West Kirby Grammar School

Curriculum Map – Year 11 – Physics (2024-25)

Topic name	Term	Skills developed	Link to subject content	Prior learning	Next link in curriculum
1. Atomic Structure	Autumn	• Understand how scientific methods and theories develop over time. • Use a variety of models such as representational, spatial, descriptive, computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts. • Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments. • Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences. • Recognise the importance of peer review of results and of communicating results to a range of audiences. • Use scientific vocabulary, terminology and definitions.	AQA 4.4 Atomic structure 4.4.1 Atoms and isotopes 4.4.2 Atoms and nuclear radiation 4.4.3 Hazards and uses of radioactive emissions and of background radiation (physics only) 4.4.4 Nuclear fission and fusion (physics only) • The structure of the atom: Students should be able to describe the basic structure of an atom. • Mass number, atomic number and isotopes: Students should be able to relate differences between isotopes to differences in conventional representations of their identities, charges and masses. • The development of the model of the atom: Students should be able to describe why the new evidence from the scattering experiment led to a change in the atomic model and the difference between the plum pudding model of the atom and the nuclear model of the atom.	Links from KS3: Particles unit in year 7 chemistry Links from KS4: GCSE Chemistry C4.1 Atomic Structure in year 9	Links to GCSE **Fission and fusion.** Autumn Year 11 Links to GCSE **Space** Spring Year 11 Links to AS/A2 **Particles and radiation** Summer Year 12

		• Use prefixes and powers of ten for orders of magnitude (eg tera, giga, mega, kilo, centi, milli, micro and nano). • Recognise and use expressions in standard form • Use ratios, fractions and percentages • Substitute numerical values into algebraic equations using appropriate units for physical quantities • Solve simple algebraic equations • Translate information between graphical and numeric form	• Radioactive decay and nuclear radiation: Students should be able to apply their knowledge to the uses of radiation and evaluate the best sources of radiation to use in a given situation. • Nuclear equations: Students should be able to use the names and symbols of common nuclei and particles to write balanced equations that show single alpha (α) and beta (β) decay. • Half-lives and the random nature of radioactive decay: Students should be able to explain the concept of half-life and how it is related to the random nature of radioactive decay. Students should also be able to determine the half-life of a radioactive isotope from given information and be able to calculate the net decline, expressed as a ratio, in a radioactive emission after a given number of half-lives. • Radioactive contamination: Students should be able to compare the hazards associated with contamination and irradiation. Students should understand that it is important for the findings of studies into the effects of radiation on humans to be published and shared with other scientists so that the findings can be checked by peer review. • Hazards and uses of radioactive emissions and of background radiation:		

			Students should be able to describe background radiation and explain why the hazards associated with radioactive material differ according to the type or radiation and the half-life involved. • Uses of nuclear radiation: Students should be able to describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue and evaluate the perceived risks of using nuclear radiations in relation to given data and consequences.		
2. Energy Resources	Autumn	• Appreciate the power and limitations of science and consider any ethical issues which may arise. • Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments. • Interpreting observations and other data (presented in verbal, diagrammatic, graphical, symbolic or numerical form), including identifying patterns and trends, making inferences and drawing conclusions • Use prefixes and powers of ten for orders of magnitude	AQA 4.1.3 National and global energy resources. • #Students should be able to: • describe the main energy sources available • Distinguish between energy resources that are renewable and energy resources that are non-renewable, • Compare ways that different energy resources are used and understand why some energy resources are more reliable than others. • Describe the environmental impact arising from the use of different energy resources and explain	Links from KS3: Energy unit in Year 7 Links with KS4: Energy stores and transformations early in year 10.	Links to GCSE Magnetism and electromagnetism Spring Year 11 Links to AS/A2 Electricity Autumn Year 12

		(eg tera, giga, mega, kilo, centi, milli, micro and nano). • Use ratios, fractions and percentages • Construct and interpret frequency tables and diagrams, bar charts and histograms • Translate information between graphical and numeric form	patterns and trends in the use of energy resources. Students should also be able to: • Consider the environmental issues that may arise from the use of different energy resources and show that science has the ability to identify environmental issues arising from the use of energy resources but not always the power to deal with the issues because of political, social, ethical or economic considerations.		
3. Forces 4.5.7 Momentum (HT only)	Autumn	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 MS 3b, 3c, 3d	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. 4.5.7.3 Changes in momentum 1. The equations F = m × 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. 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.		
3. Forces 4.5.5 Pressure and pressure differences in fluids 4.5.5.2 Atmospheric pressure	Autumn	MS 3c Students should be able to recall and apply this equation. 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	4.5.5 Pressure and pressure differences in fluids 1. pressure = force normal to a surface /area of that surface (recap from year 9) $p = F / A$ 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.	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) 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.

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3 Forces 4.5.4 <u>Moments, levers and gears</u>	Autumn	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.	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
4 <u>Magnetism and electromagnetism</u> 4.7.1 Permanent and induced magnetism, magnetic forces and fields	Spring		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	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	Year 13 A level Physics (AQA) 3.7 Fields and their consequences 3.7.5 Magnetic fields 3.7.5.1 Magnetic flux density

			explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.	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.	
4 Magnetism and electromagnetism 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)	Spring	WS 2.2 WS 1.4	4.7.2.1 Electromagnetism 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.		Year 13 A level Physics (AQA) 3.7 Fields and their consequences 3.7.5 Magnetic fields 3.7.5.2 Moving charges in a magnetic field 3.7.5.3 Magnetic flux and flux linkage

			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) 1. Students should be able to explain how a moving-coil loudspeaker and headphones work.		
4 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	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.	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 3b, c Students should be able to apply these equations which are given on the Physics equation sheet. MS 1c, 3b, c	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 4. If transformers were 100% efficient, the electrical power output would equal the electrical power input. Vs × Is = V p × 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		
5 Waves 4.6.1.3 Reflection of waves 4.6.2.5 lenses 4.6.2.6 visible light Booklet: <u>Colour and lenses</u>	Spring	MS 5a, 5c WS 1.2	4.6.1.3 Reflection of waves and refraction 1. Waves can be reflected at the boundary between two different materials. Waves can be absorbed or transmitted at the boundary between two different materials 2. Students should be able to construct ray diagrams to illustrate the reflection of a wave at a surface. Students should be able to describe	Links to KS3: Light and sound waves including reflection and refraction of light in year 8 Links to KS4: Waves in year 9	Year 12 Waves

		AT skills covered by this practical activity: AT 4 and 8. MS 5a, 5c WS 1.2 MS 3b, c Students should be able to apply this equation which is given on the Physics equation sheet. AT 4, 8 Investigate the magnification produced by a range of convex lenses.	the effects of reflection, transmission and absorption of waves at material interfaces. 3. Required practical activity 9 (physics only): investigate the reflection of light by different types of surface and the refraction of light by different substances. 4.6.2.5 lenses 1. A lens forms an image by refracting light. In a convex lens, parallel rays of light are brought to a focus at the principal focus. The distance from the lens to the principal focus is called the focal length. Ray diagrams are used to show the formation of images by convex and concave lenses. The image produced by a convex lens can be either real or virtual. The image produced by a concave lens is always virtual 2. Students should be able to construct ray diagrams to illustrate the similarities and differences between convex and concave lenses. The magnification produced by a lens can be calculated using the equation: magnification = image height /object height 3. Magnification is a ratio and so has no units. Image height and object height should both be measured in either mm or cm. Students need to know how to represent a convex lens and a concave lens in a ray diagram. 4.6.2.6 visible light 4. Each colour within the visible light spectrum has its own narrow band of wavelength and frequency.	Black body radiation in year 10	

			5. Reflection from a smooth surface in a single direction is called specular reflection. Reflection from a rough surface causes scattering: this is called diffuse reflection. 6. Colour filters work by absorbing certain wavelengths (and colour) and transmitting other wavelengths (and colour). 7. The colour of an opaque object is determined by which wavelengths of light are more strongly reflected. Wavelengths that are not reflected are absorbed. If all wavelengths are reflected equally the object appears white. If all wavelengths are absorbed the objects appears black. 8. Objects that transmit light are either transparent or translucent. Students should be able to explain: •how the colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object • the effect of viewing objects through filters or the effect on light of passing through filters • why an opaque object has a particular colour.		
6 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	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	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

		WS 1.2, 1.3, 1.1	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. 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.	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 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	3.7.2.1 Newton's law 3.7.2.4 Orbits of planets and satellites Year 13 A level Physics (AQA) 3.8 Nuclear Physics 3.8.1.6 Mass and energy