Chapter reference	Lesson title	Lesson objectives	AQA specification reference
1.1	Potential energy	• Consider what happens when a spring is stretched. • Describe what is meant by gravitational potential energy. • Calculate the energy stored by an object raised above ground level.	4.1.1.1 4.1.1.2
1.2	Investigating kinetic energy	• Describe how the kinetic energy store of an object changes as its speed changes. • Calculate kinetic energy. • Consider how energy is transferred.	4.1.1.1 4.1.1.2
1.3	Work done and energy transfer	• Understand what is meant by work done. • Explain the relationship between work done and force applied. • Identify the transfers between energy stores when work is done against friction.	4.1.1.1 4.5.2
1.4	Understanding power	• Define power. • Compare the rate of energy transfer by various machines and electrical appliances. • Calculate power.	4.1.1.4
1.5	Specific heat capacity	• Understand how things heat up. • Find out about heating water. • Find out about specific heat capacity.	4.1.1.3
1.6	Required practical: Investigating specific heat capacity	• Use theories to develop a hypothesis. • Evaluate a method and suggest improvements. • Perform calculations to support conclusions.	4.1.1.3
1.7	Dissipation of energy	• Explain ways of reducing unwanted energy transfer. • Describe what affects the rate of cooling of a building. • Understand that energy is dissipated.	4.1.2.1
1.8	Energy efficiency	• Explain what is meant by energy efficiency. • Calculate the efficiency of energy transfers. • Find out about conservation of energy.	4.1.2.2
1.9	Required practical: Investigating ways of reducing the unwanted energy transfers in a system	• Use scientific ideas to make predictions • Analyse data to identify trends. • Evaluate an experimental procedure.	4.1.2.1
1.10	Using energy resources	• Describe the main energy resources available for use on Earth. • Distinguish between renewable and non-renewable resources. • Explain the ways in which the energy resources are used.	4.1.3
1.11	Global energy supplies	• Analyse global trends in energy use. • Understand what the issues are when using energy resources.	4.1.3
1.12	Key concept: Energy transfer	• To be able to recognize objects with energy. • To be able to recognize the different types of energy. • To be able to describe energy transfers.	4.1

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
		• To be able to use and describe the law of conservation of energy.	
1.13	Maths skills: Calculations using significant figures	• Substitute numerical values into equations and use appropriate units. • Change the subject of an equation. • Give an answer using an appropriate number of significant figures.	4.1
1.14	Maths skills: Handling data	• Recognise the difference between mean, mode and median. • Explain the use of tables and frequency tables. • Explain when to use scatter diagrams, bar charts and histograms.	4.1.1.1 4.1.3
2.1	Static electricity	• Describe how insulating materials can become charged. • Know that there are two kinds of electric charge. • Explain these observations in terms of electron transfer.	4.2.5.1
2.2	Electric fields	• Explain what an electric field is. • Draw an electric field pattern for a charged sphere. • Use the idea of an electric field to explain electrostatic attraction and sparking.	4.2.5.2
2.3	Electric current	• Know circuit symbols. • Recall that current is a rate of flow of electric charge. • Recall that current (I) depends on resistance (R) and potential difference (V) • Explain how an electric current passes round a circuit.	4.2.5.1 4.2.5.2 4.2.5.3
2.4	Series and parallel circuits	• Recognise series and parallel circuits. • Describe the changes in the current in series and parallel circuits. • Describe the changes in the potential difference in series and parallel circuits.	4.2.2
2.5	Investigating circuits	• Classify materials as either conducting or insulating. • Use series circuits to test components and make measurements. • Carry out calculations on series circuits.	4.2.2
2.6	Circuit components	• Set up a circuit to investigate resistance. • Investigate the changing resistance of a filament lamp. • Compare the properties of a resistor and a filament lamp.	4.2.1.4
2.7	Required practical: Investigate, using circuit diagrams to construct circuits, the I–V characteristics of a filament lamp, a diode and a resistor at constant temperature	• Understand how an experiment can be designed to test an idea. • Evaluate how an experimental procedure can yield more accurate data. • Interpret and explain graphs using scientific ideas.	
2.8	Required practical: Use circuit diagrams to set up and check	• Use a circuit to determine resistance. • Gather valid data for use in calculations. • Apply the circuit to determine the resistance of combinations of components.	4.2.1.3

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
	appropriate circuits to investigate the factors affecting the resistance of electrical circuits, including the length of a wire at a constant temperature and combinations of resistors in series and parallel		
2.9	Control circuits	• Use a thermistor and a light-dependent resistor (LDR). • Investigate the properties of thermistors, LDRs and diodes.	4.2.1.4
2.10	Electricity in the home	• Recall that the domestic supply in the UK is 230 V ac and 50 Hz. • Describe the main features of live, neutral and earth wires.	4.2.3.1 4.2.3.2
2.11	Transmitting electricity	• Describe how electricity is transmitted using the National Grid. • Explain why electrical power is transmitted at high potential differences. • Understand the role of transformers.	4.2.4.3
2.12	Power and energy transfers	• Describe the energy transfers in different domestic appliances. • Describe power as a rate of energy transfer. • Calculate the energy transferred.	4.2.4.2
2.13	Calculating power	• Calculate power. • Use power equations to solve problems. • Consider power ratings and changes in stored energy.	4.2.4.1 4.1.1.1 4.1.1.2 4.1.1.3
2.14	Key concept: What's the difference between potential difference and current?	• Understand the concepts of current and potential difference. • Apply the concepts of current and potential difference. • Use these concepts to explain various situations.	4.2.1
2.15	Maths skills: Using formulae and understanding graphs	• Recognise how algebraic equations define the relationships between variables. • Solve simple algebraic equations by substituting numerical values. • Describe relationships expressed in graphical form.	4.2
3.1	Density	• Use the particle model to explain the different states of matter. • Describe differences in density for different states of matter. • Calculate density for the different states of matter.	4.3.1.1
3.2	Required practical: To investigate the	• Interpret observations and data. • Use spatial models to solve problems. • Plan experiments and devise procedures.	4.3.1.1

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
	densities of regular and irregular solid objects and liquids	• Use an appropriate number of significant figures in measurements and calculations.	
3.3	Changes of state	• Describe how, when substances change state, mass is conserved. • Describe energy transfer in changes of state. • Explain changes of state in terms of particles.	4.3.1.3
3.4	Internal energy	• Describe the particle model of matter. • Understand what is meant by the internal energy of a system. • Describe the effect of heating on the energy stored within a system.	4.3.2.1
3.5	Specific heat capacity	• Describe the effect of increasing the temperature of a system in terms of particles. • State the factors that are affected by an increase in temperature of a substance. • Explain specific heat capacity.	4.3.2.2
3.6	Latent heat	• Explain what is meant by latent heat. • Describe that when a change of state occurs it changes the energy stored but not the temperature. • Perform calculations involving specific latent heat.	4.3.2.3
3.7	Particle motion in gases	• Relate the temperature of a gas to the average kinetic energy of the particle. • Explain how gas has a pressure. • Explain that changing the temperature of a gas held at constant volume changes its pressure.	4.3.3.1
3.8	Increasing the pressure of a gas	• Describe the relationship between the pressure and volume of a gas at constant temperature. • 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. • Explain how doing work on a gas can increase its temperature.	4.3.3.2 4.3.3.3
3.9	Key concept: Particle model and changes of state	• Use the particle model to explain states of matter. • Use ideas about energy and bonds to explain changes of state. • Explain the relationship between temperature and energy.	4.3
3.10	Maths skills: Drawing and interpreting graphs	• Plot a graph of temperature against time, choosing a suitable scale. • Draw a line of best fit (which may be a curve). • Interpret a graph of temperature against time.	4.3.2.3
4.1	Atomic structure	• Describe the structure of the atom. • Use symbols to represent particles. • Describe ionisation.	4.4.1.1 4.4.1.2
4.2	Radioactive decay	• Describe radioactive decay. • Describe the types of nuclear radiation. • Understand the processes of alpha decay and beta decay.	4.4.2.1

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
4.3	Background radiation	• Recall sources of background radiation. • Describe how different types of radiation have differing ionising power. • Justify the selection of sources for particular applications.	4.4.2.1 4.4.3.1
4.4	Nuclear equations	• Understand nuclear equations. • Write balanced nuclear equations for alpha decay. • Write balanced nuclear equations for beta decay.	4.4.2.2
4.5	Radioactive half-life	• Explain what is meant by radioactive half-life. • Calculate half-life. • Choose the best radioisotope for a task.	4.4.2.3 4.4.2.1 4.4.3.2
4.6	Hazards and uses of radiation	• Describe radioactive contamination. • Give examples of how radioactive tracers can be used. • Explain how contaminated waste is disposed of.	4.4.2.4
4.7	Irradiation	• Explain what is meant by irradiation. • Understand the distinction between contamination and irradiation. • Appreciate the importance of communication between scientists.	4.4.2.4
4.8	Uses of radiation in medicine	• Compare gamma rays and X-rays. • Describe some uses of radiation for medical diagnosis and therapy.	4.4.3.3
4.9	Using nuclear radiation	• Explore the risks and benefits of using nuclear radiation. • Describe how internal organs can be explored. • Understand how nuclear radiation can control or destroy unwanted tissue.	4.4.3.3
4.10	Nuclear fission	• Describe nuclear fission. • Explain how a chain reaction occurs. • Explain how fission is used.	4.4.4.1
4.11	Nuclear fusion	• Explain nuclear fusion. • Describe the conditions needed for fusion. • Describe how nuclear fusion might be an attractive energy source.	4.4.4.2
4.12	Key concept: Developing ideas for the structure of the atom	• Understand how ideas about the structure of the atom have changed. • How evidence is used to test and improve models.	4.4.1.3
4.13	Maths skills: Using ratios and proportional reasoning	• Calculate radioactive half-life from a curve of best fit. • Calculate the net decline in radioactivity.	4.4.2.3
5.1	Forces	• Describe a force. • Recognise the difference between contact and non-contact forces. • State examples of scalar and vector quantities.	4.5.1.1 4.5.1.2 4.5.6.1.3
5.2	Speed	• Calculate speed using distance travelled divided by time taken. • Calculate speed from a distance–time graph. • Measure the gradient of a distance–time graph at any point.	4.5.6.1.1 4.5.6.1.2 4.5.6.1.4
5.3	Acceleration	• Describe acceleration. • Calculate acceleration.	4.5.6.1.3 4.5.6.1.5

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
		• [Higher tier] Explain motion in a circle.	
5.4	Velocity–time graphs	• Draw velocity–time graphs. • Calculate acceleration using a velocity–time graph. • [Higher tier] Calculate displacement using a velocity–time graph.	4.5.6.1.1 4.5.6.1.3 4.5.6.1.5
5.5	Calculations of motion	• Describe uniform motion. • Use an equation for uniform motion. • Apply this equation to vertical motion.	4.5.6.1.5
5.6	Heavy or massive?	• Identify the correct units for mass and weight. • Explain the difference between mass and weight. • Understand how weight is an effect of gravitational fields.	4.5.1.3
5.7	Forces and motion	• Understand what a force does. • Explain what happens to an object if all the forces acting on it cancel each other out. • Analyse how this applies to everyday situations.	4.5.6.1.5 4.5.6.2.1
5.8	Resultant forces	• Calculate the resultant from opposing forces. • Draw free-body diagrams to find resultant forces. • [Higher tier] Understand that a force can be resolved into two components acting at right angles to each other.	4.5.1.3 (centre of mass) 4.5.1.4
5.9	Forces and acceleration	• Explain what happens to the motion of an object when the resultant force is not zero. • Analyse situations in which a non-zero resultant force is acting. • Explain what inertia is.	4.5.6.2.1 4.5.6.2.2
5.10	Required practical: Investigating the acceleration of an object	• Plan an investigation to explore an idea. • Analyse results to identify patterns and draw conclusions. • Compare results with scientific theory.	4.5.6.2.2
5.11	Newton's third law	• Identify force pairs. • Understand and be able to apply Newton's third law.	4.5.6.2.3
5.12	Momentum [higher tier]	• Explain what is meant by momentum. • Apply ideas about the rate of change of momentum to safety features in cars. • Use momentum calculations to predict what happens in a collision.	4.5.7.1 4.5.7.2 4.5.7.3
5.13	Keeping safe on the road	• Explain the factors that affect stopping distance. • Explain the dangers caused by large deceleration. • Estimate the forces involved in the deceleration of a road vehicle (higher tier). • Apply the idea of rate of change of momentum to explain safety features (higher tier).	4.5.6.3.1 4.5.6.3.2 4.5.6.3.3 4.5.6.3.4
5.14	Moments	• Describe the turning effect of a force about a pivot. • Explain and use the principle of moments. • Explain what is meant by the centre of mass of an object.	4.5.1.3 (centre of mass) 4.5.4
5.15	Levers and gears	• Describe how levers and gears can be used to transmit the rotational effect of a force. • Explain how levers and gears transmit forces.	4.5.4
5.16	Pressure in a fluid	• Explain how pressure acts in a fluid. • Calculate pressure at different depths in a liquid (higher tier). • Explain what causes upthrust (higher tier).	4.5.5.1.1 4.5.5.1.2
5.17	Atmospheric	• Show that the atmosphere exerts a high pressure.	4.5.5.2

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
	pressure	• Explain variations in atmospheric pressure with height. • Describe a simple model of the Earth's atmosphere and atmospheric pressure.	
5.18	Forces and energy in springs	• Explain why you need two forces to stretch a spring. • Describe the difference between elastic and inelastic deformation. • Calculate extension, compression and elastic potential energy.	4.5.3
5.19	Required practical: Investigate the relationship between force and the extension of a spring	• Interpret readings to show patterns and trends. • Interpret graphs to form conclusions. • Apply the equation for a straight line to the graph.	4.5.3
5.20	Key concept: Forces and acceleration	• Recognise examples of balanced and unbalanced forces. • Apply ideas about speed and acceleration to explain sensations of movement. • Apply ideas about inertia and circular motion to explain braking and cornering.	4.5
5.21	Maths skills: Making estimates of calculations	• Estimate the results of simple calculations. • Round numbers to make an estimate. • Calculate order of magnitude.	4.5
6.1	Describing waves	• Describe wave motion. • Define wavelength and frequency. • Apply the relationship between wavelength, frequency and wave velocity.	4.6.1.2
6.2	Transverse and longitudinal waves	• Compare the motion of transverse and longitudinal waves. • Explain why water waves are transverse waves. • Explain why sound waves are longitudinal waves.	4.6.1.1 4.6.1.2
6.3	Key concept: Transferring energy or information by waves	• To understand that all waves have common properties. • To understand how waves can be used to carry information. • To understand various applications of energy transfer by different types of electromagnetic waves.	4.6
6.4	Measuring wave speeds	• Explain how the speed of sound in air can be measured. • Explain how the speed of water ripples can be measured. • Describe the use of echo sounding.	4.6.1.2 4.6.1.5
6.5	Required practical: Measuring the wavelength, frequency and speed of waves in a ripple tank and waves in a solid	• Develop techniques for making observations of waves. • Select suitable apparatus to measure frequency and wavelength. • Use data to answer questions.	4.6.1.2 Prac 8
6.6	Reflection and refraction of waves	• Describe reflection, transmission and absorption of waves. • Construct ray diagrams to illustrate reflection. • Construct ray diagrams to illustrate refraction.	4.6.1.3

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
6.7	Required practical: Investigate the reflection of light by different types of surface and the refraction of light by different substances	• Make and record observations of how light is reflected and transmitted at different surfaces. • Measure angles and discuss the method, apparatus and uncertainty in measurements. • Draw conclusions from experimental results.	4.6.1.3 Prac 9
6.8	Sound waves	• Describe how we hear sound and state the range of frequencies we can hear. • Explain that sound travels faster in a denser medium. • Explain about reflection, absorption and transmission of sound.	4.6.1.4
6.9	Exploring ultrasound	• Explain what ultrasound is. • Describe how ultrasound can be used in industry to investigate or detect hidden or buried objects. • Explain how ultrasound is used in medicine.	4.6.1.5
6.10	Seismic waves	• Describe how earthquakes are detected. • Describe the properties of P waves and S waves. • Explain how the properties of seismic waves allow us to investigate the inside of the Earth.	4.6.1.5
6.11	The electromagnetic spectrum	• Recall the similarities and differences between transverse and longitudinal waves. • Recognise that electromagnetic waves are transverse waves. • Describe the main groupings and wavelength ranges of the electromagnetic spectrum.	4.6.2.1
6.12	Reflection, refraction and wave fronts	• Explain reflection and refraction and how these may vary with wavelength. • Construct ray diagrams to illustrate refraction. • Use wave front diagrams to explain refraction in terms of the difference in velocity of the waves in different substances.	4.6.1.3 4.6.2.2
6.13	Gamma rays and X-rays	• List the properties of gamma rays and X-rays. • Compare gamma rays and X-rays.	4.6.2.1 4.6.2.2 4.6.2.3 4.6.2.4
6.14	Ultraviolet and infrared radiation	• Describe the properties of ultraviolet and infrared radiation. • Describe some uses and hazards of ultraviolet radiation. • Describe some uses of infrared radiation.	4.6.2.1 4.6.2.2 4.6.2.3 4.6.2.4
6.15	Required practical: Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface	• Explain reasons for the equipment used to carry out an investigation. • Explain the rationale for carrying out an investigation. • Apply ideas from an investigation to a range of practical contexts.	4.6.2.2 Prac 10
6.16	Microwaves	• List some properties of microwaves. • Describe how microwaves are used for communications.	4.6.2.1 4.6.2.2 4.6.2.4

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
6.17	Radio and microwave communication	• Describe how radio waves are used for television and radio communications. • Describe how microwaves are used in satellite communications. • Describe the reflection and refraction of radio waves.	4.6.2.1 4.6.2.2 4.6.2.3 4.6.2.4
6.18	Colour	• Describe what happens when light of different wavelengths lands on an object. • Explain what determines the colour of an opaque object. • Explain the effect of coloured filters.	4.6.2.1 4.6.2.6
6.19	Lenses	• Understand what a lens does. • Draw ray diagrams to show the formation of images by lenses. • Describe the difference between a real and a virtual image.	4.6.2.5
6.20	Images and magnification	• Draw ray diagrams to show the formation of real and virtual images by lenses. • Calculate the magnification of an image.	4.6.2.5
6.21	Emission and absorption of infrared radiation	• Realise that all bodies emit and absorb infrared radiation. • Compare emission and absorption of radiation from different surfaces. • Define a perfect black body. • Explain that the intensity and distribution of wavelengths of any emission depend on the temperature of the body.	4.6.3.1 4.6.3.2
6.22	Temperature of the Earth	• Describe how the atmosphere absorbs radiation in a way that varies with wavelength. • List the factors affecting the temperature of the Earth. • Explain how the temperature of an object is related to the radiation absorbed and radiation emitted.	4.6.3.2
6.23	Maths skills: Using and rearranging equations	• Select and apply the equations $T = 1/f$ and $v = f\lambda$ • Substitute numerical values into equations using appropriate units. • Change the subject of an equation.	4.6.1.2
7.1	Magnetism and magnetic forces	• Explain what is meant by the poles of a magnet. • Plot the magnetic field around a bar magnet. • Describe magnetic materials and induced magnetism.	4.7.1.1 4.7.1.2
7.2	Compasses and magnetic fields	• Describe the Earth's magnetic field. • Describe the magnetic field of a current. • Explain the link between current and magnetic field.	4.7.1.2 4.7.2.1
7.3	The magnetic effect of a solenoid	• Draw the magnetic field around a conducting wire and a solenoid. • Describe the force on a wire in a magnetic field. • Apply the left-hand rule to work out the direction of a magnetic field, a current or a force around a wire.	4.7.2.1 4.7.2.2
7.4	Electromagnets in action	• Describe simple uses of electromagnets. • Explain how an electric bell and relay works. • Interpret diagrams of other devices that use electromagnets to explain how the devices work.	4.7.2.1
7.5	Calculating the force on a conductor	• Explain the meaning of magnetic flux density, B. • Know the factors that make a more powerful motor. • Calculate the force on a current-carrying conductor in a magnetic field.	4.7.2.2
7.6	Electric motors	• List equipment that uses motors. • Describe how motors work. • Describe how to change the speed and direction of	4.7.2.3

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
		rotation of a motor.	
7.7	Loudspeakers	• Describe how a moving coil loudspeaker works. • Link the vibration on a loudspeaker to the properties of the waves it produces. • Compare loudspeakers and headphones.	4.7.2.4
7.8	The generator effect	• Describe how the current is induced in a wire when it moves in a magnetic field. • Identify apparatus needed to demonstrate induced current. • Identify the factors that affect the size and direction of the induced current or induced potential difference.	4.7.3.1
7.9	Key concept: The link between electricity and magnetism	• Explore how electricity and magnetism are connected. • Describe how electromagnetic induction occurs. • Describe the principle of the electric motor.	4.7.3.2; 4.7.3.3
7.10	Using the generator effect	• Explain how moving coil microphones use the generator effect. • Explain how a dynamo generates direct current and an alternator generates alternating current. • For a dynamo and alternator, draw and interpret graphs of potential difference generated in the coil against time.	4.7
7.11	Transformers	• Explain how a transformer both uses and produces alternating current. • Explain the relationship between the number of turns in the primary coil and the number of turns in the secondary coil. • Calculate the current that needs to be provided to produce a particular power output.	
7.12	Maths skills: Rearranging equations	• Know how to rearrange equations. • Know how to use the transformer equation. • Know how to calculate the force on a conductor.	4.7.3.4
8.1	The Solar System	• Describe the orbits of planets and moons in the Solar System. • Distinguish between planets, dwarf planets and moons.	4.8.1.1 4.8.1.3
8.2	Orbits of planets, moons and artificial satellites	• Compare the orbital motion of moons, artificial satellites and planets in the Solar System. • Describe what keeps bodies in orbit around planets and stars. • Explain how, for circular orbits, an object can have a changing velocity but unchanged speed. • Explain why bodies must move at a particular speed to stay in orbit at a particular distance.	4.8.1.3
8.3	The Sun and other stars	• Describe how the Sun and other stars formed. • Describe the nuclear fusion reactions in the Sun.	4.8.1.1
8.4	Main sequence of a star	• Describe the main sequence stage of a star's life cycle. • Identify the forces that are in equilibrium in a stable star.	4.8.1.1 4.8.1.2
8.5	Life cycles of stars	• Describe the life cycles of a star like the Sun and a massive star.	4.8.1.2
8.6	How the elements are formed	• Understand how new elements are produced by nuclear fusion in stars. • Recognise that the heavier elements are made in a supernova.	4.8.1.2
8.7	Red-shift	• Describe red-shift. • Describe evidence for the expanding Universe.	4.8.2

Chapter reference	Lesson title	Lesson objectives	AQA specification reference
8.8	Key concept: Gravity: the force that binds the Universe	• Understand that gravity provides the force that keeps planets and satellites in orbits. • Understand that gravity is necessary at the start of a star's life cycle and to maintain equilibrium in a stable star. • Describe how the weight of an object depends on the gravitational field strength. • Recognise that that there is still much about the universe that is not understood, e.g. dark mass and dark energy.	4.8.1.3 4.5.1.3
8.9	Maths skills: Using scale and standard form	• Understand the scale of objects in the Universe. • Use standard form.	4.8
Assessments			