West Kirby Grammar School

Curriculum Map – Year 11 – Physics (2022-23)

Topic name	Term	Skills developed	Link to subject content	Prior learning	Next link in curriculum
4.4 Atomic structure 4.4.4 Nuclear fission and fusion 4.4.4.1 Nuclear fission	Autumn	MS 0.4 Estimate the acceleration and centripetal force in situations that involve rotation.	4.4.4.1 Nuclear fission 1. Nuclear fission is the splitting of a large and unstable nucleus (eg uranium or plutonium). 2. Spontaneous fission is rare. Usually, for fission to occur the unstable nucleus must first absorb a neutron. 3. The nucleus undergoing fission splits into two smaller nuclei, roughly equal in size, and emits two or three neutrons plus gamma rays. 4. Energy is released by the fission reaction. All of the fission products have kinetic energy. 5. The neutrons may go on to start a chain reaction. The chain reaction is controlled in a nuclear reactor to control the energy released. 6. The explosion caused by a nuclear weapon is caused by an uncontrolled chain reaction. 7. Students should be able to draw/interpret diagrams representing nuclear fission and how a chain reaction may occur.	Links from KS3: Year 7 Chemistry unit on Particles Links from KS4: Year 9 chemistry C4.1 Atomic Structure	Year 13 A level Physics (AQA) 3.8 Nuclear Physics 3.8.1.7 Induced fission Fission induced by thermal neutrons; possibility of a chain reaction; critical mass. The functions of the moderator, control rods, and coolant in a thermal nuclear reactor. 3.8.1.8 Safety aspects Fuel used, remote handling of fuel, shielding, emergency shut-down. Production, remote handling, and storage of radioactive waste materials. Appreciation of balance between risk and benefits in the development of nuclear power.
4.4 Atomic structure 4.4.4 Nuclear fission and fusion	Autumn	• AT i, k Data loggers can be used to produce s – t, v – t and a – t graphs for SHM.	4.4.4.2 Nuclear fusion 1. Nuclear fusion is the joining of two light nuclei to form a heavier nucleus. In this process some of the mass may be converted into the energy of radiation.		Year 13 A level Physics (AQA) 3.8 Nuclear Physics 3.8.1.6 Mass and energy

4.4.4.2 Nuclear fusion		• MS 3.6, 3.8, 3.9, 3.12 Sketch relationships between x, v, a and a – t for simple harmonic oscillators.			Appreciation that E = mc 2 applies to all energy changes, Simple calculations involving mass difference and binding energy. Atomic mass unit, u. Conversion of units; 1 u = 931.5 MeV. Fission and fusion processes.
4.7 Magnetism and electromagnetism 4.7.1 Permanent and induced magnetism, magnetic forces and fields	Autumn		4.7.1.1 Poles of a magnet 1. the attraction and repulsion between unlike and like poles for permanent magnets 2. the difference between permanent and induced magnets. 4.7.1.2 Magnetic fields 1. describe how to plot the magnetic field pattern of a magnet using a compass 2. draw the magnetic field pattern of a bar magnet showing how strength and direction change from one point to another explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.	Links from KS2: P3.2 Forces and magnets 1. observe how magnets attract or repel each other and attract some materials and not others 2. compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials 3. describe magnets as having two poles 4. predict whether two magnets will attract or repel each other, depending on which poles are facing.	Year 13 A level Physics (AQA) 3.7 Fields and their consequences 3.7.5 Magnetic fields 3.7.5.1 Magnetic flux density
4.7 Magnetism and electromagnetism	Autumn	WS 2.2 WS 1.4	4.7.2.1 Electromagnetism		Year 13 A level Physics (AQA) 3.7 Fields and their consequences

4.7.2 The motor effect 4.7.2.1 Electromagnetism 4.7.2.2 Fleming's left-hand rule (HT only) 4.7.2.3 Electric motors (HT only) 4.7.2.4 Loudspeakers (HT only)			1. describe how the magnetic effect of a current can be demonstrated 2. draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field) 3. explain how a solenoid arrangement can increase the magnetic effect of the current. 4. Students should be able to interpret diagrams of electromagnetic devices in order to explain how they work. 4.7.2.2 Fleming's left-hand rule (HT only) 1. When a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other. This is called the motor effect. 2. Students should be able to show that Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field. 3. Students should be able to recall the factors that affect the size of the force on the conductor. 4. For a conductor at right angles to a magnetic field and carrying a current: force = magnetic f lux density × current × length 4.7.2.3 Electric motors (HT only) 1. Students should be able to explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor. 4.7.2.4 Loudspeakers (HT only)		3.7.5 Magnetic fields 3.7.5.2 Moving charges in a magnetic field 3.7.5.3 Magnetic flux and flux linkage

			1. Students should be able to explain how a moving-coil loudspeaker and headphones work.		
4.7 Magnetism and electromagnetism 4.7.3 Induced potential, transformers and the National Grid (HT only) 4.7.3.1 Induced potential 4.7.3.2 Uses of the generator effect 4.7.3.3 Microphones 4.7.3.4 Transformers	Spring	WS 1.4 4 MS 3b, c Students should be able to apply these equations which are given on the Physics equation sheet.	4.7.3.1 Induced potential (HT only) 1. the factors that affect the size of the induced potential difference/induced current. 2. the factors that affect the direction of the induced potential difference/induced current. 3. Students should be able to apply the principles of the generator effect in a given context. 4.7.3.2 Uses of the generator effect (HT) 1. explain how the generator effect is used in an alternator to generate ac and in a dynamo to generate dc 2. draw/interpret graphs of potential difference generated in the coil against time. 4.7.3.3 Microphones (HT only) 1. Students should be able to explain how a moving-coil microphone works. 4.7.3.4 Transformers (HT) 1. A basic transformer consists of a primary coil and a secondary coil wound on an iron core. 2. Iron is used as it is easily magnetised. 3. The ratio of the potential differences across the primary and secondary coils of a transformer Vp and Vs depends on the ratio of the number of turns on each coil, np and ns. vp /vs = np /ns	Links to KS3: Electricity topic in year 7 Links to KS4: Electricity topic in year 9 Energy resources in year 9 including the role of the transformers in the National Grid.	Year 13 A level Physics (AQA) 3.7 Fields and their consequences 3.7.5 Magnetic fields 3.7.5.4 Electromagnetic induction 3.7.5.6 The operation of a transformer

		MS 1c, 3b, c	4. If transformers were 100% efficient, the electrical power output would equal the electrical power input. $V_s \times I_s = V_p \times I_p$ 5. explain how the effect of an alternating current in one coil in inducing a current in another is used in transformers 6. apply the equation linking the p.d.s and number of turns in the two coils of a transformer to the currents and the power transfer involved, and relate these to the advantages of power transmission at high potential differences		
4.5 Forces 4.5.4 Moments, levers and gears 4.5.5 Pressure and pressure differences in fluids 4.5.5.2 Atmospheric pressure	Spring	MS 3c Students should be able to recall and apply this equation. MS 3c Students should be able to recall and apply this equation.	4.5.4 Moments, levers and gears 1. moment = f orce × distance $M = F d$ d, is the perpendicular distance from the pivot to the line of action of the force, in metres, m. 2. If an object is balanced, the total clockwise moment about a pivot equals the total anticlockwise moment about that pivot. 3. A simple lever and a simple gear system can both be used to transmit the rotational effects of forces. 4. Students should be able to explain how levers and gears transmit the rotational effects of forces. 4.5.5 Pressure and pressure differences in fluids 1. pressure = force normal to a surface /area of that surface (recap from year 9) $p = F/ A$	Links from KS2: P5.2.3. Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. Links from KS3: Pressure in Forces extension unit in year 8 Physics Links from KS4: 4.5.1 Forces and their interactions 4.5.6 Forces and motion	Year 12 A level Physics (AQA) 3.4 Mechanics and materials 3.4.1.2 Moments Year 13 A level Physics (AQA) 3.6 Thermal Physics 3.6.2.2 Ideal gases Gas laws as experimental relationships between p, V, T and the mass of the gas.

		MS 3b, 3c WS 4.3, 4.4, 4.5, 4.6 Students should be able to apply this equation which is given on the Physics equation sheet. MS 1c, 3c WS 1.2	2. The pressure due to a column of liquid can be calculated using the equation: pressure = height of the column × density of the liquid × gravitational field strength $p = h \rho g$ 3. Students should be able to calculate the differences in pressure at different depths in a liquid. 4. A partially (or totally) submerged object experiences a greater pressure on the bottom surface than on the top surface. This creates a resultant force upwards. This force is called the upthrust. 4.5.5.2 Atmospheric pressure 1. describe a simple model of the Earth's atmosphere and of atmospheric pressure 2. explain why atmospheric pressure varies with height above a surface.		
4.5 Forces 4.5.7 Momentum (HT only)	Spring	WS 1.2 MS 3b, c Students should be able to recall and apply this equation. AT 1, 2, 3 Investigate collisions between laboratory trollies using light gates, data loggers or ticker timers to measure and record data WS 1.2, 4	4.5.7 Momentum (HT only) 4.5.7.1 Momentum is a property of moving objects 1. Momentum is defined by the equation: momentum = mass × velocity $p = m v$ 4.5.7.2 Conservation of momentum 1. In a closed system, the total momentum before an event is equal to the total momentum after the event. This is called conservation of momentum. 2. complete calculations involving an event, such as the collision of two objects.	Links from KS2: P3.2, P5.2 Forces Links from KS3: Forces in year 7 Forces extension in year 8 Links from KS4: In year 9 Physics: 4.5.1 Forces and their interactions 4.5.2 Work done and energy transfer $.5.6 Forces and motion	Year 12 A level Physics (AQA) 3.4 Mechanics and materials 3.4.1 Force, energy and momentum

		MS 3b, 3c, 3d	4.5.7.3 Changes in momentum 1. The equations $F = m \times a$ and $a = v - u / t$ combine to give the equation $F = m \Delta v / \Delta t$ where $m\Delta v$ = change in momentum ie force equals the rate of change of momentum. 2. Students should be able to explain safety features such as: air bags, seat belts, gymnasium crash mats, cycle helmets and cushioned surfaces for playgrounds with reference to the concept of rate of change of momentum.		
4.8 Space physics	Summer		4.8.1 Solar system; stability of orbital motions; satellites 4.8.1.1 Our solar system 1. Within our solar system there is one star, the Sun, plus the eight planets and the dwarf planets that orbit around the Sun. 2. Natural satellites, the moons that orbit planets, are also part of the solar system. 3. Our solar system is a small part of the Milky Way galaxy. The Sun was formed from a cloud of dust and gas (nebula) pulled together by gravitational attraction. 4.8.1.2 The life cycle of a star 4. A star goes through a life cycle. The life cycle is determined by the size of the star.	Links from KS2: P5.1 EARTH and SPACE 1. describe the movement of the Earth, and other planets, relative to the Sun in the solar system 2. describe the movement of the Moon relative to the Earth 3. describe the Sun, Earth and Moon as approximately spherical bodies 4. use the idea of the Earth's rotation to explain day and night and the	Year 13 A level Physics (AQA) 3.6 Further Mechanics 3.6.1.1 Circular motion Year 13 A level Physics (AQA) 3.7 Fields and their consequences 3.7.2 Gravitational fields 3.7.2.1 Newton's law 3.7.2.4 Orbits of planets and satellites Year 13 A level Physics (AQA)

		WS 1.2, 1.3, 1.1	4.8.1.3 Orbital motion, natural and artificial satellites 5. Gravity provides the force that allows planets and satellites (both natural and artificial) to maintain their circular orbits.. Students (HT) should be able to explain qualitatively how: • for circular orbits, the force of gravity can lead to changing velocity but unchanged speed • for a stable orbit, the radius must change if the speed changes. 4.8.2 Red-shift 1. qualitatively the red-shift of light from galaxies that are receding 2. that the change of each galaxy's speed with distance is evidence of an expanding universe 3. how red-shift provides evidence for the Big Bang model 4. how scientists are able to use observations to arrive at theories such as the Big Bang theory 5. that there is still much about the universe that is not understood, for example dark mass and dark energy.	apparent movement of the sun across the sky. Links from KS3: The Universe unit in year 8 Links from KS4: Gravitational forces forces and motion electromagnetic spectrum	3.8 Nuclear Physics 3.8.1.6 Mass and energy