West Kirby Grammar School

Curriculum Map – Year 10 - Physics (2023-24)

Topic name	Term	Skills developed	Link to subject content	Prior learning	Next link in curriculum
1. Waves	*Autumn*	• Recognise and use expressions in decimal form • Use ratios, fractions and percentages • Change the subject of an equation • Substitute numerical values into algebraic equations using appropriate units for physical quantities • use a variety of models to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.	AQA 4.6 waves (apart from 4.6.2.5 and 4.6.2.6) and RP8 • Waves on water as undulations which travel through water with transverse motion; • The similarities and differences between light waves and waves in matter • light waves travelling through a vacuum; speed of light • Time period and frequency, f=1/T • Transverse and longitudinal waves • Properties of waves • Sound and ultrasound Seismic waves • Types of electromagnetic waves • Uses and applications of electromagnetic waves. • Time period and frequency, f=1/T • Wave equation, v=fλ REQUIRED PRACTICAL 8: make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements. AT 4.	Links from KS3: *Light and sound waves in Y8*	Year 10: 4.6.3 Black body radiation and RP 10 Year 11: 4.6.1.3 Reflection of waves and RP 9 4.6.2.5 Light and colour and 4.6.2.6 lenses and ray diagrams Links to AS/A2 waves Spring year 12 Simple harmonic motion Autumn year 13

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2. Energy stores and energy transfers	Autumn	• Use a variety of models 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. • Use SI units (eg kg, g, mg; km, m, mm; kJ, J). • Use prefixes and powers of ten for orders of magnitude (eg tera, giga, mega, kilo, centi, milli, micro and nano). • Interconvert units. • Use an appropriate number of significant figures in calculation.	AQA 4.1.1 and 4.1.2 • Changes in energy stores: Students should be able to describe all the changes involved in the way energy is stored when a system changes, for common situations and be able to calculate the changes in energy involved when a system is changed by heating, work done by forces and work done when a current flows. • Conservation of energy: Students should be able to describe with examples where there are energy transfers in a closed system, that there is no net change to the total energy. • Energy and work: Students should be able to describe the energy transfer involved when work is done. • Gravitational potential, kinetic and elastic energy stores: Students should be able to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level. • Energy dissipation: Students should be able to describe, with examples, how in all system changes energy is dissipated, so that it stored in less useful ways. • Efficiency: Students should be able to describe ways to increase the efficiency of an intended energy transfer. Students should be able to	Links from KS3: Energy in Year 7 Energy transfers. Conservation of energy. Waves in year 7 including sound and light Electricity in year 7 including the transfer of energy to components and potential difference. Forces and motion in Year 7 and 9	Links to AS/A2 Mechanics and materials Autumn Year 12 Links to A-level AT a and b.

		• Recognise and use expressions in decimal form. • Use ratios, fractions and percentages. • Change the subject of an equation. • Substitute numerical values into algebraic equations using appropriate units for physical quantities.	explain ways of reducing unwanted energy transfers, for example, through lubrication. • Energy and power: Students should be able to give examples that illustrate the definition of power. AQA 4.1.1.3 Specific Heat capacity 4.3.2 Internal energy and energy transfers And RP 1 REQUIRED PRACTICAL 1: investigation to determine the specific heat capacity of one or more materials. AT 1 and 5.		
3. Thermal energy transfers	Autumn	• Change the subject of an equation. • Substitute numerical values into algebraic equations using appropriate units for physical quantities. • MS 1a, b, c, 3b, c Students should be able to recall and apply this equation to changes where mass is conserved.	AQA 4.3.1 Changes of state and the particle model 4.3.1.1 Density of materials The density of a material is defined by the equation: Density = mass/volume REQUIRED PRACTICAL 5: use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids. Volume should be	Links from KS3: Energy in Year 7 Energy transfers. Conservation of energy. Waves in year 7 including sound and light Heating and Cooling unit in Year 8 including conduction, convection and radiation, cooling curves and internal energy	Year 10: 4.6.3 Black body radiation and RP 10 Links to AS/A2 Thermal Physics

		• Use a variety of models 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. • MS 1a, b, c, 3b, c Students should be able to recall and apply this equation to changes where mass is conserved.	determined from the dimensions of regularly shaped objects, and by a displacement technique for irregularly shaped objects. Dimensions to be measured using appropriate apparatus such as a ruler, micrometer or Vernier callipers. AT1 Students should be able to explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules. The particle model can be used to explain the different states of matter • differences in density 4.3.2.3 Changes of state and specific latent heat If a change of state happens: The energy needed for a substance to change state is called latent heat. When a change of state occurs, the energy supplied changes the energy stored (internal energy) but not the temperature. The specific latent heat of a substance is the amount of energy required to change the state of one kilogram of the substance with no change in temperature. energy for a change of state = mass × specific latent heat E = mL	Year 9 matter	Spring Year 13

			AQA 4.1.2 Conservation and dissipation of energy 4.1.2.1 Energy transfers in a system And RP 2 • Thermal energy: Students should be able to explain ways of reducing unwanted energy transfers, for example, through the use of thermal insulation and be able to describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls. REQUIRED PRACTICAL 2: investigate the effectiveness of different materials as thermal insulators and the factors that may affect the thermal insulation properties of a material. AT 1 and 5.		
4. Black body and infrared	Autumn	• Use a variety of models 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	AQA 4.6.3 Black body radiation and RP 10 • Infra-red: Students should be able to explain: that all bodies (objects) emit radiation, and that the intensity of any	Links from KS3: Heating and Cooling unit in Year 8 including conduction, convection and radiation, cooling curves and internal energy	Links to GCSE Spring Y11 Space

		associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.	emission depends on the temperature of the body. • Perfect black bodies and radiation: Students should be able to explain how the temperature of a body is related to the balance between incoming radiation absorbed and radiation emitted, using everyday examples to illustrate this balance, and the example of the factors which determine the temperature of the Earth. REQUIRED PRACTICAL 10: investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface. AT 1 and 4.	Links from KS4: 4.6.2 Electromagnetic waves	Links to AS/A2 Waves Spring Year 12 Links to A-level AT a, b, i and j.
5. Forces	Spring	• Recognise and use expressions in decimal form • Use ratios, fractions and percentages • Change the subject of an equation • Substitute numerical values into algebraic equations using appropriate units for physical quantities • use a variety of models to solve problems, make predictions and to develop scientific explanations and	AQA 4.5.1, 4.5.2 Forces 4.5.6 Forces and motion and RP7 • (speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time) • The representation of a journey on a distance-time graph) • Forces measured in newtons REQUIRED PRACTICAL 7: investigate the effect of varying the force on the	Links from KS3: Forces and motion in Year 7 and 9	Links to GCSE Spring Year 10 Topic 7 Forces and elasticity (including stopping distances and terminal velocity) Autumn Year 11: 4.5.4 Moments and levers and gears 4.5.5 Pressure and pressure differences in fluids

		understanding of familiar and unfamiliar facts.	acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force. AT 1, 2 and 3.		4.5.7 Momentum Links to AS/A2 Mechanics Autumn/Spring Year 12
6. Electricity	Spring	• Recognise and use expressions in decimal form • Recognise and use expressions in standard form • Use ratios, fractions and percentages • Change the subject of an equation • Substitute numerical values into algebraic equations using appropriate units for physical quantities • use a variety of models to solve problems, make predictions and to develop scientific explanations and understanding. • 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.	AQA 4.2 Electricity and RP 3 and 4 • Charge, electric fields • Current, potential difference and resistance • Investigating factors affecting resistance • IV characteristics • Series and parallel circuits • Charge, current, time, Q=It • Potential difference and energy, E=QV • Resistance, R=V/I • Direct and alternating potential difference: Students should be able to explain the difference between direct and alternating potential difference. • Mains electricity: Students should be able to explain that a live wire may be dangerous even when a switch in the mains circuit is open, the dangers of providing any connection between the live wire and earth.	Links from KS3: Electricity unit in Year 7 including paying for electricity; Electricity in year 9 including static electricity, electric fields and circuits	Links to GCSE Magnetism and electromagnetism Spring Year 11 Links to AS/A2 Electricity Autumn Year 12

		• Evaluate risks both in practical science and the wider societal context, including perception of risk in relation to data and consequences.	• Power and energy: Students should be able to explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to the energy changes over time. • Energy transfers in everyday appliances: Students should be able to describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices. Students should be able to explain how the power of a circuit device is related to the potential difference across it and the current through it, the energy transferred over a given time. Students should be able to describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use. • National grid: Students should be able to explain why the National Grid system is an efficient way to transfer energy. REQUIRED PRACTICAL 3: Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the resistance of electrical circuits. This should include: • the length of a wire at		

			constant temperature • combinations of resistors in series and parallel. AT 1, 6, 7. REQUIRED PRACTICAL 4: use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature.AT 6 and 7.		
7. Elasticity	Spring	• give examples of the forces involved in stretching, bending or compressing an object • explain why, to change the shape of an object (by stretching, bending or compressing), more than one force has to be applied – this is limited to stationary objects only • describe the difference between elastic deformation and inelastic deformation caused by stretching forces. • describe the difference between a linear and non-linear relationship between force and extension • calculate a spring constant in linear cases • interpret data from an investigation of the relationship between force and extension • calculate work done in stretching (or compressing) a spring (up to	AQA 4.1.1.2 changes in energy – elastic potential energy 4.5.3 Forces and elasticity • Forces: associated with deforming objects; stretching and squashing – springs; Hooke's Law as a special case • Work done and energy changes on deformation • Measurements of stretch or compression as force is changed • Force-extension linear relation; Hooke's Law as a special case • Moment as the turning effect of a force • Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged REQUIRED PRACTICAL 6: investigate the relationship between force and extension for a spring. AT 1 and 2.	Links from KS3: Forces and motion in Year 7 and 9 Year 10 Topic 5 forces	Links to AS/A2 Materials Spring Year 12

		the limit of proportionality) using the equation: elastic potential energy = 0.5 × s pring constant × extension ^{2} $E_e = 1/2\ k e^2$			
8. Atomic Structure	Summer	• 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.	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	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

		• Recognise the importance of peer review of results and of communicating results to a range of audiences. • Use scientific vocabulary, terminology and definitions. • 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	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. • 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.		
9. Energy Resources	Summer	● 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	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	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

		numerical form), including identifying patterns and trends, making inferences and drawing conclusions • Use prefixes and powers of ten for orders of magnitude (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	resources are more reliable than others. • Describe the environmental impact arising from the use of different energy resources and explain 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.		