MAIDSTONE GRAMMAR SCHOOL
FOUNDED 1549

Physics Curriculum Outline 2024-2025

This outline provides a long-term overview of the knowledge and skills developed in this subject. More detailed short- and medium-term schemes of work, not published here, are available by contacting the Physics Department.

Year 13

Term 1

Unit Title:
Teacher1 - Further Mechanics
Teacher 2 – Radioactivity

Knowledge:
FURTHER MECHANICS

- The earlier study of mechanics is further advanced through a consideration of circular motion and simple harmonic motion (the harmonic oscillator).
- Circular motion.
- SHM.
- Resonance.

RADIOACTIVITY

- This section builds on the work of Particles and radiation to link the properties of the nucleus to the production of nuclear power through the characteristics of the nucleus, the properties of unstable nuclei, and the link between energy and mass. Students should become aware of the physics that underpins nuclear energy production and also of the impact that it can have on society.

Skills:
AO1, AO2, AO3

Term 2

Unit Title:
Teacher1 - Fields
Teacher 2 - Radioactivity

Knowledge:
FIELDS

- The concept of field is one of the great unifying ideas in physics. The ideas of gravitation, electrostatics and magnetic field theory are developed within the topic to emphasise this unification. Many ideas from mechanics and electricity from earlier in the course support this and are further developed. Practical applications considered include planetary and satellite orbits, capacitance and capacitors, their charge and discharge through resistors, and electromagnetic induction. These topics have considerable impact on modern society.

Skills:
AO1, AO2, AO3

Term 3

Unit Title:
Teacher1 - Fields
Teacher 2 - Thermal Gases

Knowledge:
THERMAL PHYSICS

- A further section allows the thermal properties of materials, internal energy, density, the properties and nature of ideal gases, and the molecular kinetic theory to be studied in depth.

Skills:
AO1, AO2, AO3

Term 4

Unit Title:
Teacher1 - Magnetism
Teacher 2 – OPTION: Turning Points in Physics

Knowledge:
OPTION:

- Turning Points in Physics. This option is intended to enable key concepts and developments in physics to be studied in greater depth than in the core content. Students will be able to appreciate, from historical and conceptual viewpoints, the significance of major paradigm shifts for the subject in the perspectives of experimentation and understanding. Many present-day technological industries are the consequence of these key developments and the topics in the option illustrate how unforeseen technologies can develop from new discoveries
  - Discovery of the electron
  - Nature of light
  - Special Relativity

Skills:
AO1, AO2, AO3

Term 5

Unit Title:
Teacher1 - Capacitors
Teacher 2 - OPTION: Turning Points in Physics

Knowledge:
CAPACITORS

- Definition of capacitance
- Energy stored
- Charging and discharging
- Practical applications

Skills:
AO1, AO2, AO3

Year 12

Term 1

Unit Title:
Teacher 1- Mechanics
Teacher 2 - Fundamental Particles

Knowledge:

Term 2

Term 3

Unit Title:
Teacher 1- Materials
Teacher 2 -
Quantum phenomena

Term 4

Unit Title:
Teacher 1- Waves
Teacher 2 - Electricity

Knowledge:

Term 5

Term 6

Unit Title:
Teacher 1- Revision
Teacher 2 - Revision

Knowledge:

	MECHANICS • Measurements and their errors. Content in this section is a continuing study for a student of physics. A working knowledge of the specified fundamental (base) units of measurement is vital. Likewise, practical work in the subject needs to be underpinned by an awareness of the nature of measurement errors and of their numerical treatment. The ability to carry through reasonable estimations is a skill that is required throughout the course and beyond. • Mechanics. Vectors and their treatment are introduced followed by development of the student's knowledge and • understanding of forces, energy and momentum. FUNDAMENTAL PARTICLES • This section introduces students both to the fundamental properties of matter, and to electromagnetic radiation and quantum phenomena. Teachers may wish to begin with this topic to provide a new interest and knowledge dimension beyond GCSE. Through a study of these topics, students become aware of the way ideas develop and evolve in physics. They will appreciate the importance of international collaboration in the development of new experiments and theories in this area of fundamental research. **Skills**: AO1, AO2, AO3		**Knowledge**: MATERIALS The section continues with a study of materials considered in terms of their bulk properties and tensile strength. QUANTUM • Electromagnetic radiation and quantum phenomena. • The photoelectric effect. • Collisions of electrons with atoms. • Energy levels and photon emission. • Wave-particle duality. **Skills**: AO1, AO2, AO3	WAVES • GCSE studies of wave phenomena are extended through a development of knowledge of the characteristics, properties, and applications of travelling waves and stationary waves. Topics treated include refraction, diffraction, superposition and interference. • Progressive and stationary waves. • Principle of superposition of waves and formation of stationary waves. • Refraction, diffraction and interference ELECTRICITY • This section builds on and develops earlier study of these phenomena from GCSE. It provides opportunities for the development of practical skills at an early stage in the course and lays the groundwork for later study of the many electrical applications that are important to society. • Current electricity including circuits, resistivity, potential dividers, EMF and internal resistance. **Skills** AO1, AO2, AO3:		Review of all AS topics. Use of past papers and revision documents. Self-study sections to be completed and acknowledged. Any outstanding practicals must be completed before the end of the term. **Skills**: AO1, AO2, AO3:
	Term 1	Term 2	Term 3	Term 4	Term 5	
Year 11	**Unit Title**: Electro Magnetism **Knowledge**: • Electromagnetic Effects. • Permanent and Induced Magnetism. • Magnetic Forces and Fields. • Electromagnetism. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Motors **Knowledge**: • Motor Effect. • Magnetic Field. • Fleming's Left-hand Rule. • Building a Motor. • Loudspeakers • Induction. • Generator Effect. • Microphones. • Transformers. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Space **Knowledge**: • Dark Matter • The Solar System & Satellites. • Life Cycle of a Star. • Orbital Motion. • Red-shift. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Revision and Practice **Knowledge**: • A review of the whole course. Focus on grouping topics as per paper 1 and paper 2. Past papers and revision documents available as seen fit. • Opportunity to revisit any practicals that have been missed due to disruption. • Revision of equations. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.		
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 10	**Unit Title**: Atomic Model & Radioactivity. **Knowledge**: • Ionising radiation. • Radioactivity. • Structure of the Atom. • Mass number, atomic number and isotopes.	**Unit Title**: Radioactivity. **Knowledge**: • Radioactive decay and nuclear radiation. • Nuclear equations. • Half-lives and the random nature of radioactive decay.	**Unit Title**: Forces & Motion. **Knowledge**: • Forces and their interactions. • Scalar and vector quantities. • Contact and non-contact forces. • Weight, mass & gravity. • Resultant forces.	**Unit Title**: Forces & Motion. **Knowledge**: • Moments, levers and gears. • Motion graphs. • Equations of motion inc. SUVAT. • Newton's Laws of Motion.	**Unit Title**: Waves & EM Spectrum. **Knowledge**: • Wave behaviour • Electromagnetic waves. • Transverse and longitudinal waves. • Properties of waves.	**Unit Title**: Waves & EM Spectrum. **Knowledge**: • Electromagnetic spectrum. • Radio, microwave, infrared, visible light (red to violet), ultraviolet, X-rays and gamma rays.

	• The development of the model of the atom – Thomson, Rutherford, Chadwick, Bohr (complimenting Chemistry course content). • Radioactive decay and nuclear radiation. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	• Radioactive contamination. • Hazards and uses of radioactive emissions and of background radiation. • Uses of nuclear radiation. • Nuclear fission and fusion. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	• Work Done and energy transfers. • Elasticity. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	• Braking distances. • Momentum. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	• Reflection and refraction. • Sound and ultrasound. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	• Properties and uses. • Lenses. • Black body radiation. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.
	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 9	**Unit Title**: Energy Transfers & Energy Resources **Knowledge**: • The concept of energy. • Understanding chemical reactions and biological systems. • Limits to the use of fossil fuels and global warming. • Identify ways to reduce our energy usage. • Energy changes in a system, and the ways energy is stored before and after such changes. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Energy Changes in Systems. **Knowledge**: • Energy transfers in a closed system. • Dissipated energy. • Reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation. • National and global energy resources. • The uses of energy resources include: transport, electricity generation and heating. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: DC Electricity & Static & AC Electricity **Knowledge**: • Electric charge. • Understanding the difference in the microstructure of conductors, semiconductors and insulators. • Design components and build electric circuits. • Standard circuit diagram symbols. • Electrical charge and current. • Current, resistance and potential difference. • Resistors. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Direct and Alternating Potential Difference. **Knowledge**: • Mains electricity. • Difference between direct and alternating potential difference. • Electrical Power. • Static Electricity. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Particle Model of Matter. **Knowledge**: • The Particle Model. • Changes of state and the particle model. • Internal energy. • Latent heat. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.	**Unit Title**: Particle Model of Matter. **Knowledge**: • Particle model and pressure. • Transfer of energy by a force. **Skills**: M1, M2, M3, M4, M5. AT 1, AT 2, AT 3, AT 4, AT 5, AT 6, AT 7, AT 8.

Key/Legend/Notes:

KS5 Skills:
AO1: Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2: Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:
• in a theoretical context
• in a practical context
• when handling qualitative data
• when handling quantitative data.
AO3: Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to:
• make judgements and reach conclusions
• develop and refine practical design and procedures.

KS4 Skills:

M1 = Arithmetic and numerical computation.
M2 = Handling data.
M3 = Algebra.
M4 = Graphs
M5 = Geometry and trigonometry.
AT 1 = Use of appropriate apparatus to make and record a range of measurements accurately, including length, area, mass, time, volume and temperature. Use of such measurements to determine densities of solid and liquid objects (links to A-level AT a and b).
AT 2 = Use of appropriate apparatus to measure and observe the effects of forces including the extension of springs (links to A-level AT a).
AT 3 = Use of appropriate apparatus and techniques for measuring motion, including determination of speed and rate of change of speed (acceleration/deceleration) (links to A-level AT a, b and d).
AT 4 = Making observations of waves in fluids and solids to identify the suitability of apparatus to measure speed/frequency/wavelength. Making observations of the effects of the interaction of electromagnetic waves with matter (links to A-level AT i and j).
AT 5 = Safe use of appropriate apparatus in a range of contexts to measure energy changes/ transfers and associated values such as work done (links to A-level AT a, b).
AT6 = Use of appropriate apparatus to measure current, potential difference (voltage) and resistance, and to explore the characteristics of a variety of circuit elements (links to A level AT f).
AT 7 = Use of circuit diagrams to construct and check series and parallel circuits including a variety of common circuit elements (links to A-level AT g).
AT 8 (physics only) = Making observations of waves in fluids and solids to identify the suitability of apparatus to measure the effects of the interaction of waves with matter (links to A-level AT h, j).