West Kirby Grammar School

Curriculum Map – Year 13 – Physics Teacher 1 (2026-27)

Topic name	Term	Skills developed	Link to NC subject content and beyond	Prior learning	Next link in curriculum
6.2 Electric fields	Autumn	HSW1 - Use theories, models and ideas to develop scientific explanations HSW2 - Use knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and scientific ideas HSW5 - Analyse and interpret data to provide evidence, recognising correlations and causal relationships	**6.2.1 Point and spherical charges** – electric fields are due to charges – modelling a uniformly charged sphere as a point charge at its centre – electric field lines to map electric fields – electric field strength **6.2.2 Coulombs Law** – Coulomb's law for the force between two point charges – electric field strength for a point charge – similarities and differences between the gravitational field of a point mass and the electric field of a point charge – the concept of electric fields as being one of a number of forms of field giving rise to a force. **6.2.3 Uniform electric field** – uniform electric field strength – parallel plate capacitor and permittivity – motion of charged particles in a uniform electric field. **6.2.4 Electric potential and energy** – electric potential at a point as the work done in bringing unit positive charge from infinity to the point; electric potential is zero at infinity – electric potential at a distance r from a point charge; changes in electric potential – capacitance for an isolated sphere – force–distance graph for a point or spherical charge; work done is area under graph – electric potential energy at a distance r from a point charge Q.	Year 12 – Charge and current – Energy, power and resistance – Electrical circuits	Further study opportunities beyond KS5

6.3 Electromagnetism	Spring	HSW7 - Know that scientific knowledge and understanding develops over time HSW1 - Use theories, models and ideas to develop scientific explanations HSW2 - Use knowledge and understanding to pose scientific questions, define scientific problems, present scientific arguments and scientific ideas HSW6 - Evaluate methodology, evidence and data, and resolve conflicting evidence M3.9 - Apply the concepts underlying calculus (but without requiring the explicit use of derivatives or integrals) by solving equations involving rates of change, e.g. t x x T T =-m using a graphical method or spreadsheet modelling HSW8 - Communicate information and ideas in appropriate ways using appropriate terminology M0.3 - Use ratios, fractions and percentages HSW3 - Use appropriate methodology, including information and communication technology (ICT), to answer scientific questions and solve scientific problems HSW9 - Consider applications and implications of science and	**6.3.1 Magnetic fields** – magnetic fields are due to moving charges or permanent magnets – magnetic field lines to map magnetic fields – magnetic field patterns for a long straight current carrying conductor, a flat coil and a long solenoid – Fleming's left-hand rule – force on a current-carrying conductor – techniques and procedures used to determine the uniform magnetic flux density between the poles of a magnet using a current-carrying wire and digital balance – magnetic flux density; the unit tesla. **6.3.2 Motion of charged particles** – force on a charged particle travelling at right angles to a uniform magnetic field – charged particles moving in a uniform magnetic field; circular orbits of charged particles in a uniform magnetic field – charged particles moving in a region occupied by both electric and magnetic fields; velocity selector. **6.3.3 Electromagnetism** – magnetic flux z and the unit weber – magnetic flux linkage – Faraday's law of electromagnetic induction and Lenz's law – e.m.f. = − rate of change of magnetic flux linkage – techniques and procedures used to investigate magnetic flux using search coils – simple a.c. generator simple laminated iron-cored transformer	Year 12 – Charge and current – Energy, power and resistance – Electrical circuits	

		evaluate their associated benefits and risks	– techniques and procedures used to investigate transformers.		
6.4 Nuclear and particle physics	Spring	HSW7 - Know that scientific knowledge and understanding develops over time M0.4 - Estimate results M1.4 - Make order of magnitude calculations HSW9 - Consider applications and implications of science and evaluate their associated benefits and risks M1.3 - Understand simple probability M3.12 - Sketch relationships which are modelled by y = k/x, y = kx2, y = k/x2, y = kx, y = sin x, y = cos x, y = e±x , and y = sin2x, y = cos2x as applied to physical relationships M0.5 - Use calculators to find and use power, exponential and logarithmic functions M2.5 - Use logarithms in relation to quantities that range over several orders of magnitude M3.9 - Apply the concepts underlying calculus (but without requiring the explicit use of derivatives or integrals) by solving equations involving rates of change, e.g. t x x T T =-m using	**6.4.1 The nuclear atom** – alpha-particle scattering experiment; evidence of a small charged nucleus – simple nuclear model of the atom; protons, neutrons and electrons – relative sizes of atom and nucleus – proton number; nucleon number; isotopes; nuclear notation – strong nuclear force; short-range nature of the force; attractive to about 3 fm and repulsive below about 0.5 fm – radius of nuclei – mean densities of atoms and nuclei. **6.4.2 Fundamental particles** – particles and antiparticles; electron–positron, proton-antiproton, neutron-antineutron and neutrino-antineutrino – particle and its corresponding antiparticle have same mass; electron and positron have opposite charge; proton and antiproton have opposite charge – classification of hadrons; proton and neutron as examples of hadrons; all hadrons are subject to both the strong nuclear force and the weak nuclear force – classification of leptons; electron and neutrino as examples of leptons; all leptons are subject to the weak nuclear force but not the strong nuclear force	Year 12 – Quantum Physics	

		a graphical method or spreadsheet modelling HSW10 - Consider ethical issues in the treatment of humans, other organisms and the environment HSW12 - Evaluate the ways in which society uses science to inform decision making.	– simple quark model of hadrons in terms of up, down and strange quarks and their respective anti-quarks – quark model of the proton and the neutron – charges of the up, down, strange, anti- up, anti-down and the anti-strange quarks as fractions of the elementary charge – beta-minus decay in terms of a quark model – Beta-plus decay in terms of a quark model – balancing of quark transformation equations in terms of charge – decay of particles in terms of the quark model. **6.4.3 Radioactivity** – radioactive decay; spontaneous and random nature of decay – α-particles, β-particles and γ-rays; nature, penetration and range of these radiations – techniques and procedures used to investigate the absorption of α-particles, β-particles and γ-rays by appropriate materials – nuclear decay equations for alpha, beta-minus and beta-plus decays; balancing nuclear transformation equations – activity of a source; decay constant m of an isotope – half-life of an isotope – techniques and procedures used to determine the half-life of an isotope such as protactinium – the decay equations – simulation of radioactive decay using dice – graphical methods and spreadsheet modelling of decay **6.4.4 Nuclear fission and fusion** – Einstein's mass–energy equation		

			– energy released (or absorbed) in simple nuclear reactions – creation and annihilation of particle–antiparticle pairs – mass defect; binding energy; binding energy per nucleon – binding energy per nucleon against nucleon number curve; energy changes in reactions – binding energy of nuclei – induced nuclear fission; chain reaction – basic structure of a fission reactor; components – fuel rods, control rods and moderator – environmental impact of nuclear waste – nuclear fusion; fusion reactions and temperature – balancing nuclear transformation equations.		
6.5 Medical Imaging	Spring / Summer 1	M0.5 - Use calculators to find and use power, exponential and logarithmic functions M3.11 - Use logarithmic plots to test exponential and power law variations HSW9 - Consider applications and implications of science and evaluate their associated benefits and risks HSW10 - Consider ethical issues in the treatment of humans, other organisms and the environment HSW12 - Evaluate the ways in which society uses science to inform decision making. M0.3 - Use ratios, fractions and percentages	**6.5.1 using X-rays** – basic structure of an X-ray tube; components – heater (cathode), anode, target metal and high voltage supply – production of X-ray photons from an X-ray tube – X-ray attenuation mechanisms; simple scatter, photoelectric effect, Compton effect and pair production – attenuation of X-rays – X-ray imaging with contrast media; barium and iodine – computerised axial tomography (CAT) scanning; components – rotating X-tube producing a thin fan-shaped X-ray beam, ring of detectors, computer software and display – advantages of a CAT scan over an X-ray image. **6.5.2 Diagnostic methods in medicine**	Year 12 – Waves	

			– medical tracers; technetium–99m and fluorine–18 – gamma camera; components – collimator, scintillator, photomultiplier tubes, computer and display; formation of image – diagnosis using gamma camera – positron emission tomography (PET) scanner; annihilation of positron–electron pairs; formation of image – diagnosis using PET scanning. **6.5.3 Using ultrasound** – ultrasound; longitudinal wave with frequency greater than 20 – piezoelectric effect; ultrasound transducer as a device that emits and receives ultrasound – ultrasound A-scan and B-scan – acoustic impedance of a medium – reflection of ultrasound at a boundary – impedance (acoustic) matching; special gel used in ultrasound scanning – Doppler effect in ultrasound; speed of blood in the patient		