors - Modelling nuclear decay using dice. Problem solving - Analysing particle tracks. - Application of conservation rules to decay equations. - Using Explicit Practice to analyse longer problems. Research - Types of particle detector and the role of magnetic and electric fields in such detectors. - Methods for the CP, 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 Diagnostic - Mock examination 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 15 write up

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	Electric field strength, electric potential, force, capacitance, capacitors, uniform electric fields, magnetic flux density, magnetic flux, magnetic flux linkage, Faraday's law, Lenz's law, electromagnetic induction, conservation of momentum, Newton's laws, non-relativistic particle, kinetic energy, circular motion, angular displacement, angular velocity, centripetal acceleration, centripetal force, simple harmonic motion, resonance, damping, specific heat capacity, specific latent heat, internal energy, absolute temperature, phase, ideal gas, kinetic theory, black body radiator, gravitational force, gravitational field strength, gravitational potential, Hubble constant, dark matter, dark energy, quarks, leptons, mesons, baryons, fundamental forces, standard model, mass-energy, atom, nuclear model, atomic number, nucleon number, nuclear instability, radiation emission.
Super-curricular enrichment and scholarly extension	**Read:** 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:** The Elegant Universe (PBS NOVA documentary)---The Elegant Universe (PBS NOVA documentary) - Bing video The Secrets of Quantum Physics" (BBC documentary series)---The Secrets of Quantum Physics" (BBC documentary series) - Bing video The Story of Electricity" (BBC documentary series)---The Story of Electricity" (BBC documentary series) - Bing video The Day the Universe Changed (BBC documentary series)---The Day the Universe Changed (BBC documentary series) - Bing video Particle Fever (documentary film about the Large Hadron Collider)---Particle Fever (documentary film about the Large Hadron Collider) - Bing video The Farthest: Voyager in Space (documentary about the Voyager spacecraft)---The Farthest: Voyager in Space (documentary about the Voyager spacecraft) - Bing video The Atom: Clash of Titans (BBC documentary series)---The Atom: Clash of Titans (BBC documentary series) - Bing video Wonders of the Solar System (BBC documentary series hosted by Brian Cox)---Wonders of the Solar System (BBC documentary series hosted by Brian Cox) - Bing video The Hunt for Higgs (BBC documentary about the discovery of the Higgs boson)---The Hunt for Higgs (BBC documentary about the discovery of the Higgs boson). - Bing video

	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	**Listen:** The Titanium Physicists Podcast---The Titanium Physicists Podcast - Bing video The Science Hour---The Science Hour - Bing video StarTalk Radio---StarTalk Radio Show by Neil deGrasse Tyson - Science, pop culture & comedy collide on StarTalk w/ astrophysicist & Hayden Planetarium director Neil deGrasse Tyson, comic co-hosts, celebrities & scientists. : Monday, Neil deGrasse Tyson and Dr. Paul Offit, MD, Talk COVID-19 Vaccines (startalkmedia.com) The Infinite Monkey Cage---BBC Radio 4 - The Infinite Monkey Cage Physics World Stories Podcast---Physics World Stories Podcast - Physics World | Listen Notes The Skeptics' Guide to the Universe---Podcasts | The Skeptics Guide to the Universe The Big Picture Science Radio Show---Big Picture Science | The Science Show---The Science Show on Apple Podcasts 13 Minutes to the Moon---BBC World Service - 13 Minutes to the Moon - Downloads The 30 animals that made us smarter---30 Animals That Made Us Smarter - Podcast (globalplayer.com) Cosmos" by Carl Sagan---Cosmos" by Carl Sagan - Bing video
Useful websites	**Isaac Physics** **Physics and Maths Tutor** **A level Physics Online** **Physics Net** **Edexcel** **Revisely**	
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