Sir Joseph Williamson's Mathematical School

# Department of Physics

Recent A Level Results

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| 2021 | 61% A*-B grades (Teacher assessment) |
| 2020 | 60% A*-B grades (Teacher assessment) |
| 2019 | 58% A*-B grades |
| 2018 | 63% A*-B grades |
| 2017 | 92% A*-B grades |
| 2016 | 66% A*-B grades |

## VI Form Physics at the Math

*Why does an atom bomb release so much energy? How can light be a particle? How can an electron be a wave?*

*How can gamma rays spontaneously produce an electron from their energy? So what is anti-matter?*

*Why do our eyes detect only red to violet and not infra-red?*

Students often take Physics because they have enjoyed the subject at GCSE and want to continue studying because they simply enjoy it, and maybe want to pursue a career in a related field e.g. science, engineering, architecture, education or finance. Finance? Yes, many Physics graduates go on to exciting careers in finance, as their ability to use differential equations to solve problems is a skill that is in demand by global financial institutions.

The departmental ethos encourages students to develop critical thought processes and take greater responsibility for their own development, through structured tasks and practical work in which students will draw on their experience from GCSE.
Students will be expected to apply themselves consistently over the 2 years, engaging in private study and keeping evidence of the ongoing revision and past paper practice that they are doing. The course is demanding and a good working knowledge of GCSE physics is essential for students to perform highly. In view of this students are set a package of self-study work over the summer holidays prior to entering the VI form to consolidate and slightly extend their knowledge from GCSE. Worked examples help students to understand the subject matter and a variety of questions are posed. Answers are given with workings, so that students can learn effectively, all with the aim of making the transition from GCSE to A Level easier. This work is published under the Sixth Form Induction page of the school website (https://sjwms.org.uk/sixth-form-induction), so do have a look if you wish by clicking on the Physics icon at the top of the Sixth Form Induction page.

The course is highly conceptual, whilst still requiring a high degree of practical aptitude and the ability to transfer skills to unfamiliar situations, but these practical and academic skills are taught and developed over the course.

There is no requirement for students to be studying A level Mathematics, but an ability to manipulate equations is very important.

An important feature of A Level science subjects is the Practical Endorsement, a confirmation on the A Level certificate that the student has met the Core Practical Assessment Criteria (CPAC). This involves undertaking a series of prescribed practical activities and displaying the necessary skills associated with planning and undertaking practical work with due regard to safe working and obtaining valid, accurate and reliable data. These skills are taught from the outset and assessed throughout the course. The department was praised by the examination board for its thorough and detailed approach to embedding the core practicals and systematic assessment of students. When students have been at risk of not passing one of the CPACs, additional support and assessment tasks have been used to ensure our 100% success rate in students achieving the Practical Endorsement.

## Below is an outline of the specification and examination

**Edexcel GCE Physics**
**The Edexcel specification has been chosen which provides a natural progression from the Edexcel Combined Science and Physics GCSE courses.**

**Paper 1 30% 1h 45 min Paper 2 30% 1h 45 min Paper 3 (synoptic) 40% 2h 30 min**

| Unit of Work | Material Covered | Assessment |
|---|---|---|
| Topic 1 Mechanics | Motion, forces, momentum, energy, power and efficiency | Paper 1 and Paper 3 |
| Topic 2 Electric Circuits | Current, resistance, power, current-potential difference relationships, resistivity, the transport equation, emf and internal resistance. | Paper 1 and Paper 3 |
| Topic 3 Materials | Density, upthrust, viscous drag, Hooke's law, stress, strain and Young modulus and elastic strain energy. | *Paper 2 and Paper 3* |
| Topic 4 Waves and the Particle Nature of Light | Wave properties, the wave equation, superposition and interference, refractive index, critical angle, lenses, plane polarisation, diffraction, the pulse-echo technique, photons, the photoelectric effect and atomic line spectra. | *Paper 2 and Paper 3* |
| Topic 5 Further Mechanics | Impulse, conservation of momentum in two dimensions, elastic and inelastic collisions, the radian and angular velocity, circular motion | Paper 1 and Paper 3 |
| Topic 6 Electric and Magnetic Fields | Electric field strength, radial and uniform electric fields, capacitance and energy stored by capacitors, exponential discharge, magnetic flux, Fleming's left hand rule, electromagnetic induction, alternating currents and rms currents and p.ds | Paper 1 and Paper 3 |
| Topic 7 Nuclear and Particle Physics | Atomic structure, alpha scattering, thermionic emission and particle accelerators, interpreting particle tracks, de Broglie wavelength, $E=c^2\Delta m$ applied to particle interactions, the standard model of particles and particle equations. | Paper 1 and Paper 3 |
| Topic 8 Thermodynamics | Specific heat capacity and specific latent heat, internal energy, absolute zero, ideal gases, blck body radiators, intensity. | *Paper 2 and Paper 3* |
| Topic 9 Space | Intensity and luminosity, trigonometric parallax, the Hertzsprung-Russell diagram and the life cycle of stars, the Doppler effect and Hubble's Law, dark matter. | *Paper 2 and Paper 3* |
| Topic 10 Nuclear radiation | Binding energy and mass deficit, fission and fusion, background radiation, nuclear radiations, nuclear equations, radioactive decay and its exponential nature. | *Paper 2 and Paper 3* |
| Topic 11 Gravitational Fields | The gravitational force equation, gravitational field strength, gravitational potential. | *Paper 2 and Paper 3* |
| Topic 12 Oscillations | F=-kx and its importance to simple harmonic motion, shm equations, simple harmonic oscillators, shm graphs, free, forced and damped oscillations and resonance. | *Paper 2 and Paper 3* |

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| Mathematical skills | This will include use of exponential functions, logarithms, sin, cos and tan, precision, uncertainities, algebra, (instantaneous and average) rate of change | 40% of the marks are for numeracy. |
| Practical Skills | These will be taught through the course with core practicals being assessed through the course. These do not contribute to the A Level grade, but practical performance is recorded on the certificate and a pass of the ‘practical endorsement’ is required for some university courses. | |