STAGE 2 PHYSICS PROGRAM 1

**Term 1**

This planner articulates with learning and assessment plan 1

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| Week | **Section** | **Topic** | **Formative tasks** | **Summative tasks** |
| 1 | **Topic 1:**  **Motion and Relativity** | **Projectile motion**: Use of equations of motion in horizontal and vertical components to solve problems involving time of flight, range, and resultant velocity. Vector problems. |  |  |
| 2 | Factors affecting the drag force and the effect that drag has on the motion of projectiles in sports, and the study of aerodynamics. |  |  |
| 3 | **Forces and momentum:** Use of force and acceleration vectors and both and the momentum form of Newton’s Second Law of Motion, including vector subtraction. |  |  |
| 4 | Conservation of momentum questions, including multi-image problems. Momentum conservation in rocket propulsion and space craft, including solar sails and ion drives. (**SHE**) Links made between momentum and the Standard Model-neutrinos. |  |  |
| 5 | **Circular motion and gravitation.**  Use of vectors and formulae to solve problems involving centripetal acceleration and the force causing it. **SHE**: Banked curves, amusement park rides, high-speed trains. Review practical skills. | Formative Test:  Projectile motion, forces, and momentum. |  |
| 6 | Gravitational force formula and the concept of a gravitational field. | **SIS**  Formative Practical: Centripetal force |  |
| 7 | Explore detection of existence of stars, predicting dark matter. Properties of satellite orbits and uses of satellites. (**SHE**) | **SIS**  Formative Practical:  Projectiles |  |
| 8 | Kepler’s Laws of motion, comets and planets. Use of formulae to calculate periods, radii, altitudes and speeds of satellites. Calculating the mass of the sun or Saturn. | **SIS**  Formative Practical:  Speed of sound (resonance) |  |
| 9 | **Einstein’s relativity:** Frames of reference,constancy of the speed of light. Special theory of relativity and the behaviour of objects at high speeds. | Formative Practical submitted to give feedback |  |
| 10 | Simultaneous events, Einstein’s formulae, time dilation, length contraction, effects on mass. Evidence/applications involving relativity, such as muons and GPS. (**SHE**) | **SIS**  Formative Practical:  Teltron tube | **Test 1:** **Motion and relativity** |
| 11 | **Topic 2: Electricity and Magnetism** | **Electric fields:** Coulomb’s Law and the electric field concept. Electric field problems and electric field diagrams. Superposition of electric forces and fields. |  |  |

**Term 2**

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| Week | **Section** | **Content** | **Formative tasks** | **Summative tasks** |
| 1 | **Topic 2:**  **Electricity and Magnetism** (continued) | Applications of electric fields and electrostatic shielding, including electrostatic loudspeakers, corona discharge, shark shields, Faraday cages, photocopiers. (**SHE**) |  | **Practical Design-Snow Globes** |
| 2 | **Motion of charged particles in electric fields:** Concept of work done by an electric field, potential difference and energy changes of charged particles moving in a vacuum, and the electronvolt unit. Application of the motion of ions in ion thrusters, and particle accelerators, such as the cyclotron. (**SHE**) |  |  |
| 3 | Use of formulae to determine force, acceleration, and resulting motion of charged particles in an electric field. **SHE**: Cathode ray tubes, discovery offundamental particles. |  | **Select** **SHE focus** & **use Internet** |
| 4 | **Magnetic fields:** Moving charges produce magnetic fields. Magnitude and direction of the magnetic field/force around a current-carrying conductor. Research: focus and planning. |  |  |
| 5 | **Motion of charged particles in magnetic fields:** Solve problems about force, current, angle, magnetic field strength and direction for a current-carrying conductor in a magnetic field. **SHE**: Loudspeakers and maglev trains. |  | **First drafts of SHE Investigation** |
| 6 | Force on a moving charged particle in a uniform magnetic field. Solve problems involving the circular path of charged particles in magnetic fields. Applications of charges moving in a magnetic field, such as mass spectrometer and electron microscopes. Use of formulae to explore properties of a cyclotron. |  |  |
| 7 | **Electromagnetic induction:** Concepts of magnetic flux and electromotive force (emf).  Explaining and using Faraday’s Law and Lenz’s Law to solve problems. |  |  |
| 8 | Applications of electromagnetic induction, including generators, transformers and induction stoves. Structure of transformers and generators. Use formula to solve problems on transformers. (**SHE**) |  | **SHE Investigation Report due** |
| 9 | **Topic 3:**  **Light and Atoms** | **Wave behaviour of light:** Production of electromagnetic waves from oscillating charges. The wave model of light and the link between the frequency of electromagnetic waves and oscillating charges. Applications of electromagnetic waves and polarised waves. |  | **Test 2: Electricity and Magnetism** |
| 10 | Revision | Mid-Year Trial Exams |  |

**Term 3**

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| Week | **Section** | **Content** | **Formative tasks** | **Summative tasks** |
| 1 | **Topic 3:**  **Light and Atoms**  (continued) | Concepts of monochromatic, coherent and incandescent light. Phase relationships, constructive and destructive interference.  Description and explanation of two source patterns, including the role of diffraction. | **SIS**  Formative Practical:  Spectra |  |
| 2 | Use of formulae to solve problems for two source interference patterns.  Applications of interference, including data storage. Determination of wavelength of light using interference. | **SIS**  Formative Practical:  Wavelength of LASER |  |
| 3 | Description and explanation of transmission diffraction gratings. Use of formulae to solve problems for diffraction gratings. Determination of wavelength of light using interference/spectroscopy. | **SIS** Formative Practical:  Photoelectric effect |  |
| 4 | **Wave-Particle duality:** Properties of photons. Investigate and explain the photoelectric effect and its features. Solve problems about the photoelectric effect, using formulae. Explore applications of the photoelectric effect, such as photomultiplier tubes, smoke detectors, charged coupled devices, and solar cells. (**SHE**) | **SIS**  Formative Practical:  Spectrometer |  |
| 5 | Describe and explain the production of X-rays and their properties. Explore examples of the application of X-rays and their uses. Explore attenuation, penetrating power, and minimum exposure time for X-ray machines. Explain features of the X-ray spectrum and use formula to solve problems. Features of a simple X-ray tube. | **SIS**  Formative Practical: Light intensity and distance |  |
| 6 | Discuss the wave behaviour of particles and solve problems using appropriate formulae. Explore the evidence for the wave behaviour of particles.  **SHE**: Electron microscopes. |  | **Practical Design- Magnetic Field** |
| 7 | **The structure of the atom.**  Investigate and compare continuous emission spectra, line emission spectra, and line absorption spectra. Energy level diagrams of hydrogen, energy transitions, and the regions of the electromagnetic spectrum of the photons produced/absorbed. |  |  |
| 8 | Excited states, ionisation and fluorescence.  Stimulated emission, metastable states and population inversions. Explore the properties and applications of lasers and fluorescence. |  | Test 3: Science Inquiry Skills Test |
| 9 | **Standard Model:** Fundamental particles- gauge bosons, leptons and quarks. Gauge bosons mediate four fundamental forces. Study the 6 types of quarks and how particles such as baryons are made of quarks and leptons. |  |  |
| 10 | Definition of Lepton & Baryon numbers, conservation laws in reactions. Antimatter & antiquarks. Explore the Large Hadron Collider research & changes in understanding of the standard model. Explore PET scanners and impacts of SAHMRI cyclotron. Annihilation. |  | **Test 4:** **Light and Atoms** |

**Holiday revision day at school**

**Revise Motion and relativity**

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| **Term 4** | **Section** | **Topic** | **Formative tasks** | **Summative tasks** |
| Week 1 | Revision | Revise Electricity and Magnetism |  |  |
| Week 2 | Revision | Revise Light and Atoms |  |  |
| Week 3 | Revision | Trial Exam | Trial Exam |  |