

Year 10	Week	Lesson title	Lesson objectives
	1	Atomic structure	<ul style="list-style-type: none"> <li>Describe the structure of the atom.</li> <li>Use symbols to represent particles.</li> <li>Describe ionisation.</li> </ul>
	1	Developing ideas for the structure of the atom	<ul style="list-style-type: none"> <li>Understand how ideas about the structure of the atom have changed.</li> <li>Understand how evidence is used to test and improve models.</li> </ul>
	1 + 2	Radioactive decay	<ul style="list-style-type: none"> <li>Describe radioactive decay.</li> <li>Describe the types of nuclear radiation.</li> <li></li> </ul>
		Nuclear equations	<ul style="list-style-type: none"> <li>Understand the processes of alpha decay and beta decay.</li> <li>Understand nuclear equations.</li> <li>Write balanced nuclear equations for alpha decay.</li> <li>Write balanced nuclear equations for beta decay.</li> </ul>
	2	Background radiation	<ul style="list-style-type: none"> <li>Describe how different types of radiation have different ionising power.</li> <li>Recall the different penetrating powers of alpha, beta and gamma radiation.</li> </ul>
	3	Radioactive half-life	<ul style="list-style-type: none"> <li>Explain what is meant by radioactive half-life.</li> <li>Calculate half-life.</li> <li>Graph drawing / interpretation</li> <li>Calculate radioactive half-life from a curve of best fit.</li> <li>Calculate the net decline in radioactivity.</li> </ul>
	4	<b>Nuclear fission (separates)</b>	<ul style="list-style-type: none"> <li><i>Describe nuclear fission.</i></li> <li><i>Explain how a chain reaction occurs.</i></li> <li><i>Explain how fission is used.</i></li> </ul>
	4	<b>Nuclear fusion (separates)</b>	<ul style="list-style-type: none"> <li><i>Explain nuclear fusion.</i></li> <li><i>Describe the conditions needed for fusion.</i></li> <li><i>Describe how nuclear fusion may be an attractive energy source.</i></li> </ul>
	5	Hazards and uses of radiation Irradiation	<ul style="list-style-type: none"> <li>Describe radioactive contamination.</li> <li>Explain what is meant by irradiation.</li> <li>Understand the distinction between contamination and irradiation.</li> <li>Appreciate the importance of communication between scientists.</li> </ul>
	5	Uses of radiation	<p><b>Separates:</b></p> <ul style="list-style-type: none"> <li><b><i>Describe some uses of nuclear radiation for medical diagnosis and therapy.</i></b></li> <li><b><i>Explore the risks and benefits of using nuclear radiation.</i></b></li> <li><b><i>Describe how internal organs can be explored.</i></b></li> <li><b><i>Understand how nuclear radiation can control or destroy unwanted tissue.</i></b></li> </ul>
	7	Scalars and vector quantities (and units and prefixes)	<ul style="list-style-type: none"> <li>What is the difference between a quantity and a unit?</li> <li>State examples of scalar and vector quantities.</li> </ul>

			<ul style="list-style-type: none"> <li>• What are metric prefixes and why do we use them?</li> </ul>
	7	Speed	<ul style="list-style-type: none"> <li>• Calculate speed using distance travelled divided by time taken.</li> <li>• Calculate speed from a distance–time graph.</li> <li>• Measure the gradient of a distance–time graph at any point.</li> </ul>
	8	Acceleration	<ul style="list-style-type: none"> <li>• Describe acceleration.</li> <li>• Calculate acceleration.</li> <li>• Explain motion in a circle.</li> </ul>
	9	Velocity–time graphs	<ul style="list-style-type: none"> <li>• Draw velocity–time graphs.</li> <li>• Calculate acceleration using a velocity–time graph.</li> <li>• Calculate displacement using a velocity–time graph.</li> </ul>
	10	Calculations of motion	<ul style="list-style-type: none"> <li>• Describe uniform motion.</li> <li>• Use an equation for uniform motion.</li> <li>• Apply this equation to vertical motion.</li> </ul>
	10	Heavy or massive? Forces introduction	<ul style="list-style-type: none"> <li>• Identify the correct units for mass and weight.</li> <li>• Explain the difference between mass and weight.</li> <li>• Understand how weight is an effect of gravitational fields.</li> <li>• Describe a force.</li> <li>• Understand what a force does.</li> </ul>
	11	Balanced forces	<ul style="list-style-type: none"> <li>• Explain what happens to an object if all the forces acting on it cancel each other out.</li> <li>• Analyse how this applies to everyday situations.</li> <li>• Recognise the difference between contact and non-contact forces.</li> </ul>
	13	Resultant forces	<ul style="list-style-type: none"> <li>• Calculate the resultant from opposing forces.</li> <li>• Draw free-body diagrams to find resultant forces.</li> <li>• Understand that a force can be resolved into two components acting at right angles to each other.</li> </ul>
	14	Forces and acceleration Terminal velocity	<ul style="list-style-type: none"> <li>• Explain what happens to the motion of an object when the resultant force is not zero.</li> <li>• Analyse situations in which a non-zero resultant force is acting.</li> <li>• Explain what inertia is.</li> </ul>
	14	Work done and energy transfer	<ul style="list-style-type: none"> <li>• Understand what is meant by work done.</li> <li>• Explain the relationship between work done and force applied.</li> <li>• Identify the transfers between energy stores when work is done against friction.</li> </ul>
	15	Resolving forces	<ul style="list-style-type: none"> <li>• Understand that a force can be resolved into two components acting at right angles to each other.</li> </ul>
	16	Required practical: Investigating the acceleration of an object	<ul style="list-style-type: none"> <li>• Plan an investigation to explore an idea.</li> <li>• Analyse results to identify patterns and draw conclusions.</li> <li>• Compare results with scientific theory.</li> </ul>
	17	Newton's third law	<ul style="list-style-type: none"> <li>• Identify force pairs.</li> <li>• Understand and be able to apply Newton's third law.</li> <li>• What is the difference between a pair of balanced forces and a N3 pair of forces?</li> </ul>
	17	Momentum	<ul style="list-style-type: none"> <li>• Explain what is meant by momentum.</li> </ul>

			<ul style="list-style-type: none"> <li>● Use momentum calculations to predict what happens in a collision.</li> </ul>
	18	Keeping safe on the road	<ul style="list-style-type: none"> <li>● Explain the factors that affect stopping distance.</li> <li>● Explain the dangers caused by large deceleration.</li> <li>● Estimate the forces involved in the deceleration of a road vehicle.</li> <li>● Apply ideas about rate of change of momentum to safety features in cars.</li> </ul>
	19	Moments	<ul style="list-style-type: none"> <li>● Describe the turning effect of a force about a pivot.</li> <li>● Explain and use the principle of moments.</li> <li>● Explain what is meant by the centre of mass of an object.</li> </ul>
	20	Levers and gears	<ul style="list-style-type: none"> <li>● Describe how levers and gears can be used to transmit the rotational effect of a force.</li> <li>● Explain how levers and gears transmit forces.</li> </ul>
	20	Extra maths lesson for practice on moments, levers and gears	
	21	Pressure in a fluid	<ul style="list-style-type: none"> <li>● Explain how pressure acts in a fluid.</li> <li>● Calculate pressure at different depths in a liquid.</li> <li>● Explain what causes upthrust.</li> </ul>
	21	Increasing the pressure of a gas	<ul style="list-style-type: none"> <li>● Describe the relationship between the pressure and volume of a gas at constant temperature.</li> <li>● Calculate the change in the pressure or volume of a gas held at constant temperature when either the pressure or volume is increased or decreased.</li> <li>● Explain how doing work on a gas can increase its temperature.</li> </ul>
	22	Atmospheric pressure	<ul style="list-style-type: none"> <li>● Show that the atmosphere exerts a high pressure.</li> <li>● Explain variations in atmospheric pressure with height.</li> <li>● Describe a simple model of the Earth's atmosphere and atmospheric pressure.</li> </ul>
	22	Forces and energy in springs	<ul style="list-style-type: none"> <li>● Explain why you need two forces to stretch a spring.</li> <li>● Describe the difference between elastic and inelastic deformation.</li> <li>● Calculate extension, compression and elastic potential energy.</li> </ul>
	23	Required practical: Investigate the relationship between force and the extension of a spring	<ul style="list-style-type: none"> <li>● Interpret readings to show patterns and trends.</li> <li>● Interpret graphs to form conclusions.</li> <li>● Apply the equation for a straight line to the graph.</li> </ul>
	24	Key concept: Forces and acceleration	<ul style="list-style-type: none"> <li>● Recognise examples of balanced and unbalanced forces.</li> <li>● Apply ideas about speed and acceleration to explain sensations of movement.</li> <li>● Apply ideas about inertia and circular motion to explain braking and cornering.</li> </ul>
	26	Making estimates of calculations	<ul style="list-style-type: none"> <li>● Estimate the results of simple calculations.</li> <li>● Round numbers to make an estimate.</li> <li>● Calculate order of magnitude.</li> </ul>
	26	Describing waves	<ul style="list-style-type: none"> <li>● Describe wave motion.</li> <li>● Define wavelength and frequency.</li> <li>● Apply the relationship between wavelength, frequency and wave velocity.</li> </ul>
	27	Transverse and longitudinal waves	<ul style="list-style-type: none"> <li>● Compare the motion of transverse and longitudinal waves.</li> <li>● Explain why water waves are transverse waves.</li> <li>● Explain why sound waves are longitudinal waves.</li> </ul>

	27	Key concept: Transferring energy or information by waves	<ul style="list-style-type: none"> <li>To understand that all waves have common properties</li> <li>To understand how waves can be used to carry information</li> <li>To understand various applications of energy transfer by different types of electromagnetic waves</li> </ul>
	28	Measuring wave speeds	<ul style="list-style-type: none"> <li>Explain how the speed of sound in air can be measured.</li> <li>Explain how the speed of water ripples can be measured.</li> <li>Describe the use of echo sounding.</li> </ul>
	28 + 29	Required practical: Measuring the wavelength, frequency and speed of waves in a ripple tank and waves in a solid	<ul style="list-style-type: none"> <li>Develop techniques for making observations of waves.</li> <li>Select suitable apparatus to measure frequency and wavelength.</li> <li>Use data to answer questions.</li> </ul>
	29	Reflection and refraction of waves	<ul style="list-style-type: none"> <li>Describe reflection, transmission and absorption of waves.</li> <li>Construct ray diagrams to illustrate reflection.</li> <li>Construct ray diagrams to illustrate refraction.</li> </ul>
	30	Pause lesson	
	30	Knowledge test	
	31	Required practical: Investigate the reflection of light by different types of surface and the refraction of light by different substances	<ul style="list-style-type: none"> <li>Make and record observations of how light is reflected and transmitted at different surfaces.</li> <li>Measure angles and discuss the method, apparatus and uncertainty in measurements.</li> <li>Draw conclusions from experimental results.</li> </ul>
	32	Sound waves	<ul style="list-style-type: none"> <li>Describe how we hear sound and state the range of frequencies we can hear.</li> <li>Explain that sound travels faster in a denser medium.</li> <li>Explain about reflection, absorption and transmission of sound.</li> </ul>
	32	Exploring ultrasound	<ul style="list-style-type: none"> <li>Explain what ultrasound is.</li> <li>Describe how ultrasound is used in industry to investigate or detect hidden or buried objects.</li> <li>Explain how ultrasound is used in medicine.</li> </ul>
	33	Seismic waves	<ul style="list-style-type: none"> <li>Describe how earthquakes are detected.</li> <li>Describe the properties of P waves and S waves.</li> <li>Explain how the properties of seismic waves allow us to investigate the inside of the Earth.</li> </ul>
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Year 11	1	The electromagnetic spectrum	<ul style="list-style-type: none"> <li>Recall the similarities and differences between transverse and longitudinal waves.</li> <li>Recognise that electromagnetic waves are transverse waves.</li> <li>Describe the main groupings and wavelength ranges of the electromagnetic spectrum.</li> </ul>
	1	Reflection, refraction and wave fronts	<ul style="list-style-type: none"> <li>Explain reflection and refraction and how these may vary with wavelength.</li> <li>Construct ray diagrams to illustrate refraction.</li> <li>Use wave front diagrams to explain refraction in terms of the difference in velocity of the waves in different substances.</li> </ul>
	2	Gamma rays and X-rays	<ul style="list-style-type: none"> <li>List the properties of gamma rays and X-rays.</li> <li>Compare gamma rays and X-rays.</li> </ul>
	2	Ultraviolet and infrared radiation	<ul style="list-style-type: none"> <li>Describe the properties of ultraviolet and infrared radiation.</li> <li>Describe some uses and hazards of ultraviolet radiation.</li> </ul>

			<ul style="list-style-type: none"> <li>Describe some uses of infrared radiation.</li> </ul>
	3	Microwaves	<ul style="list-style-type: none"> <li>List some properties of microwaves.</li> <li>Describe how microwaves are used for communications.</li> </ul>
	3	Radio and microwave communication	<ul style="list-style-type: none"> <li>Describe how radio waves are used for television and radio communications.</li> <li>Describe how microwaves are used in satellite communications.</li> <li>Describe the reflection and refraction of radio waves.</li> </ul>
	4	Emission and absorption of infrared radiation	<ul style="list-style-type: none"> <li>Realise that all bodies emit and absorb infrared radiation.</li> <li>Compare emission and absorption of radiation from different surfaces.</li> <li>Define a perfect black body.</li> <li>Explain that the intensity and distribution of wavelengths of any emission depend on the temperature of the body.</li> </ul>
	5	Required practical: Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface	<ul style="list-style-type: none"> <li>Explain reasons for the equipment used to carry out an investigation.</li> <li>Explain the rationale for carrying out an investigation.</li> <li>Apply ideas from an investigation to a range of practical contexts.</li> </ul>
	7	Temperature of the Earth	<ul style="list-style-type: none"> <li>Describe how the atmosphere absorbs radiation in a way that varies with wavelength.</li> <li>List the factors affecting the temperature of the Earth.</li> <li>Explain how the temperature of an object is related to the radiation absorbed and radiation emitted.</li> </ul>
	7	Recap of dissipation of energy (include brief conduction and convection)	<ul style="list-style-type: none"> <li></li> </ul>
	8	Required practical: Investigating ways of reducing the unwanted energy transfers in a system	<ul style="list-style-type: none"> <li>Use scientific ideas to make predictions</li> <li>Analyse data to identify trends.</li> <li>Evaluating an experimental procedure.</li> </ul>
	8	Colour	<ul style="list-style-type: none"> <li>Describe what happens when light of different wavelengths lands on an object.</li> <li>Explain what determines the colour of an opaque object.</li> <li>Explain the effect of coloured filters.</li> </ul>
	9	Lenses	<ul style="list-style-type: none"> <li>Understand what a lens does.</li> <li>Draw ray diagrams to show the formation of images by lenses.</li> <li>Describe the difference between a real and a virtual image.</li> </ul>
	9	Images and magnification	<ul style="list-style-type: none"> <li>Draw ray diagrams to show the formation of real and virtual images by lenses.</li> <li>Calculate the magnification of an image.</li> </ul>
	10	Static electricity	<ul style="list-style-type: none"> <li>Describe how insulating materials can become charged.</li> <li>Know that there are two kinds of electric charge.</li> <li>Explain these observations in terms of electron transfer.</li> </ul>
	10	Electric fields	<ul style="list-style-type: none"> <li>Explain what an electric field is.</li> <li>Draw an electric field pattern for a charged sphere.</li> <li>Use the idea of an electric field to explain electrostatic attraction and sparking.</li> </ul>
	11	Magnetism and magnetic forces	<ul style="list-style-type: none"> <li>Explain what is meant by the poles of a magnet.</li> <li>Plot the magnetic field around a bar magnet.</li> <li>Describe magnetic materials and induced magnetism.</li> </ul>

	11	Compasses and magnetic fields	<ul style="list-style-type: none"> <li>Describe the Earth's magnetic field.</li> <li>Describe the magnetic effect of a current.</li> <li>Explain the link between current and magnetic field.</li> </ul>
	13	The magnetic effect of a solenoid	<ul style="list-style-type: none"> <li>Draw the magnetic field around a conducting wire and a solenoid.</li> <li>Describe the force on a wire in a magnetic field.</li> <li>Apply the left-hand rule to work out the direction of a magnetic field, a current or a force around a wire.</li> </ul>
	14	Electromagnets in action	<ul style="list-style-type: none"> <li>Describe simple uses of electromagnets.</li> <li>Explain how an electric bell and relay works.</li> <li>Interpret diagrams of other devices that use electromagnets to explain how they work.</li> </ul>
	14	Calculating the force on a conductor	<ul style="list-style-type: none"> <li>Explain the meaning of magnetic flux density, <math>B</math>.</li> <li>Know the factors that make a more powerful motor.</li> <li>Calculate the force on a current-carrying conductor in a magnetic field.</li> </ul>
	15	Electric motors	<ul style="list-style-type: none"> <li>List equipment that uses motors.</li> <li>Describe how motors work.</li> <li>Describe how to change the speed and direction of rotation of a motor.</li> </ul>
	15	Loudspeakers	<ul style="list-style-type: none"> <li>Describe how a moving-coil loudspeaker works.</li> <li>Link the vibration on a loudspeaker to the properties of the waves it produces.</li> <li>Compare loudspeakers and headphones.</li> </ul>
	16	The generator effect	<ul style="list-style-type: none"> <li>Describe how a current is induced in a wire when it moves in a magnetic field.</li> <li>Identify apparatus needed to demonstrate induced current.</li> <li>Identify the factors that affect the size and direction of the induced current or induced potential difference.</li> </ul>
	16	Key concept: The link between electricity and magnetism	<ul style="list-style-type: none"> <li>Explore how electricity and magnetism are connected.</li> <li>Describe how electromagnetic induction occurs.</li> <li>Describe the principle of the electric motor.</li> </ul>
	17	Using the generator effect	<ul style="list-style-type: none"> <li>Explain how moving-coil microphones use the generator effect.</li> <li>Explain how a dynamo generates direct current and an alternator generates alternating current.</li> <li>For a dynamo and alternator, draw and interpret graphs of potential difference generated in the coil against time.</li> </ul>
	17	Transformers	<ul style="list-style-type: none"> <li>explain how a transformer both uses and produces alternating current</li> <li>explain the relationship between the number of turns in the primary coil and the number in the secondary coil</li> <li>calculate the current that needs to be provided to produce a particular power output.</li> </ul>
	18	Transmitting electricity	<ul style="list-style-type: none"> <li>Describe how electricity is transmitted using the National Grid.</li> <li>Explain why electrical power is transmitted at high potential differences.</li> <li>Understand the role of transformers.</li> </ul>
	18	Electricity in the home	<ul style="list-style-type: none"> <li>Recall that the domestic supply in the UK is a.c. at 50 Hz and about 230 V.</li> <li>Describe the main features of live, neutral and earth wires.</li> </ul>
	20	The Solar System	<ul style="list-style-type: none"> <li>Describe the orbits of planets and moons in the Solar System.</li> <li>Distinguish between planets, dwarf planets and moons.</li> </ul>

	20	Orbits of planets, moons and artificial satellites	<ul style="list-style-type: none"> <li>● Compare the orbital motion of moons, artificial satellites and planets in the Solar System.</li> <li>● Describe what keeps bodies in orbit around planets and stars.</li> <li>● Explain how for circular orbits an object can have a changing velocity but unchanged speed.</li> <li>● Explain why bodies must move at a particular speed to stay in orbit at a particular distance.</li> </ul>
	21	The Sun and other stars	<ul style="list-style-type: none"> <li>● Describe how the Sun and other stars formed.</li> <li>● Describe the nuclear fusion reactions in the Sun.</li> </ul>
	21	Main sequence of a star	<ul style="list-style-type: none"> <li>● Describe the main sequence of a star's life cycle.</li> <li>● Identify the forces that are in equilibrium in a stable star.</li> </ul>
	22	Life cycles of stars	<ul style="list-style-type: none"> <li>● Describe the life cycles of a star like the Sun and a massive star.</li> </ul>
	22	How the elements are formed	<ul style="list-style-type: none"> <li>● Understand how new elements are produced by nuclear fusion in stars.</li> <li>● Recognise that the heavier elements are made in a supernova.</li> </ul>
	23	Red-shift	<ul style="list-style-type: none"> <li>● Revision of wave properties i.e. wavelength and frequency.</li> <li>● Describe red-shift.</li> <li>● Describe evidence for the expanding Universe.</li> </ul>
	24	Key concept: Gravity: the force that binds the Universe	<ul style="list-style-type: none"> <li>● Understand that gravity provides the force that keeps planets and satellites in orbits.</li> <li>● Understand that gravity is necessary at the start of a star's life cycle and to maintain equilibrium in a stable star.</li> <li>● Describe how the weight of an object depends on the gravitational field strength.</li> <li>● Recognise that there is still much about the universe that is not understood, e.g. dark mass and dark energy.</li> </ul>
	24	Maths skills: Using scale and standard form	<ul style="list-style-type: none"> <li>● Understand the scale of objects in the Universe.</li> <li>● Use standard form.</li> </ul>