



### Learning Aims and Curriculum Intent:

Students will build on the Physics covered in the year 9 and 10 curriculum and further develop their skills as 'physicists'.

Students will learn the fundamental ideas involved in space, forces, motion, waves, energy, electromagnetism, and matter. Content will be taken from the Edexcel iGCSE syllabus and is the continuation of a spiralling curriculum through Year 9, 10 and 11, where all these topics will be met again and again, building on these fundamental ideas.

Term	Content, Key Questions and Knowledge	Skills	Assessment
Michaelmas	<ul style="list-style-type: none"> <li> <b>Solids, Liquids, Gases</b> <ul style="list-style-type: none"> <li>Understanding the particle model and the nature of solids, liquids and gases according to kinetic theory.</li> <li>Exploring how the particle model explains changes of state, or changes in temperature, depending on the kinetic and potential energies of the particles.</li> <li>Understanding the difference between temperature and thermal energy. Specific heat capacity.</li> </ul> </li> <li> <b>Gas laws</b> <ul style="list-style-type: none"> <li>Understand that motion of molecules in a gas leads to pressure in a container.</li> <li>Understand how temperature links to average speed of gas molecules.</li> <li>Understand the Kelvin temperature scale and how temperature of a gas is proportional to the average kinetic energy of its molecules.</li> <li>Understand the relationship between pressure, Kelvin temperature and volume of a fixed mass of gas.</li> </ul> </li> <li> <b>Electricity</b> <ul style="list-style-type: none"> <li>Revisiting current and voltage rules in series and parallel circuits, resistance, ohmic behaviour.</li> <li>Understanding current as the rate of flow of charge and know that electric current in solid metallic conductors is a flow of negatively charged electrons.</li> <li>Define the volt as a joule per coulomb and relate energy with potential difference across components.</li> </ul> </li> <li> <b>Electromagnetic Induction</b> <ul style="list-style-type: none"> <li>Revisiting magnetic fields and electromagnetic forces</li> <li>Electromagnetic induction and transformers</li> </ul> </li> <li> <b>Further mechanics</b> <ul style="list-style-type: none"> <li>Understanding linear momentum and its conservation</li> <li>Impulse and Newton's 2<sup>nd</sup> Law in terms of momentum. Momentum and safety.</li> <li>Newton's third law of motion and applications</li> </ul> </li> </ul>	<p><b>Mathematical</b></p> <ul style="list-style-type: none"> <li>Graph plotting for gas laws</li> <li>Inverse proportionality</li> <li>Using formulas (<math>I = Q/t</math> and <math>W = VQ</math>) in calculations</li> <li>Using powers of ten prefixes</li> <li>Algebra, rearranging equations</li> </ul> <p><b>Practical</b></p> <ul style="list-style-type: none"> <li>Planning and designing a collision-proof vehicle to carry an egg</li> </ul> <p><b>Problem solving</b></p> <ul style="list-style-type: none"> <li>Circuit analysis problems</li> <li>Using Explicit Practice to analyse longer problems</li> </ul> <p><b>Research</b></p> <ul style="list-style-type: none"> <li>The National Grid</li> <li>Brownian motion</li> </ul> <p><b>Technical literacy</b></p> <ul style="list-style-type: none"> <li>Writing succinct explanations and descriptions</li> <li>Drafting and redrafting</li> </ul>	<p>Summative</p> <ul style="list-style-type: none"> <li>End of topic tests</li> </ul> <p>Explicit Practice</p> <ul style="list-style-type: none"> <li>Assessment of decoding, retrieval, analysis and feedback in problem solving</li> </ul> <p>Mini-quizzes</p> <ul style="list-style-type: none"> <li>Low-stakes 10-mark multiple choice progress quizzes on Y10 material</li> </ul> <p>Mini-tests at halfway point of each topic</p>

<b>Lent</b>	<ul style="list-style-type: none"> <li>• <b>Wave Behaviour</b> <ul style="list-style-type: none"> <li>- Understand that waves obey the laws of reflection and can be refracted. Investigate these using light and draw ray diagrams to illustrate.</li> <li>- Understand how the incident and refracted angles are related to refractive index.</li> <li>- Understand TIR and critical angle and their relationship with refractive index.</li> </ul> </li> <li>• <b>Nuclear Fission and Fusion</b> <ul style="list-style-type: none"> <li>- Revisiting atomic structure and radioactive decay</li> <li>- Understand the processes of fusion and fission, their use in power stations and stars. Explore the parts of a nuclear power station.</li> <li>- Understand why fusion does not occur at low temperatures and pressures.</li> </ul> </li> <li>• <b>Space</b> <ul style="list-style-type: none"> <li>- Understand how to classify stars according to their colour which is related to their temperature, their luminosity, and the Hertzsprung-Russell diagram</li> <li>- Understand how stars of different mass evolve.</li> <li>- Understand the evidence for the big bang including the cosmic microwave background and the redshift of galaxies</li> </ul> </li> </ul>	<p>Mathematical</p> <ul style="list-style-type: none"> <li>- Graph plotting</li> <li>- Analysing d-t graphs</li> <li>- Using complex formulas (<math>n = \sin(i)/\sin(r)</math>. <math>c = \sin^{-1}(1/n)</math>) in calculations</li> <li>- Using powers of ten prefixes</li> <li>- Algebra, rearranging equations</li> </ul> <p>Problem solving</p> <ul style="list-style-type: none"> <li>- Analysing Hertzsprung-Russell diagrams</li> <li>- Using Explicit Practice to analyse longer problems</li> </ul> <p>Research</p> <ul style="list-style-type: none"> <li>- Find out about different types of stars in the Milky Way</li> <li>- Find out about how different radioactive waste is dealt with</li> </ul> <p>Technical literacy</p> <ul style="list-style-type: none"> <li>- Writing extended prose on the evolution of stars</li> </ul>	<p>Summative</p> <ul style="list-style-type: none"> <li>- Mock exam</li> </ul> <p>Explicit Practice</p> <ul style="list-style-type: none"> <li>- Assessment of decoding, retrieval, analysis and feedback in problem solving</li> </ul> <p>Mini-quizzes</p> <ul style="list-style-type: none"> <li>- Low-stakes 10-mark multiple choice progress quizzes</li> </ul> <p>Mini-tests at halfway point of each topic</p>
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<b>What consolidation looks like in this subject</b>	Using the strategy of ' <i>explicit practice</i> ' requires students to do regular retrieval practice every time they are given a set of problems to solve. This, along with in-built interleaving of mini-quizzes from previous topics, means they have consolidation built in to their learning automatically. Independently, students use their textbook/other resources to supplement notes and summarise them from the lesson content, undertake regular retrieval quizzes, seek support when required, and engage with super-curricular resources.
<b>Examples of Homework</b>	Isaac Physics questions, problem solving using explicit practice, revision for interleaved mini-tests, research and presentation on stellar evolution, nuclear power stations, researching crumple zones
<b>Key terminology</b>	Solid, liquid gas, molecule, kinetic theory, states of matter, melting, freezing, boiling, evaporation, condensation, heat, temperature, specific heat capacity, conduction, convection, radiation, expansion, contraction, density, pressure, gas laws, Boyle's law, Charles's law, pressure law, proportional, inversely proportional, current, potential difference, resistance, Ohm's law, ohmic, power, energy, charge, electromagnetic induction, generator, alternating current, transformer, step-up, step-down, efficiency, power loss, momentum, impulse, conservation of momentum, Newton's third law, crumple zones, refraction, refraction, angle of incidence, angle of refraction, refractive index, Snell's law, total internal reflection, critical angle, optical fibre, endoscope, prism, radioactivity, fission, chain reaction, fusion, isotope, background radiation, half-life, luminosity, absolute magnitude, apparent magnitude, stellar evolution, protostar, main sequence, red giant, red supergiant, supernova, white dwarf, black dwarf, neutron star, black hole, H-R diagram, Doppler effect, red-shift, blue-shift, frequency, wavelength, velocity, Hubble's law, Big Bang theory, cosmic background radiation
<b>Super-curricular enrichment and scholarly extension</b>	<ul style="list-style-type: none"> <li>• <b>Read:</b> Physics for Scientists and Engineers by Raymond A. Serway and John W. Jewett: This comprehensive textbook covers a wide range of physics topics and provides clear explanations and examples. The Physics of Superheroes by James Kakalios: An entertaining and educational book that explores the principles of physics through the lens of superheroes, making the subject fun and relatable. Astrophysics for Young People in a Hurry by Neil deGrasse Tyson: A simplified version of Neil deGrasse Tyson's popular book, it covers astrophysics, cosmology, stellar evolution, and the concept of redshift in an engaging and accessible manner.</li> <li>The Atom: A Visual Tour by Jack Challoner: This visually stunning book takes readers on a journey into the world of atoms, exploring atomic physics, nuclear fission, and fusion.</li> <li>Seven Brief Lessons on Physics by Carlo Rovelli: A concise and thought-provoking book that introduces key concepts in modern physics, including quantum mechanics, relativity, and cosmology.</li> <li>Conceptual Physics by Paul G. Hewitt: This book focuses on building a conceptual understanding of physics principles through engaging explanations and real-world examples.</li> <li>The Feynman Lectures on Physics by Richard P. Feynman: A classic collection of lectures by the renowned physicist, Richard Feynman, that covers various topics in an engaging and accessible manner.</li> <li>Introduction to Electrodynamics by David J. Griffiths: This book delves into electromagnetism, including electromagnetic induction, electric transformers, and other related concepts.</li> <li>• <b>Watch:</b> Crashcourse physics <a href="https://youtu.be/OoO5d5P0Jn4">https://youtu.be/OoO5d5P0Jn4</a> &amp; Fuseschool stopping distances <a href="https://youtu.be/HTANxqGQcfl">https://youtu.be/HTANxqGQcfl</a></li> <li>• <b>Listen:</b> The infinite monkey cage <a href="https://www.bbc.co.uk/programmes/b00snr0w">https://www.bbc.co.uk/programmes/b00snr0w</a> Sound/echoes <a href="https://www.brainson.org/episode/2019/04/23/forever-echo-can-a-sound-wave-go-on-forever">https://www.brainson.org/episode/2019/04/23/forever-echo-can-a-sound-wave-go-on-forever</a> The brightest supernova: <a href="https://www.bbc.co.uk/programmes/w3ct4sc9">https://www.bbc.co.uk/programmes/w3ct4sc9</a></li> <li>• <b>Visit:</b> The Science Museum, London, The Royal Observatory, Greenwich, The National Space Centre, Leicester, The RAF Museum, Hendon, The Winchester Science Centre and Planetarium</li> </ul>
<b>Useful websites</b>	Isaac Physics <a href="https://isaacphysics.org/">https://isaacphysics.org/</a> BBC Bitesize - Physics <a href="https://www.bbc.co.uk/bitesize/subjects/zrkw2hv">https://www.bbc.co.uk/bitesize/subjects/zrkw2hv</a> S-cool - GCSE Physics <a href="https://www.s-cool.co.uk/gcse/physics">https://www.s-cool.co.uk/gcse/physics</a> Khan Academy <a href="https://www.khanacademy.org/science/physics">https://www.khanacademy.org/science/physics</a> Physics Classroom <a href="https://www.physicsclassroom.com">https://www.physicsclassroom.com</a> Physics & Maths Tutor <a href="https://www.physicsandmathstutor.com/physics-revision">https://www.physicsandmathstutor.com/physics-revision</a>
<b>Who can I contact?</b>	<b>Head of Department</b> <b>Mr Aspery</b> <a href="mailto:ptsa@forest.org.uk">ptsa@forest.org.uk</a>
	<b>Teachers</b> <b>Dr Peters</b> <a href="mailto:psp@forest.org.uk">psp@forest.org.uk</a> <b>Miss Kelly</b> <a href="mailto:vak@forest.org.uk">vak@forest.org.uk</a> <b>Mrs Atraszkiewicz</b> <a href="mailto:ima@forest.org.uk">ima@forest.org.uk</a> <b>Mr Sierens</b> <a href="mailto:aps@forest.org.uk">aps@forest.org.uk</a> <b>Ms Hua</b> <a href="mailto:yh@forest.org.uk">yh@forest.org.uk</a>