Subject Curriculum Overview for Academic Year 2022/2023

Subject: Physics	Subject Leader: Hugo Crossley	Year Group: 12	AUTUMN TERM
Topic	**Key Learning Points**	**Key Vocabulary**	**Assessments**
1: Physics skills	*End Point: To understand the quantitative skills needed in physics.* • Understand the distinction between base and derived quantities, to understand the idea of a fixed system of units, and describe the Système International (SI) system. • Estimate values for physical quantities, and use estimates to solve problems. • Understand what is meant by the error and uncertainty in a measurement.	Base unit Derived unit Error Uncertainty	**Formative Assessment:** • Teachers constantly assess students, (for example using questioning, mini-whiteboards, short quizzes and true or false activities) and provide immediate verbal feedback during the lesson. **Summative Assessment:** • Students have test weeks in late October and mid-December. **Homework and Independent study:** • Students complete tutorial questions for each topic, based on the content delivered in lesson and workshops where they apply their knowledge to exam-style questions. • Students complete write up and discussion of practical work in their lab book.
2: Mechanics	*End Point: To understand how the motion of objects can be predicted by analysing the forces that are applied to them.* • Explain the distinction between scalar and vector quantities. • Interpret displacement–time graphs, velocity–time graphs and acceleration–time graphs. • Calculate the turning moment of a force, apply the principle of moments and be able to find the centre of gravity of an object. • Recall Newton's laws of motion and use them to explain the movement and acceleration of objects. • Be able to resolve two perpendicular components of any given vector. • Combine horizontal and vertical motion of an object to be able to calculate its projectile motion. • Calculate resultant force from rate of change of momentum.	Scalar vs vector Instantaneous speed Resultant force Moment Equilibrium Centre of gravity Newton's laws Projectile motion Work done Power Efficiency Momentum	
3: Electricity	*End Point: To understand how electric currents are created and how they are affected by the materials and circuits in which they flow.* • Describe electric current as the rate of flow of charge. • Explain how currents come about, and how they are affected by resistance. • Define resistivity explain how it relates to electrical resistance. • Explain conduction in semiconductors in terms of conduction and valence bands. • Calculate currents, voltages and resistances in series and parallel circuits. • Derive the equations for combining resistances in series and parallel. • Understand how the distribution of current in a circuit is a consequence of charge conservation. • Explain the behaviour and uses for potential divider circuits. • Make calculations of internal resistance of a power supply, and explain when high internal resistance may be a desirable feature. • Explain electric power in circuits.	Charge Current Voltage Potential difference Resistance Electromotive force Resistivity Drift velocity Valence band Conduction band Series circuit Parallel circuit Potential divider Internal resistance	

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Topic	**Key Learning Points**	**Key Vocabulary**	**Assessments**
4: Materials	*End Point: To understand how fluid forces affect objects that are moving through liquids or gases, and to understand how materials are affected by tensile forces.* • Be able to calculate densities of fluids, and describe upthrust forces that arise. • Be able to explain the difference between laminar flow and turbulent flow in a fluid. • Understand viscosity, and explain how it is related to temperature. • Be able to explain how an object's terminal velocity in a fluid relates to the weight, drag and upthrust forces acting on it. • Describe Hooke's law, and use it to calculate the elastic strain energy stored in a compressed or extended object. • Explain what is meant by the Young modulus of a material, and how it relates to stress and strain. • Interpret stress/strain graphs for a given material.	Density Upthrust Archimedes' principle Laminar flow Turbulent flow Streamlines Viscosity Terminal velocity Stress, strain & Young Modulus Elastic/plastic	**Formative Assessment:** • Teachers constantly assess students, (for example using questioning, mini-whiteboards, short quizzes and true or false activities) and provide immediate verbal feedback during the lesson. **Summative Assessment:** • Students have test week in late February. **Homework and Independent study:** • Students complete tutorial questions for each topic, based on the content delivered in lesson and workshops where they apply their knowledge to exam-style questions. • Students complete write up and discussion of practical work in their lab book.
5: Waves (part 1)	*End Point: To understand the properties of waves, and be able to contrast longitudinal and transverse types. To be able to explain common wave behaviours such as superposition, diffraction and interference.* • Explain what is meant by the various terms defining the key characteristics of waves. • Differentiate between longitudinal waves and transverse waves, and give examples of each type. • To explain what is meant by the phase of a point on a wave, and how phase is related to wavefronts. • To use the concept of phase to explain the principle of wave superposition. • To explain how a stationary wave forms due to wave superposition, and to explain the difference between stationary waves and progressive waves. • Be able to calculate the possible frequencies and wavelengths of stationary waves, and predict the numbers and positions of their nodes and antinodes. • To describe what is meant by diffraction, and how the degree of diffraction is affected by the wavelength of a wave. • To explain the diffraction pattern from coherent sources in terms of the path difference and phase difference of the waves that form them. • Be able to predict the interference pattern from coherent sources in a number of different contents (e.g. sound waves from speakers, light from lasers).	Amplitude Frequency/period, Wavelength Wave speed Transverse wave Longitudinal wave Compression Rarefaction Phase Wavefront Interference (constructive and destructive) Stationary/standing wave Coherence Progressive wave Node/antinode Sonometer Diffraction	

Subject Curriculum Overview for Academic Year 2022/2023

Subject: Physics	Subject Leader: Hugo Crossley	Year Group: 12	SUMMER TERM
Topic	**Key Learning Points**	**Key Vocabulary**	**Assessments**
5: Waves (part 2)	*End Point: To understand optical phenomena in terms of wave behaviour. To understand what is meant by wave/particle duality, and explain quantum behaviour in terms of waves.* • To relate refraction to the refractive index of materials, and explain how and when Total Internal Reflection can occur. • Be able to describe the actions of concave and convex lenses on light rays, and construct diagrams to show how these lenses form images. • To explain polarisation effects in transverse waves (and why they are not possible with longitudinal waves). • Explain what is meant by wave/particle duality, and describe examples of the different behaviours that it predicts. • Describe the photoelectric effect, and explain how it is evidence for the existence of photons (light particles). • Describe what is meant by matter waves, e.g. electron diffraction.	Refraction Refractive index Total internal reflection Convex/concave Real/virtual images Magnification Polarisation Quantisation Photons Photoelectrons Ionisation Excitation	**Formative Assessment:** • Teachers constantly assess students, (for example using questioning, mini-whiteboards, short quizzes and true or false activities) and provide immediate verbal feedback during the lesson. **Summative Assessment:** • Students have internal Summative Exams in late June. **Homework and Independent study:** • Students complete tutorial questions for each topic, based on the content delivered in lesson and workshops where they apply their knowledge to exam-style questions. • Students complete write up and discussion of practical work in their lab book.
6: Further Mechanics	*End Point: Know how to apply the laws of mechanics to predict the movement of objects that are in circular motion, and to objects involved in collisions.* • Be able to contrast elastic and inelastic collisions. • Explain how the rate of change of momentum is equal to the force on an object. • Be able to define rotational motion of an object in terms of mathematical quantities. • Describe what is meant by a centripetal acceleration, and calculate their magnitudes.	Elastic collision Inelastic collision Impulse Angular velocity Centripetal	
10: Nuclear Radiation	*End Point: To understand how the stability of nuclei and any modes of decay relate to their baryonic composition, and to understand how fission and fusion may both release energy.* • Describe what is meant when talking about leptons and baryons. • Describe the different types of nuclear radiation, and how they are related to the balance of baryons in an atomic nucleus. • Apply the rules of lepton and baryon conservation to explain the need for neutrinos in some forms of nuclear decay. • Describe how to measure radioactivity, what is meant by background radiation, and how to account for it when measuring the activity of a radioisotope. • Explain what is meant by the half-life of a radioisotope, why it varies between isotopes, and how it relates to the decay constant of a radioisotope. • Be able to calculate the rates and proportions of nuclear decay. • Describe what is meant by nuclear binding energy, how it relates to the 'mass deficit' of a nucleus, and the implications for energy production by fission and fusion.	Lepton/baryon Neutrino Isotope Radioisoptope Geiger-Muller tube Background radiation Activity Half-life Decay constant Mass deficit/defect Binding energy Fusion Fission	

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How parents can support learning in the subject this academic year

All students are provided with their own copy of a text book, revision guide and revision workbook for home and study-room use, but there are a variety of other good resources available including revision guides, revision cards and online resources. Please contact your child's Physics teacher if you would like any direction to appropriate resources that you could buy.

Students in the Sixth Form are expected to complete at least 6 hours of homework and independent study per week for each subject.
In Physics A-level the homework takes the form of:

- Knowledge based questions and question sheets based on past exam questions
- Lab book work
- Reviewing notes from lessons

Parents can support learning by ensuring students use their free time effectively and are completing all of the homework and independent study. In the event that students are struggling with independent work it is helpful if the teacher can be contacted as soon as possible to enable for them to support your child to catch up.

Recommended Reading

Please find below some suggested science books/magazines/websites that students may find interesting. These are linked to the topics that are covered in school and so may extend and strengthen your child's knowledge but are primarily focused on instilling a sense of curiosity and wonder:

- A Short History of Nearly Everything – Bill Bryson
- Atom – Piers Bizony
- We Need to Talk About Kelvin: What everyday things tell us about the universe – Marcus Chown
- Seven brief lessons on physics – Carlo Rovelli
- The Boy Who Harnessed the Wind – William Kamkwamba and Bryan Mealer
- The Universe in Your Hand: A Journey Through Space, Time, and Beyond – Christophe Galfard
- BBC Science Focus magazine (sciencefocus.com), Catalyst magazine (catalyst-magazine.org), New Scientist (newscientist.com)

Points to note

Physics A-level is assessed using three written exams at the end of Y13:

- Paper 1 (1hr 45min long, 30% of the final grade) is based on Topics 1-3 and 6-8.
- Paper 2 (1hr 45min long, 30% of the final grade) is based on Topics 1, 4, 5 and 8-13.
- Paper 3 (2hr 30min long, 40% of the final grade) is based on all topics, with significant focus on questions based around the core practicals.

The assessment of practical skills is a compulsory requirement of the course of study for A level Physics. It will appear on all students' certificates as a separately reported result, alongside the overall grade for the qualification. Students' practical work will be assessed by teachers, using common practical assessment criteria (CPAC) that are consistent across exam boards. Overall, a minimum of 40% of the marks across the three papers will be awarded for mathematics at Level 2 or above.