GCSE Physics

Units of Work

Year – Term – Unit	Summary of Learning Content
Year 1 – Autumn Term-Energy	What is the connection between energy transfer and power? • Energy is transferred by heating, by electric current in a circuit , and when work is done by a force. • We can measure the rate at which energy is being transferred or the rate at which work is done - this is called power. What is the connection between energy changes and temperature change? • We can calculate the energy stored in or released from a system when its temperature changes. • The rate of cooling of a building is affected by the thickness and the thermal conductivity of its walls. Insulation can be used to reduce the transfer of energy by conduction and convection. How can we monitor and control the transfer of energy? • Energy can be transferred usefully, stored or dissipated. The total amount of energy does not change. We can calculate the energy efficiency for any energy transfer. Some energy transfers are wasteful; we can try to reduce them.
Year 1 – Autumn Term- Electricity	What is static electricity? • Insulators become charged when they gain or lose electrons. • When two materials are electrically charged, there is an electric field between them. • Static electricity can give a person an electric shock and it may create a spark which could cause petrol vapour or natural gas to explode. What are the key concepts in electricity?

	• Electric current is the rate of flow of charge through a conductor. • Some electrical components resist the flow of electrons more than others so have greater resistance. • Potential difference is a measure of the energy transferred per unit charge as charges move between two points in a circuit. What are the characteristics of some electrical components? • When electrical components are connected in parallel, there is more current passing through each component than when they are connected in series. • A fixed resistor at constant temperature obeys Ohm's law, so the current through it is directly proportional to the potential difference across it. • Diodes, thermistors and light-dependent resistors do not obey Ohm's law.
Year 1 – Spring Term - Particle Model of Matter	What uses are made of the high specific heat capacity of water? • The specific heat capacity, c, is the energy required to raise the temperature of 1 kg of an object by 1 °C. The unit for c is J/kg °C. • Water has a very high specific heat capacity. A lot of energy is needed to heat the water in a radiator or hot water bottle. • The internal energy of the system is the total amount of kinetic energy and potential energy. What are the specific latent heat of vaporisation and the specific latent heat of fusion? • A particle model is used to show that mass is conserved when changing state. • The specific latent heat of fusion is the energy required to change 1 kg of an object from a solid to a liquid without a change in temperature. • The specific latent heat of vaporisation is the energy required to change 1 kg of an object from a liquid to a gas without a change in temperature. What happens to the pressure of a gas when it is heated, keeping the volume constant? • An increase in temperature increases the kinetic energy of the gas particles.

	• The particles move faster, colliding more often and with greater force on the walls of their container. The pressure of the gas increases. How are pressure and volume connected? • When the mass and temperature are constant, the pressure multiplied by the volume is a constant. • Increasing the volume of a gas can decrease the pressure.
Year 1 – Spring Term - Atomic Structure	Are all the atoms in an element exactly the same? • The number of protons in the nucleus is called the atomic number and this defines an element. • The number of electrons can change when an atom combines with another element chemically. • Isotopes are atoms of the same element with different numbers of neutrons and so have a different atomic mass. • A radioisotope has nuclei that are unstable and undergo radioactive decay. Is it possible for atoms to change from one element into another? • Radioactive decay occurs when an atom emits an alpha or beta particle or a gamma ray. • Nuclear fission occurs when a nucleus splits into the nuclei of two different atoms, emitting nuclear radiation and sometimes other particles. • Nuclear fusion occurs when two small atomic nuclei join to form a larger nucleus. • The nuclear radiation emitted from nuclei has many uses in medicine and elsewhere. Can equations be used to represent nuclear reactions? • Atoms can be represented by their atomic symbols with their atomic number and mass number. • Subatomic particles such as alpha and beta particles are represented by symbols with their atomic number, mass number and charge.

	• A nuclear equation summaries what happens in a nuclear reaction. • There is always the same number of each type of subatomic particle before and after a nuclear reaction.
Year 2 – Autumn Term - Forces	How can we describe motion? • Acceleration is a useful way of showing how speed is changing. • When a car changes velocity it is accelerating. • All moving objects have momentum. How can understanding forces make driving safer? • Safety features such as seat belts and air bags reduce the force acting on the human body in an impact. • This is because they reduce the body's rate of change of momentum. • Reaction time is the time the brain takes to respond. • Stopping distances depend upon the driver's reaction time and also on the vehicle and road conditions. What causes pressure in a fluid? • Pressure in a gas is caused by particles colliding with a surface. • We can work out the pressure in a liquid when we know how dense the liquid is and the depth. How does the motion of a falling object change as it falls? • In the absence of air resistance, all falling objects accelerate at the same rate. • An object falling through water or the atmosphere reaches a terminal velocity when the resultant force is zero.
Year 2 – Spring Term - Waves	What ways do other electromagnetic waves behave like light? • All electromagnetic waves are transverse waves that transfer energy. • All electromagnetic waves can be reflected and refracted at a boundary between two different media.

	What characteristics of waves can be measured? • We can measure the speed, wavelength and frequency of waves. • We can calculate one of these three properties using the other two. • The amplitude of a wave is its maximum displacement from its rest position. Are there any waves beyond the visible spectrum? • The colour of an object depends on which wavelengths it reflects most strongly. • The visible spectrum is only a small part of a much wider spectrum called the electromagnetic spectrum. • The invisible waves beyond red are called infrared and those beyond violet are called ultraviolet. • Gamma rays, X-rays and ultraviolet rays have the highest frequencies (smallest wavelengths) and transfer the most energy. How do waves allow us to detect structures we cannot see? • Echo sounding and ultrasound scans use reflections of high- frequency sound waves to detect objects hidden from view. • The reflection and refraction arrival times of seismic waves from earthquakes reveal information about the structure of the Earth. How do lenses work? • There are two types of lenses: convex and concave. • Convex lenses can converge light, bringing it to a focus, and concave lenses diverge light. • We can draw ray diagrams to show the formation of images by lenses. • Only convex lenses magnify.

Year 2 – Spring Term - Electromagnetism	What is a motor and how does it work? • Describe some uses of motors. • Explain how a motor works. • Explain how a commutator is used. How can a magnetic field be used to produce an electric current? • Do generators are similar in construction to de motors • A coil is rotated in a magnetic field. This induces an alternating current in the coil. • Direct current like that from a battery is obtained by using a commutator. What is a transformer? • A transformer changes the size of an ac potential difference. • Step-up transformers increase the potential difference. • Step-down transformers decrease the potential difference. How can we use transformers to supply energy efficiently? • Using a transformer to increase the potential difference reduces the current. • A smaller current in the transmission lines reduces the energy losses to the surroundings. • This means a greater proportion of the energy reaches the end-user.
Year 2 – Summer Term - Space	What can we learn about stars? • Our Solar System contains planets and dwarf planets which the planets. • Orbit the Sun and natural satellites called moons which orbit • Fusion processes in stars lead to the formation of new elements. • A star goes through a life cycle which is determined by the size of the star. What movements can we detect in space physics? • Moons orbit many of the planets in the Solar System. • Artificial satellites have also been placed in orbit around the Earth.

	• The Universe is expanding at an increasing rate. What movements can we detect in space physics? • Moons orbit many of the planets in the Solar System. • Artificial satellites have also been placed in orbit around the Earth. • The Universe is expanding at an increasing rate. What do our measurements tell us about the universe? • The increase in the wavelength called red-shift tells us that most stars and galaxies are moving away from us. • The further away the galaxy, the faster it is moving and the bigger the red-shift. • Red-shift provides evidence that the Universe is still expanding and supports the Big Bang theory. • There is still much about the Universe that is not understood, such as dark matter and dark energy. What is the role of gravity in space physics? • Our sun and other stars are formed from dust and gas nebulae pulled together by the force of gravity. • A Gravity allows planets and satellites to maintain their orbits. • The force of gravity acts towards the centre of the orbit and causes acceleration in that direction which results in a changing velocity but unchanged speed.

GCSE Physics End of Course Exams

Paper 1		
What's assessed Energy	**How it's assessed** Written exam: 1 hour 45 minutes	**Questions**

Electricity Particle model of matter Atomic structure.	Foundation and Higher Tier 100 marks 50% of GCSE	Multiple choice, structured, closed short answer and open response.
Paper 2		
What's assessed Forces Waves Magnetism and electromagnetism Space physics. Questions in Paper 2 may draw on an understanding of energy changes and transfers due to heating, mechanical and electrical work and the concept of energy conservation from Energy and Electricity.	**How it's assessed** Written exam: 1 hour 45 minutes Foundation and Higher Tier 100 marks 50% of GCSE	**Questions** Multiple choice, structured, closed short answer and open response.