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Year 7	Topics covered	Key knowledge and skills covered	Sequencing of units
Y7 term 1	Forces	Describing what forces do and the effect of having balanced and unbalanced forces. Describing the effect of gravity and friction on objects and linking forces to increases in speed. Calculating the speed of an object using the speed equation. Drawing and analysing distance-time graphs and using the gradient to calculate the speed of an object.	This introduces the fundamental idea of Forces and builds upon the ideas of contact and non-contact forces introduced at KS2.
Y7 term 2	Electricity & Electromagnetism	Explaining how static electricity can be produced by charging rods, analysing how charges interact with each other and ways in which to avoid electrostatic shocks. Using the idea of flowing charges to explain current, linking this to potential difference and the ways in which these two quantities change when components are added into different arrangements of circuits, both series and parallel. The derivation of resistance is examined and the use of Ohm's law to predict the effects of changing one of the factors on the others.	This builds upon ideas brought up in the unit of energy but also on the KS2 work which introduced electricity and circuits to the pupils. Series circuits are built as previously but we now extend their skills by introducing parallel circuits in addition. The unit also extends pupil knowledge by introducing the concepts of potential difference, current and resistance and the use of Ohm's Law.
Year 7 term 3	Energy	The energy store model of energy is examined and pupils are introduced to the different types of energy store. They examine experimentally and through data the measurement of energy values in food and how these are transferred to humans when eaten. They look at fossil fuels and the transfer of energy from these into electrical energy. We then look at renewable sources of energy and their efficiency for the long-term production of sustainable energy.	This introduces the key topic of energy and the different stores of energy that exist. This introduces pupils to the idea that energy is transferred through stores but the amount of energy remains constant and therefore provides a basis for the next units to be built upon. It looks at where we get and generate our energy from by looking at power stations enabling pupils to gain an understanding that electricity is derived from other sources and ultimately from the Sun.

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Y7 term 3	Waves	This unit starts by comparing different types of surface and how light does or does not travel through them. We then examine practically the laws of reflection and compare the effects of specular and diffuse reflection. We then look at what happens in refraction and how this can be used in concave and convex lenses to change the focal point of light. This is then linked to how the eye works and how an optician uses lenses to make glasses to aid short and long-sighted people. Finally, we examine how colour is seen by the eye and how this can be changed using filters.	Here we link the learning on Light waves in KS2 topics of Light (Year 6) and extend it further to show the effects of refraction, reflection and how colour is observed in the eye.

Year 8	Topics covered	Key knowledge and skills covered	Sequencing of units
Year 8 term 1	Forces – Movement & Pressure	In this unit we start with the idea of specific forces being resistive and they prevent the movement of objects. This is used to bring about the idea of resultant forces and streamlining. This then leads into compression and extension and touching on the idea of elastic limits linked to Hooke's Law. This then leads into the law of moments and the effects of turning forces using calculations to derive which way an object will turn. Then we lead into pressure in both gases and liquids and the calculation of pressure using the equation. This is then developed further within the stresses in solids and how we can use these ideas to design footwear.	This unit builds on the knowledge first covered in Year 7 Forces. We develop the idea of balanced and unbalanced forces to explain resultant forces and effect of drag. This goes further to look at the effect of pressure and how this arises building on ideas taken from the Year 7 Matter topic.

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Year 8 term	Electromagnets	Magnetism and what magnetic fields represent is the starting point here with pupils completing practical lessons to plot magnetic fields around bar magnets. This is then developed by looking at how to make an electromagnet and the temporary nature of the magnetic field around them. Investigations take place to examine how you can increase the strength of these fields and how electromagnets are used in objects such as loudspeakers, microphones and doorbells.	This takes as the starting point the work completed in Year 3 on magnets which was developed again in Year 5. Here we look at magnetic fields and how they can be used with electromagnets to make different devices.
Year 8 term	Energy – Work & Heat	This unit starts by looking at the definition of work and how it applies to forces. The use of machines such as levers and pulleys are then examined and the turning effect of forces resulting in moments and the calculations that these entail is studied in detail. From there we move to temperature and the difference between temperature and heat linking this to the thermal energy stores. The conversion of this energy through conduction, convection and radiation is then examined and linked to the different ways in which houses can be made more energy efficient.	This unit builds upon the work started in Year 8 term 1 extending the ideas of energy to turning forces and moments. We look in greater depth at levers and pulleys (started in Year 5) and apply this to machines in work places. Finally, we look at the way in which energy is transferred through conduction, convection and radiation to explain heat losses in systems.
Year 8 term	Waves – Light & EM waves	This reinforces their previous knowledge of sound waves and links this to how varying the speed of waves changes various aspects of the waves. These are then examined in terms of amplitude, frequency and wavelength, and how these can affect what we hear. The hearing is then examined and how the ear is structured to enable organisms to hear certain frequencies and how these frequencies enable us to use them for medical purposes such as ultrasound and increasingly infrasound. This leads into examining the different waves that are found in the electromagnetic spectrum and their uses and dangers in our everyday lives.	Picking up from ideas introduced in Year 4 on sound waves and Year 7 on light waves, this unit extends their knowledge by first examining how sound waves are produced but then showing how sound waves travel. This follows on from the work in the Matter unit on particles when they examine the speed of sound through different objects and materials. They then extend their knowledge by looking at the characteristics of sound waves and build upon the fundamentals that they have

			learned about volume and pitch by relating this to amplitude and frequency of waves. This then is linked to the organisms unit where we examine the way in which animals detect sound and the uses of frequencies of sound. We then delve deeper into what light is and examine the EM spectrum and the dangers that come with this.
Y9 Term 1	Energy conservation and dissipation	In this unit, students will continue to develop their understanding of energy and energy transfer. Students will learn how to measure the work done by a force acting over a distance and how this concept can be used to analyse energy changes in gravitational stores, through lifting and falling, and elastic potential stores during stretching using the relevant mathematical relationships. The conservation of energy through changes in the gravitational, kinetic, and elastic stores will also be discussed. They will consider the dissipation of energy during transfers such as those caused by friction or electrical heating, leading to the idea of efficiency during different energy changes and its calculation. The concept of efficiency will then be applied to the selection of electrical devices. The students will learn about the rate of energy transfer in different systems through the concept of power and how this power rating can be used to determine total energy change over time.	The different energy stores are examined in this unit, looking at how energy is transferred from one store to another through the use of different systems. We develop the ideas of E_p, E_k and E_e that were initially introduced in Year 7 term 2, and the movement of thermal energy taught in Year 8 term 2. These are then linked to efficiency and how energy and hence power is used in electrical devices.

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Year 9 Term 1	Energy transfer by heating	The students will then develop their understanding of the heating and cooling processes, which transfer energy within a material or from one object to another. They will investigate thermal conductivity and the differences in the processes of thermal conduction in metals and non-metals. Some students will go on to describe the transfer of energy between objects through absorption and emission of infra-red radiation as a part of the electromagnetic spectrum. This includes the factors that affect the rate of this transfer such as temperature and surface colour. The students will analyse the changes in temperature when a material is heated. The concept of specific heat capacity will then be used to explain the choice of materials used in heating systems. The reduction of energy transfers to the surroundings by insulation, such as loft or cavity wall insulation, will be studied and applied to the context of reducing energy loss in buildings to reduce heating costs including the idea prioritising home improvements in line with payback time.	

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Year 9 Term 2	Energy	Finally the students will examine the different sources of energy that are used to generate electricity or provide heating for homes. They will consider the effect of the production and use of biofuels on the environment along with the concept of carbon neutrality before outlining the use of nuclear power in comparison to fossil fuels. Students will describe and evaluate renewable resources such as wave power, wind power, hydroelectricity and tidal technology and how these can be used to generate electricity in specific locations.	They will look at the different energy sources that can be used to generate electricity and consider which is a better source of power by comparing nuclear and fossil fuels.

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Year 9 Term 2	Energy Resources	The students will examine the different sources of energy that are used to generate electricity or provide heating for homes. They will consider the effect of the production and use of biofuels on the environment along with the concept of carbon neutrality before outlining the use of nuclear power in comparison to fossil fuels. Students will describe and evaluate renewable resources such as wave power, wind power, hydroelectricity and tidal technology and how these can be used to generate electricity in specific locations.	They will look at the different energy sources that can be used to generate electricity and consider which is a better source of power by comparing nuclear and fossil fuels.

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Y9 Term 2	Electricity	In this unit the students will describe the structure of an atom in terms of charged particles and the process of charging by friction resulting in ions and the transfer of electrons. This leads to the concept of an electric field surrounding charged objects causing attractive or repulsive forces between them. The students will then describe electric circuits and the components used to construct them using the concept of current as the rate of charge flow through components due to a potential difference between points in the circuit. Resistance is introduced and the cause of a heating effect and corresponding energy transfer. Students will investigate the factors affecting the resistance of a wire and the corresponding current-potential difference graphs. Further investigations of the components and analysis of the current-potential difference graphs will show ohmic and non-ohmic behaviours for wires, filaments, and diodes. The relationship between the resistance of a thermistor and its temperature along with the relationship between the resistance of a light-dependent resistor and light level will be investigated. Next, the students investigate and analyse a range of series and parallel circuits describing the path of current at junctions, the potential difference across branches and components, and the effect on resistance of series and parallel branches.	This unit picks up on ideas introduced in Year 7 term 1 and Year 8 term 2, then developed in the energy topic in Year 10 term 1. We start by looking at the basics of current, Potential difference and resistance, then link this to different components and how they are measured in different types of circuit.

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Yr9 Term 3	Electricity in the home	The students will compare direct and alternating currents in terms of current direction. The students will describe the UK mains supply and the wires used within it, outlining the National Grid and the high voltages associated with it. Understanding of mains circuits, including the function of the neutral and earth wires, has been applied to three pin plugs and a simple ring-main. The choice of materials used for construction of mains circuits such as wires, cables and plugs will be discussed along with the need for a fuse to prevent overheating and insulation for protection from short circuits. Students will mathematically analyse circuits to determine the power supplied by a current and the relationship between power and the resistance of components. This will be linked back to the charge transfer in a circuit and the concept of electrical heating as charges move within or through components. Finally, students will consider the importance of efficiency within mains powered electrical devices linking this concept back to energy transfer by a current and to the simplified system of energy efficiency ratings used when considering the purchase of an appliance.	Students apply experiences to electricity domestically by looking at alternating current, cables and plugs plus how electricity is generated and transferred efficiently (year 8 term 2 and Year 10 term 1).

Y9 Term 3	Molecules and matter	In this unit the students will increase their understanding of the concept of density as a property of a material or object by measuring and calculating the density of solids and liquids. This leads to a discussion of the states of matter, solid liquid and gas, the properties of matter which is in these states and the changes which occur as a material changes from one state to another. The changes in the properties of matter are used to introduce the kinetic theory and to analyse the changes in temperature occurring during heating and the concept of latent heat. The students move on to discuss the concept of internal energy in more detail; analysing the behaviour of particles in a solid, liquid or gas as the temperature changes. Students should describe latent heat of fusion and vaporisation mathematically, calculating energy changes during the appropriate phase changes and attempt to measure the latent heat of fusion for ice using electrical heating. The students will analyse the relationships between the pressure and temperature of a fixed mass of gas. They can describe the cause of pressure in terms of random particle behaviour and impact between the particles and the container, explaining the changes in pressure in terms of changes in the motion of the gas particles as the temperature decreases.	In this unit we pick up on work started in Year 7 term 1 Matter dealing with the different states of matter and how they change. We then move to focus on how the density of an object is calculated (Year 8 term 1) and how pressure is created in gases but importantly how that is affected by temperature and the internal energy of the substance.
Year 10 Term 1	Radioactivity	In this unit the students will describe how the structure of the nucleus was discovered by the radiation emitted during nuclear decay and how experimentation and developments in our understanding of subatomic particles have driven to changes in the model used to describe the atom from the plum pudding model, through to the Rutherford model and then Bohr model. The students will describe the changes in the nucleus which occur during alpha, beta, and gamma decay along with neutron emission in terms of atomic (proton) number and mass number using the appropriate nuclear notation for isotopes. The properties of alpha, beta, and gamma radiation will be demonstrated leading to a discussion of their use in thickness monitoring and then the safety measures required when using radioactive materials.	This unit looks at the atom and what happens when atoms breakdown. It builds upon work completed in Year 9 term 1 chemistry (atomic structure) and develops the ideas of the structure of the atom and how the nucleus can be changed. It then discusses the three types of radiation which links to Gamma radiation being part of the EM spectrum (Year 8 term 3). We then look at the long term effects of using nuclear

		Students will then move on to discuss the concepts of activity, count rate, and the patterns in radioactive decay that explain half-life and the associated graphs despite the random nature of individual decays. Some students will perform calculations involving the relationship between the initial activity, current activity, and half-life.	power (Year 9 term 2) and the products that are made.
Y10 Term 1	Forces in balance	In this unit students will compare vectors and scalars using the examples of distance and displacement along with the nature of forces. Representations of vectors using scale diagrams lead to descriptions of the forces acting in a wide variety of situations and the identification of Newton's third law. The concept of balanced and unbalanced forces is then used to determine the behaviour of objects and the application of Newton's first law of motion. Some students will produce free body diagrams demonstrating the forces acting on an isolated object. All students will determine the centre of mass of an object experimentally. Some students will analyse the forces acting on an object in additional depth using a parallelogram of forces approach to determine the resultant force or a 'missing force' when an object is in equilibrium. In addition, these students will be taught to resolve forces at right angles to analyse systems and determine if a system is in equilibrium.	This is a large unit which builds upon work previously covered in Year 8 term 1 and Year 9 term 2. We look at the types of forces and how they can be added, the effects of gravity and the centre of mass and how forces can be resolved to derive in which direction they will act.

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Year 10 Term 2	Forces & motion	The students move onto analyse the motion of objects in depth starting from a recap of the concept of speed and this relationship to distance travelled and time taken. The representation of motion using distance-time graphs representing single and multiple objects will be analysed to give detailed descriptions of the movement of the objects. The students will define acceleration in terms of changes in velocity before analysing it graphically and mathematically. Students will then investigate acceleration caused by an unbalanced force on a ramp, linking acceleration to the gradient of a line on a velocity time graph. They will then continue to analyse graphs representing motion by looking at the area beneath the line on a velocity-time graph and its relationship to the distance travelled by an object. Students will then use the gradient of a distance-time graph to determine the speed of an object. Some students will go on to use the tangent of a line on a distance-time graph to determine the speed. Students then experimentally determine the relationships between a force acting on an object and the acceleration, and the mass of the object and the acceleration. The results lead to an idea of Newton's second law of motion and its application. The students then compare the concepts of mass and weight, linking the idea of a gravitational field before looking at the forces acting on an object as it falls through a fluid and the resulting terminal velocity. The forces acting during stopping a car are analysed; identifying two phases of the motion - thinking and braking distance, and the effects of a wide range of factors on both of these distances. Students will then calculate the size of the accelerations experienced during braking. Finally, all of the students will investigate the effect of forces on the stretching of a range of materials identifying both linear and non-linear relationships between the force and extension.	We then look at Newton's laws to analyse motion and velocity leading to work on momentum, forces in car crashes and car safety and finally elasticity and energy changes (Year 10 term 1).

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Year 10 Term 3	Wave Properties	In this unit the students will observe and describe the properties of mechanical and electromagnetic waves in terms of energy transfer with or without the need for a transfer medium. They will compare transverse waves and longitudinal waves by examining the relationship between the direction of propagation and the direction of the oscillations. The students will analyse wave properties such as wavelength, amplitude, and period leading to the relationships between period, frequency and wave speed, frequency, and wavelength. They will also measure the speed of sound in air and the speed of ripples on water. Some students will investigate and describe both the reflection and refraction of waves describing these effects in terms of wave fronts. The processes of absorption, transmission, and reflection of waves in terms of energy will also be described.	Here we consolidate the work completed in Year 8 Term 3 on the EM spectrum and the reflection and refraction of light. We extend this knowledge using ripple tanks to show how refraction of waves occurs at different depths and how the speed of sound can be measured and tested.

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Yr10 Term 3	Electromagnetic waves	The students then move on to describing the electromagnetic spectrum in terms of different regions related to wavelength. The speed of electromagnetic waves in a vacuum will be described as constant allowing the use of the wave equation to link wavelength and frequency which will then be tied to the energy carried by the wave. Each of the regions of the electromagnetic spectrum will be described along with associated uses and the students will investigate the relationship between surface colour, temperature, and the rate of emission of infra-red radiation. The use of radio waves in communications for television and mobile phones will be described along with outlining transmissions of signals through optical fibres. The students will describe the application of ultra violet waves in phosphorescence and the damage these waves can cause to skin and eyes before describing the uses of X-rays and gamma rays in medical applications. The process of ionisation will be outlined and as the cause of tissue damage but also as a useful technique in killing bacteria or cancerous cells. The use of X-rays is described including contrast media and detection devices and the concept of radiation dose.	The EM spectrum is studied in greater depth to investigate the absorption and emission of infrared radiation, and examine the use of x-rays and gamma rays in medicine.

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Year 11 Term 1	Magnetism	Students begin this chapter by reinforcing their knowledge of magnetism by looking at the magnetic fields around permanent magnets and the concept of induced magnetism in some materials. The students will use techniques to plot a magnetic field and the shape of the Earth's field. Students move on to examine the magnetic field produced by a current and investigate the factors that affect the direction and strength of this field. They compare the field shape of a solenoid to that produced by a simple bar magnet. Some students will describe how a current carrying wire placed in a magnetic field will experience the motor effect before going on to explain how this effect can be used to create an electric motor. The force produced on the motor is linked mathematically to the magnetic flux density of the magnetic field.	This unit builds on the work covered in the electricity unit (Year 10 term 2) and links it to the magnetism work covered in Year 8 term 2. We look at how magnetic fields are formed around solenoids and how these can be used to produce forces. We examine the use of Fleming's Left hand rule to predict the movement of wires and examine its use to predict the motor effect in motors and generators.
Year 11 Term 2 (11Sc1 only)	Light *Trilogy - Topics will be planned following on from a question by question analysis of the Feb PPEs and the topics released from the exam board in February.*	In this topic pupils will revisit the law of reflection of light ray at a plain mirror and understand how an image is formed. They will also learn what is meant by specular and diffuse reflection. next they will learn where reflection of light can happen and how a light refracts when it goes from air into glass or from glass into air. Next, they will learn how the wavelength of light changes across the visible spectrum and what determines the colour of a surface. also, what a translucent object is and the difference between a translucent object and a transparent object. Finally, they will look at lenses and learn the difference between a convex and concave lens and must calculate magnification before looking at the applications of lenses in the real world, such as in a camera.	this links with topic of wave properties when they looked at reflection and refraction, which included wavefronts it also links to the investigation of refraction of water waves in a ripple tank full stops travel more slowly in shallow water than in deep water. there is also a link too electromagnetic spectrum when we look at colour how each band of the spectrum merges with the next.

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Year 11 Term 2 (11Sc1 only)	Space *Trilogy - Topics will be planned following on from a question by question analysis of the Feb PPEs and the topics released from the exam board in February.*	In this topic students begin to unravel the mysteries behind how the Solar System is formed. This will lead to understanding how stars are formed and they will relate this to our star, the sun. next they will look at why stars eventually become unstable looking at each stage in the life of a star in relating this to the future of the Sun. Next they will learn what force keeps planets and satellites moving along their orbits, understanding the different types of orbits in the role of satellites. Finally they will look into the theory of the expanding universe and learn what is meant by the red shift of a light source and how it depends on speed. They will learn what the big Bang Theory of the universe is and use this to explain why the universe expanding what cosmic background radiation is while studying the evidence that their race that the universe was created in a Big Bang.	This topic builds on key stage 2 Where they Learn about the structure of the solar system to explain the phases of the moon and the seasons of the year. There is a link with radioactivity studied in year yeah 10 with a reminder about the heavier elements and half lives of atoms.