Year 11 Physics Curriculum		
Term 1	**Topic**	**Details**
1	**Units** **Energy Transfer**	• use the following units: kilogram (kg), joule (J), metre (m), metre/second (m/s), metre/second2 (m/s2), newton (N), second (s) and watt (W) • describe energy transfers involving energy stores: • energy stores: chemical, kinetic, gravitational, elastic, thermal, magnetic, electrostatic, nuclear • energy transfers: mechanically, electrically, by heating, by radiation (light and sound) • use the principle of conservation of energy
2	**Work and Power**	• know and use the relationship between work done, force and distance moved in the direction of the force: work done = force × distance moved W = F × d • know that work done is equal to energy transferred • know and use the relationship between gravitational potential energy, mass, gravitational field strength and height: gravitational potential energy = mass × gravitational field strength × height GPE = m × g × h • know and use the relationship: kinetic energy = 1/2mv^2

		• understand how conservation of energy produces a link between gravitational potential energy, kinetic energy and work • describe power as the rate of transfer of energy or the rate of doing work • use the relationship between power, work done (energy transferred) and time taken: power = work done/time taken • know that specific heat capacity is the energy required to change the temperature of an object by one degree Celsius per kilogram of mass (J/kg °C) • use the equation: change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta T$ • practical: investigate the specific heat capacity of materials including water and some solids
3	**Energy**	• describe how thermal energy transfer may take place by conduction, convection and radiation • explain the role of convection in everyday phenomena • explain how emission and absorption of radiation are related to surface and temperature • practical: investigate thermal energy transfer by conduction, convection and radiation • explain ways of reducing unwanted energy transfer, such as insulation

4	**Energy**	• know and use the relationship between efficiency, useful energy output and total energy output: e3fficiency= useful energy/total energy x 100% • describe a variety of everyday and scientific devices and situations, explaining the transfer of the input energy in terms of the above relationship, including their representation by Sankey diagrams
5	**Energy Resources and Electricity Generation**	• describe the energy transfers involved in generating electricity using: • wind • water • geothermal resources • solar heating systems • solar cells • fossil fuels • nuclear power • describe the advantages and disadvantages of methods of large-scale electricity production from various renewable and non-renewable resources
6	**Electricity**	• know the difference between mains electricity being alternating current (a.c.) and direct current (d.c.) being supplied by a cell or battery • describe how current varies with voltage in wires, resistors, metal filament lamps and diodes, and how to investigate this experimentally • describe the qualitative effect of

		changing resistance on the current in a circuit • describe the qualitative variation of resistance of light-dependent resistors (LDRs) with illumination and thermistors with temperature • know that lamps and LEDs can be used to indicate the presence of a current in a circuit • know and use the relationship between voltage, current and resistance: voltage = current × resistance $V = I \times R$ • know that current is the rate of flow of charge • know and use the relationship between charge, current and time: charge = current × time $Q = I \times t$ • know that electric current in solid metallic conductors is a flow of negatively charged electrons • understand why current is conserved at a junction in a circuit • use the following units: ampere (A), coulomb (C), joule (J), ohm (Ω), second (s), volt (V) and watt (W)
7	**Energy Voltage and Circuits**	• explain why a series or parallel circuit is more appropriate for particular applications, including domestic lighting

		• understand how the current in a series circuit depends on the applied voltage and the number and nature of other components • know that the voltage across two components connected in parallel is the same • calculate the currents, voltages and resistances of two resistive components connected in a series circuit
8	**Mid Term Test and Review**	
9	**Main Electricity**	• understand how the use of insulation, double insulation, earthing, fuses and circuit breakers protects the device or user in a range of domestic appliances • understand why a current in a resistor results in the electrical transfer of energy and an increase in temperature, and how this can be used in a variety of domestic contexts • know and use the relationship between power, current and voltage: power = current × voltage $P = I \times V$ and apply the relationship to the selection of appropriate fuses • use the relationship between energy transferred, current, voltage and time: energy transferred = current × voltage × time $E = I \times V \times t$
10	**Electricity Charge**	• identify common materials that are electrical conductors or insulators, including metals and plastics • practical: investigate how insulating materials can be charged by friction • explain how positive and negative electrostatic charges are produced on materials by the loss and

		gain of electrons • know that there are forces of attraction between unlike charges and forces of repulsion between like charges • explain electrostatic phenomena in terms of the movement of electrons • P explain the potential dangers of electrostatic charges, e.g. when fueling aircraft and tankers • explain some uses of electrostatic charges, e.g. in photocopiers and inkjet printers
11	**Units** **Density & Pressure** **Change of State**	• use the following units: degree Celsius (°C), Kelvin (K), joule (J), kilogram (kg), kilogram/metre3 (kg/m3), metre (m), metre2 (m2), metre3 (m3), metre/second (m/s), metre/second2 (m/s2), newton (N) and pascal (Pa) • use the following unit: joules/kilogram degree Celsius (J/kg °C) • know and use the relationship between density, mass and volume: density/mass/volume • practical: investigate density using direct measurements of mass and volume • know and use the relationship between pressure, force and area: pressure=force/area • understand how the pressure at a point in a gas or liquid at rest acts equally in all directions • know and use the relationship for pressure difference: pressure difference = height × density × gravitational field strength $p = h \times \rho \times g$ • explain why heating a system

		will change the energy stored within the system and raise its temperature or produce changes of state • describe the changes that occur when a solid melts to form a liquid, and when a liquid evaporates or boils to form a gas • describe the arrangement and motion of particles in solids, liquids and gases • practical: obtain a temperature–time graph to show the constant temperature during a change of state
12	**Ideal Gas Molecules**	• explain how molecules in a gas have random motion and that they exert a force, and hence a pressure, on the walls of a container • understand why there is an absolute zero of temperature, which is –273 °C • describe the Kelvin scale of temperature and be able to convert between the Kelvin and Celsius scales • understand why an increase in temperature results in an increase in the average speed of gas molecules • know that the Kelvin temperature of a gas is proportional to the average kinetic energy of its molecules • explain, for a fixed amount of gas, the qualitative relationship between: • pressure and volume at constant temperature • pressure and Kelvin temperature at constant volume • use the relationship between the pressure and Kelvin temperature of a fixed mass of gas at constant

		volume: $P_1/T_1=P_2/T_2$ • use the relationship between the pressure and volume of a fixed mass of gas at constant temperature: $p_1 V_1 = p_2 V_2$
13	**Units** **Radioactivity**	• use the following units: becquerel (Bq), centimetre (cm), hour (h), minute (min) and second (s) • describe the structure of an atom in terms of protons, neutrons and electrons and use symbols such as 14 6 C to describe particular nuclei • know the terms atomic (proton) number, mass (nucleon) number and isotope • know that alpha (α) particles, beta (β−) particles, and gamma (γ) rays are ionising radiations emitted from unstable nuclei in a random process • describe the nature of alpha (α) particles, beta (β−) particles and gamma (γ) rays, and recall that they may be distinguished in terms of penetrating power and ability to ionise • practical: investigate the penetration powers of different types of radiation using either radioactive sources or simulations • describe the effects on the atomic and mass numbers of a nucleus of the emission of each of the four main types of radiation (alpha, beta, gamma and neutron radiation)
14	**Nuclear**	• understand how to balance nuclear equations in terms of mass and charge • know that photographic film or a Geiger−Müller detector can detect ionising radiations • know that the activity of a radioactive source decreases

		over a period of time and is measured in becquerels • know the definition of the term 'half-life' and understand that it is different for different radioactive isotopes • use the concept of the half-life to carry out simple calculations on activity, including graphical methods
15	**Fission and Fusion**	• explain the sources of background (ionising) radiation from Earth and space • describe uses of radioactivity in industry and medicine • describe the difference between contamination and irradiation • describe the dangers of ionising radiations, including: • that radiation can cause mutations in living organisms • that radiation can damage cells and tissue • the problems arising from the disposal of radioactive waste and how the associated risks can be reduced • know that nuclear reactions, including fission, fusion and radioactive decay, can be a source of energy • understand how a nucleus of U-235 can be split (the process of fission) by collision with a neutron and that this process releases energy as kinetic energy of the fission products • know that the fission of U-235 produces two radioactive daughter nuclei and a small number of neutrons • describe how a chain reaction can be set up if the neutrons produced by one fission strike other U-235 nuclei • describe the role played by the control rods and moderator in

		the fission process • understand the role of shielding around a nuclear reactor • explain the difference between nuclear fusion and nuclear fission • describe nuclear fusion as the creation of larger nuclei resulting in a loss of mass from smaller nuclei, accompanied by a release of energy • know that fusion is the energy source for stars • explain why nuclear fusion does not happen at low temperatures and pressures, due to electrostatic repulsion of protons
16	**End of Term Test and Review**	

Term 2	Topic	Details
1	**Forces, Movement, Shape and Momentum**	• describe the effects of forces between bodies such as changes in speed, shape or direction • identify different types of force such as gravitational or electrostatic • understand how vector quantities differ from scalar quantities • understand that force is a vector quantity • calculate the resultant force of forces that act along a line • know and use the relationship between weight, mass and gravitational field strength: weight = mass × gravitational field strength
2	**Forces, Movement, Shape and Momentum**	• practical: investigate how extension varies with applied force for helical springs, metal wires and rubber bands • know that the initial linear region of a force-extension graph is associated with Hooke's law • describe elastic behaviour as the ability of a material to recover its original shape after the forces causing deformation have been removed • know and use the relationship between the moment of a force and its perpendicular distance from the pivot: moment = force × perpendicular distance from the pivot • know that the weight of a body acts through its centre of gravity • use the principle of moments for a simple system of parallel forces acting in one plane • understand how the upward forces on a light beam, supported at its ends, vary with the position of a heavy

		object placed on the beam
3	**Movement and Position**	• plot and explain distance–time graphs • know and use the relationship between average speed, distance moved and time taken • practical: investigate the motion of everyday objects such as toy cars or tennis balls • know and use the relationship between acceleration, change in velocity and time taken: • plot and explain velocity–time graphs • determine acceleration from the gradient of a velocity–time graph • determine the distance travelled from the area between a velocity–time graph and the time axis • use the relationship between final speed, initial speed, acceleration and distance moved: • describe the forces acting on falling objects (and explain why falling objects reach a terminal velocity)
4	**Movement and Position**	• know that friction is a force that opposes motion • know and use the relationship between unbalanced force, mass and acceleration: force = mass × acceleration • know that the stopping distance of a vehicle is made up of the sum of the thinking distance and the braking distance • describe the factors affecting vehicle stopping distance, including speed, mass, road condition and reaction time • know and use the relationship between momentum, mass and velocity: momentum =

		mass × velocity • use the idea of momentum to explain safety features • use the conservation of momentum to calculate the mass, velocity or momentum of objects • use the relationship between force, change in momentum and time taken: force=change in momentum/time taken • demonstrate an understanding of Newton's third law
5	**Properties of Waves**	• explain the difference between longitudinal and transverse waves • know the definitions of amplitude, wavefront, frequency, wavelength and period of a wave • know that waves transfer energy and information without transferring matter • know and use the relationship between the speed, frequency and wavelength of a wave: wave speed = frequency × wavelength $v = f \times \lambda$ • use the relationship between frequency and time period: frequency =1/time period • explain that all waves can be reflected and refracted
6	**The electro-magnetic spectrum**	• know that light is part of a continuous electromagnetic spectrum that includes radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray radiations, and that all these waves travel at the same speed in free space • know the order of the electromagnetic spectrum in terms of decreasing wavelength and increasing frequency, including the colours of the visible spectrum • explain some of the uses of electromagnetic radiations, including: • radio waves: broadcasting and communications •

		microwaves: cooking and satellite transmissions • infrared: heaters and night vision equipment • visible light: optical fibres and photography • ultraviolet: fluorescent lamps • x-rays: observing the internal structure of objects and materials, including for medical applications • gamma rays: sterilising food and medical equipment • explain the detrimental effects of excessive exposure of the human body to electromagnetic waves, including: • microwaves: internal heating of body tissue • infrared: skin burns • ultraviolet: damage to surface cells and blindness • gamma rays: cancer, mutation and describe simple protective measures against the risks
7	**Light & Sound**	• "use the following units: degree (°), hertz (Hz), metre (m), metre/second (m/s) and • second (s)" • know that light waves are transverse waves and that they can be reflected and refracted • use the law of reflection (the angle of incidence equals the angle of reflection) • draw ray diagrams to illustrate reflection and refraction • practical: investigate the refraction of light, using rectangular blocks, semi-circular blocks and triangular prisms • know and use the relationship between refractive index, angle of incidence and angle of refraction: n=sin i/sin r • practical: investigate the refractive index of glass, using a glass block • describe the role of total

		internal reflection in transmitting information along optical fibres and in prisms • explain the meaning of critical angle c • know and use the relationship between critical angle and refractive index: sin c =1/n
8	**Review and Test**	
9	**Sound**	• use the above relationships in different contexts, including sound waves and electromagnetic waves • explain why there is a change in the observed frequency and wavelength of a wave when its source is moving relative to an observer and that this is known as the Doppler effect • know that sound waves are longitudinal waves that can be reflected and refracted • know that the frequency range for human hearing is 20–20 000 Hz • practical: investigate the speed of sound in air • understand how an oscilloscope and microphone can be used to display a sound wave • practical: investigate the frequency of a sound wave using an oscilloscope • understand how the pitch of a sound relates to the frequency of vibration of the source • understand how the loudness of a sound relates to the amplitude of vibration of the source
10	**Magnetism and Electromagnets**	• know that magnets repel and attract other magnets and attract magnetic substances • describe the properties of magnetically hard and soft materials

		• understand the term 'magnetic field line' • know that magnetism is induced in some materials when they are placed in a magnetic field • practical: investigate the magnetic field pattern for a permanent bar magnet and between two bar magnets • describe how to use two permanent magnets to produce a uniform magnetic field pattern • know that an electric current in a conductor produces a magnetic field around it • describe the construction of electromagnets • draw magnetic field patterns for a straight wire, a flat circular coil and a solenoid when each is carrying a current • know that there is a force on a charged particle when it moves in a magnetic field as long as its motion is not parallel to the field
11	**Electromagnet Induction**	• use the following units: ampere (A), volt (V) and watt (W) • understand why a force is exerted on a current-carrying wire in a magnetic field and how this effect is applied in simple d.c. electric motors and loudspeakers • use the left-hand rule to predict the direction of the resulting force when a wire carries a current perpendicular to a magnetic field • describe how the force on a current-carrying conductor in a magnetic field changes with the magnitude and direction of the field and

		current • know that a voltage is induced in a conductor or a coil when it moves through a magnetic field or when a magnetic field changes through it and describe the factors that affect the size of the induced voltage • describe the generation of electricity by the rotation of a magnet within a coil of wire and of a coil of wire within a magnetic field, and describe the factors that affect the size of the induced voltage • describe the structure of a transformer and understand that a transformer changes the size of an alternating voltage by having different numbers of turns on the input and output sides • explain the use of step-up and step-down transformers in the large-scale generation and transmission of electrical energy • know and use the relationship between input (primary) and output (secondary) voltages and the turns ratio for a transformer: • know and use the relationship: input power = output power p s V I = V I for 100% efficiency
12	**Motion in the Universe** **Stellar Evolution**	• use the following units: kilogram (kg), metre (m), metre/second (m/s), metre/second2 (m/s2), newton (N), second (s), newton/kilogram (N/kg) • know that: • the universe is a large collection of billions of galaxies • a galaxy is a large collection of billions of stars • our solar system is in the Milky Way galaxy

		• understand why gravitational field strength, g, varies and know that it is different on other planets and the Moon from that on the Earth • explain that gravitational force: • causes moons to orbit planets • causes the planets to orbit the Sun • causes artificial satellites to orbit the Earth • causes comets to orbit the Sun • describe the differences in the orbits of comets, moons and planets • use the relationship between orbital speed, orbital radius and time period: • understand how stars can be classified according to their colour • know that a star's colour is related to its surface temperature • describe the evolution of stars of similar mass to the Sun through the following stages: • nebula • star (main sequence) • red giant • white dwarf • describe the evolution of stars with a mass larger than the Sun • understand how the brightness of a star at a standard distance can be represented using absolute magnitude • draw the main components of the Hertzsprung–Russell diagram (HR diagram)
13	**Cosmology**	• describe the past evolution of the universe and the main arguments in favour of the Big Bang theory • describe evidence that supports the Big Bang theory (red-shift and cosmic

		microwave background – CMB – radiation) • describe that if a wave source is moving relative to an observer, there will be a change in the observed frequency and wavelength • use the equation relating to change in wavelength, reference wavelength, velocity of a galaxy and the speed of light: • describe the red-shift in light received from galaxies at different distances away from the Earth • explain why the red-shift of galaxies provides evidence for the expansion of the universe
14	**Course Review – Term 1 and past exam papers**	
15	**Course Review – Term 2 and past exam papers**	
16	**End of Term Test and Review**	