AQA GCSE (9-1) Physics

HODDER EDUCATION
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Old GCSE Grade	GCSE equivalent	1	2	3	4	5a	5b	6	7	8
		Energy	**Electricity**	**Particle model**	**Atomic structure**	**Forces**	**Motion**	**Waves**	**Magnetism and electromagnetism**	**Space physics**
A** and A*	9 and 8	Fully describe and explain energy transfers between stores, giving details of the pathways and processes involved.	Draw and interpret circuit diagrams using standard symbols.	Recall and use (after rearranging if needed) the equation for density. Describe an experiment to take measurements needed for density calculations.	Describe the components of the nuclear atom including typical accepted values. Derive mass and numbers of sub-atomic particles from periodic table data. Describe and explain differences between isotopes.	Give examples of scalar and vector quantities. Explain the difference between these two descriptions and the use of arrows to show magnitude and direction for vectors. Give examples of contact and non-contact forces and describe the interaction of two objects which results in a force on them both.	Explain the difference between distance and displacement, and express a displacement in terms of direction and magnitude. Recall typical values for speed. Describe an experiment to measure distance travelled and time taken so speed can be calculated. Recall and use (after rearranging if needed) the equation for speed.	Describe and explain the difference between longitudinal and transverse waves, giving examples. Describe wave motion in terms of their amplitude, wavelength, frequency and period. Use (after rearranging if needed) the inverse relationship between period and frequency.	Describe attraction and repulsion using the ideas of magnetic poles, and the difference between permanent and induced magnets. Explain the effects seen in a magnetic field including the strength and direction of the force. Describe the method for plotting a magnetic field using a compass and explain how the behaviour of a magnetic compass shows the Earth has a magnetic core.	Describe the current understanding of the solar system as part of the *Milky Way* galaxy. Explain how, at the start of a star's life cycle, the dust and gas drawn together by gravitational attraction causes fusion reactions.
		Recall and use (after rearranging if needed) the equations for kinetic, gravitational and thermal energy stores. Use (after rearranging if needed) the equation for an elastic energy store.	Recall and use (after rearranging if needed) the equation for current as a rate of flow of charge and be able to explain fully why the current is the same at each point in a single-loop (series) circuit.	Describe states of matter using the particle model and explain how mass is conserved when the state changes. Use diagrams to explain differences between particle arrangements in each state of matter.	Explain the historical stages in the development of modern atomic model and describe the new evidence which led to changes each time. Give a detailed comparison between models, in particular plum pudding vs. nuclear atom.	Explain that weight is the force that acts on all objects with mass because of gravity. Recall and use (after rearranging if needed) the weight equation. Describe the use of a newton-meter to measure weight, which is proportional to mass.	Explain the difference between speed and velocity, and use examples to show that motion in a circle involves constant speed but changing velocity. Plot and interpret distance-time graphs, finding velocity at specified points, using tangents if needed.	Recall and use (after rearranging if needed) the wave equation. Identify amplitude and wavelength from diagrams. Describe methods for measuring wave speed including sound in air, ripples on water and waves in a solid. Explain how changes in wave properties when sound crosses boundaries are inter-related.	Describe how the magnetic effect of a current can be demonstrated. Draw the magnetic field patterns for a straight wire and a solenoid carrying current. Explain how the solenoid arrangement increases the strength of the magnetic field. Interpret diagrams of electromagnetic devices to explain how they work.	Explain how fusion reactions, which produce new elements, lead to an equilibrium between gravitational collapse and expansion due to heating. Describe the life cycle of a star including variations due to size. Describe the production of elements heavier than iron during a supernova, which then distributes these elements through the universe.
		Recall and use (after rearranging if needed) the equation for work done and be able to explain fully how this relates to current in a circuit.	Recall and use (after rearranging if needed) the equation linking potential difference, current and resistance and be able to explain fully how a potential difference causes current to flow against resistance.	Explain the effect of changing the energy of a system (by heating or cooling) on the particles of that system, and link this to the state of matter.	Identify nuclear radiation from limited characteristics, explaining the differences between types. Choose an appropriate source for a particular application, explaining the link to required properties.	Use free-body diagrams to describe interacting forces on an object. Calculate the resultant of two forces acting in a straight line. Use scale drawings to show the link between component forces at right angles and their resultant.	Recall and use (after rearranging if needed) the equation for acceleration. Plot and interpret velocity-time graphs, finding acceleration using the gradient, and find area 'below the line' to calculate/estimate distance travelled.	Describe and explain the effects of reflection, refraction, transmission and absorption at boundaries, using wave diagrams where appropriate. Use wave front diagrams to explain refraction in terms of changing speed at the boundary between materials. Describe an experiment to investigate the effect of surface on absorption or transmission of infra-red radiation.	Define the motor effect and explain it using Fleming's Left Hand Rule. Explain the factors that affect the size of the force acting on the conductor. Use (after rearranging if needed) the equation for the force on a conductor.	State that gravity provides the force which maintains circular orbits, for planets around the sun and satellites around planets. Describe the similarities and differences between planets, their moons and artificial satellites. Explain qualitatively how velocity can change during a circular orbit while speed remains constant, and that the radius must change if speed changes.
		Recall and use (after rearranging if needed) the equations for power and be able to explain how this relates to the transfer of energy between stores, giving examples.	Fully describe and explain the resistance of ohmic and non-ohmic components including wires, resistors, filament lamps and diodes. Describe fully an experiment to find the resistance of a component by measuring potential difference applied and the resulting current.	Use (after rearranging if needed) the specific heat capacity equation. Explain fully how to collect measurements when heating a sample that allow the specific heat capacity to be calculated.	Use names and symbols of common nuclei and particles to write balanced equations showing single alpha or beta decay. Describe the changes in mass and atomic number during nuclear decay.	Recall and use (after rearranging if needed) the equation for work done. Describe and explain the energy transfers between stores when work is done. Convert between joules and newton-metres.	Use (after rearranging if needed) the equation for uniform motion ($v2\text{-}u2 = 2as$). Explain the effects of air resistance on a falling object and factors affecting how it reaches terminal velocity. Draw and interpret velocity-time graphs for objects that reach terminal velocity.	Describe processes which convert sound waves in air to waves in solids, such as those in the ear. Explain why these processes work over a limited frequency range and why this means human hearing is limited to 20Hz to 20kHz.	Explain how the force on a conductor in a magnetic field causes the rotation of a coil in an electric motor. Explain how a moving-coil loudspeaker and headphones work.	Describe qualitatively the red-shift effect and explain how this supports the Big Bang theory by providing evidence for an expanding universe. Explain that although much about the universe is not yet understood, for example dark mass and dark energy, observations allow models to be improved.
		Recall and use (after rearranging if needed) the equations for efficiency and be able to explain fully how this relates to dissipated (or 'wasted') energy, as well as how to reduce this: for example, by insulation.	Fully describe the varying resistance of LDRs and thermistors, explaining how this is relevant to their possible applications.	Use (after rearranging if needed) the specific latent heat equation. Interpret and explain heating and cooling graphs that include a change of state.	Fully explain the concept of half-life and calculate the value for an unknown sample, given data in numerical or graphical form. Calculate the net decline, expressed as a ratio, of the activity of a sample after a specified number of half-lives. Explain how half-life varies widely between isotopes and is relevant to discussion of the risk a sample poses to the environment.	Explain the difference between elastic and inelastic deformation, and the significance of the limit of proportionality (elastic limit). Recall and use (after rearranging if needed) the force-extension equation.	Explain Newton's First Law and apply this to explain the motion of objects, those with uniform velocity and those where the speed and/or direction vary. Define inertia.	Describe and explain how wave behaviour in solids and liquids allows detection and exploration of structures hidden from direct observation. Explain the use of ultrasound in medical diagnosis and industrial situations as well as echo sounding for deep water investigation. Describe how information from P and S waves, linked to their characteristics, provides evidence about the Earth's structure.	Define the generator effect and explain the factors that affect the size and direction of the induced potential difference. Explain how the generator effect is used to generate ac (in an alternator) and dc (in a dynamo), and interpret or draw graphs of potential difference against time for these. Explain how a moving-coil microphone works.	
		Fully describe and explain advantages and disadvantages of various energy resources, to include their use for transport, heating and generating electricity, as well as patterns and trends in their use.	Describe the difference between series and parallel connections in a circuit. Explain how potential difference and current can be measured at various points in circuits and how the readings are connected. Calculate and explain total resistance in a series circuit with several components.	Explain how the motion of particles in a gas is related to both its temperature and pressure. Explain how the pressure and temperature are related when volume is kept constant.	Explain the difference between irradiation and contamination, identifying which is appropriate in a given situation. Compare the hazards of these effects and explain why peer review of studies into repeated samples gives the best basis for decisions.	Explain the difference between a linear and non-linear relationship, and calculate the spring constant if linear. Use (after rearranging if needed) the equation for elastic potential energy.	Explain Newton's Second Law in words. Recall and use (after rearranging if needed) the equation. Define and explain inertial mass. Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.	Describe the electromagnetic spectrum in order of energy or wavelength and give examples of the transfer of energy by EM waves. Describe and explain the applications of different parts of the EM spectrum. Explain why each type is particularly appropriate for the application.	Explain the process and parts involved in a basic transformer. Use (after rearranging if needed) the turns ratio equation and describe transformers as step-up or step-down. State that for 100% efficiency power input would equal output, and use (after rearranging if needed) the transformer power equation.	
			Explain the difference between direct and alternating potential difference, and state standard UK values for mains supply.	Use (after rearranging if needed) Boyle's Law (pV=constant). Use the particle model to fully explain how increasing the pressure will reduce the volume if temperature is kept constant.	Explain why background radiation dose varies depending on location and occupation. Describe natural and artificial sources of background radiation. Describe uses of nuclear radiation including medical diagnosis and treatment, evaluating data on relative risk and benefit when provided.	Describe examples in which forces cause rotation. Recall and use (after rearranging if needed) the equation for the moment of a force. Explain the overall effect of clockwise and anti-clockwise moments. Explain how levers and gears transmit the rotational effects of forces.	Explain Newton's Third Law and apply it to examples of equilibrium situations.	Explain the consequences of the absorption of electromagnetic waves including heating, ionisation or an induced alternating current, as well as longer term effects such as cancer from some wavelengths. Analyse and interpret data on the risks and consequences of exposure to radiation. Describe the emission of EM waves due to alternating currents and nuclear changes.	Apply the equation linking the potential differences and numbers of coils of a transformer to the currents and power transfer involved, and relate these to the advantages of power transmission at high potential differences.	
			Interpret and explain the connections in a UK mains plug, including colours of insulation and safety features.	Use the concept of work done to explain how exerting a force on a gas will lead to an increase in temperature.	Fully describe the process of nuclear fission, explaining why the parts of a nuclear reactor are important. Draw a diagram as part of an explanation of a chain reaction. Define nuclear fusion.	Recall and use (after rearranging if needed) the equation for fluid pressure. Use (after rearranging if needed) the pressure at depth equation and explain the increase in pressure with depth. Describe the factors which influence floating and sinking. Describe a simple model of the Earth's atmosphere and atmospheric pressure, and explain why atmospheric pressure varies with height above a surface.	Define and explain stopping distance as the sum of thinking and braking distance. Explain the effects of factors that change thinking distance and state the range of typical values for reaction times, as well as describing experiments to measure this for a specific person. Interpret graphs and data for various situations relating to stopping distance.	Construct and interpret ray diagrams to illustrate the similarities and differences between convex and concave lenses. Label the features of a ray diagram and distinguish between real and virtual images. Use (after rearranging if needed) the magnification equation.		
			Recall and use (after rearranging if needed) the equations for power and explain how the potential difference and current affect the rate of energy transfer.				Explain the effects of factors that change braking distance and link this to implications for safety. Estimate the increase in stopping distance as speed increases. Explain the forces acting when a vehicle decelerates and how this leads to the transfer of energy between stores. Explain the dangers caused by large decelerations and estimate the forces involved in typical highway situations.	Distinguish between specular (linear) reflection and diffuse (scattering) reflection. Explain how the colour of an object is related to the different wavelengths (i.e. colours of light) which it absorbs and reflects. Explain the effect on light passing through filters.		
			Recall and use (after rearranging if needed) the equations for energy transferred and explain the pathways involved in common household devices, as well as how their power ratings affect changes to energy stores.				Define and explain momentum. Recall and use (after rearranging if needed) the equation for momentum. Explain the conservation of momentum when no external forces act, describing events and calculating changes using the equation. Use (after rearranging if needed) the impulse equation to link changes of momentum with an external force.	Describe a perfect black body in terms of absorption and emission. Explain that all objects emit radiation but that the intensity and wavelength distribution depends on the temperature. Compare the radiation absorbed with that emitted to show a net change, positive or negative. Explain the factors affecting absorption and emission and so the temperature of the Earth, and analyse data and diagrams on this process.		
			Give non-mathematical descriptions of the National Grid, explaining why step-up and -down transformers are needed for increased efficiency.							
			Explain the effects of static electricity, including attraction and repulsion, in terms of electrons being displaced. Describe the forces acting in the electric field around a charged object and draw a diagram to show the field pattern.							
A and B	7 and 6	Describe in detail energy transfers between stores, explaining the pathways and processes involved.	Draw and interpret circuit diagrams using standard symbols.	Use (after rearranging if needed) the equation for density. Describe an experiment to take measurements needed for density calculations.	Describe the components of the nuclear atom including typical accepted values. Derive mass and numbers of sub-atomic particles from periodic table data. Describe differences between isotopes.	Give examples of scalar and vector quantities. Explain the difference between these two descriptions and use arrows to show magnitude and direction for vectors. Give examples of contact and non-contact forces and describe the interaction of two objects which results in a force on them both.	Explain the difference between distance and displacement, and express a displacement in terms of direction and magnitude. Recall typical values for speed. Describe an experiment to measure distance travelled and time taken so speed can be calculated. Use (after rearranging if needed) the equation for speed.	Describe and explain the difference between longitudinal and transverse waves, giving examples. Describe wave motion in terms of their amplitude, wavelength, frequency and period. Use (after rearranging if needed) the inverse relationship between period and frequency.	Describe attraction and repulsion using the ideas of magnetic poles, and the difference between permanent and induced magnets. Explain the effects seen in a magnetic field including the strength and direction of the force. Describe the method for plotting a magnetic field using a compass and explain how the behaviour of a magnetic compass shows the Earth has a magnetic core.	Describe the current understanding of the solar system as part of the *Milky Way* galaxy. Explain that, at the start of a star's life cycle, the dust and gas drawn together by gravitational attraction causes fusion reactions.
		Use (after rearranging if needed) the equations for kinetic, gravitational and thermal energy stores. Use (after rearranging if needed) the equation for an elastic energy store.	Use (after rearranging if needed) the equation for current as a rate of flow of charge and be able to explain why the current is the same at each point in a single-loop (series) circuit.	Describe states of matter using the particle model and explain how mass is conserved when the state changes. Use diagrams to explain differences between particle arrangements in each state of matter.	Explain the historical stages in the development of modern atomic model and summarise new evidence which led to changes each time. Give a comparison between models, in particular plum pudding vs. nuclear atom.	Explain that weight is the force that acts on all objects with mass because of gravity. Use (after rearranging if needed) the weight equation. Describe the use of a newton-meter to measure weight, which is proportional to mass.	Explain the difference between speed and velocity, and use examples to show that motion in a circle involves constant speed but changing velocity. Plot and interpret distance-time graphs, finding velocity at specified points, using tangents if needed.	Use (after rearranging if needed) the wave equation. Identify amplitude and wavelength from diagrams. Describe methods for measuring wave speed including sound in air, ripples on water and waves in a solid. State that changes in wave properties when sound crosses boundaries are inter-related.	Describe how the magnetic effect of a current can be demonstrated. Draw the magnetic field patterns for a straight wire and a solenoid carrying current. State that the solenoid arrangement increases the strength of the magnetic field. Interpret diagrams of electromagnetic devices to explain how they work.	Describe how fusion reactions, which produce new elements, lead to an equilibrium between gravitational collapse and expansion due to heating. Describe the life cycle of a star including variations due to size. Briefly describe the production of elements heavier than iron during a supernova, which then distributes these elements through the universe.
		Use (after rearranging if needed) the equation for work done and be able to explain how this relates to current in a circuit.	Use (after rearranging if needed) the equation linking potential difference, current and resistance and be able to explain how a potential difference causes current to flow against resistance.	Explain the effect of changing the energy of a system (by heating or cooling) on the particles of that system, and link this to the state of matter.	Identify nuclear radiation from limited characteristics, explaining the differences between types. Choose an appropriate source for a particular application, linking to required properties.	Use free-body diagrams to describe interacting forces on an object. Calculate the resultant of two forces acting in a straight line. Use scale drawings to show the link between component forces at right angles and their resultant.	Use (after rearranging if needed) the equation for acceleration. Plot and interpret velocity-time graphs, finding acceleration using the gradient, and find area 'below the line' to calculate/estimate distance travelled.	Describe the effects of reflection, refraction, transmission and absorption at boundaries, using wave diagrams where appropriate. Use wave front diagrams to explain refraction in terms of changing speed at the boundary between materials. Describe an experiment to investigate the effect of surface on absorption or transmission of infra-red radiation.	Define the motor effect and Fleming's Left Hand Rule. Explain the factors that affect the size of the force acting on the conductor. Use (after rearranging if needed) the equation for the force on a conductor.	State that gravity provides the force which maintains circular orbits, for planets around the sun and satellites around planets. Describe the similarities and differences between planets, their moons and artificial satellites. State that velocity can change during a circular orbit while speed remains constant, and that the radius must change if speed changes.
		Use (after rearranging if needed) the equations for power and be able to explain how this relates to the transfer of energy between stores, giving examples.	Explain factors affecting the resistance of ohmic and non-ohmic components including wires, resistors, filament lamps and diodes. Describe an experiment to find the resistance of a component by measuring potential difference applied and the resulting current.	Use (after rearranging if needed) the specific heat capacity equation. Explain how to collect measurements when heating a sample that allow the specific heat capacity to be calculated.	Use names and symbols of common nuclei and particles to write balanced equations showing single alpha or beta decay. Describe the changes in mass and atomic number during nuclear decay.	Use (after rearranging if needed) the equation for work done. Describe the energy transfers between stores when work is done. Convert between joules and newton-metres.	Use (after rearranging if needed) the equation for uniform motion ($v2\text{-}u2 = 2as$). Explain the effects of air resistance on a falling object and state factors affecting how it reaches terminal velocity. Draw and interpret velocity-time graphs for objects that reach terminal velocity.	Describe processes which convert sound waves in air to waves in solids, such as those in the ear. Explain why these processes work over a limited frequency range and what this means human hearing is limited to 20Hz to 20kHz.	Explain that the force on a conductor in a magnetic field causes the rotation of a coil in an electric motor. Explain how a moving-coil loudspeaker and headphones work.	Describe qualitatively the red-shift effect, which supports the Big Bang theory by providing evidence for an expanding universe. Explain that although much about the universe is not yet understood, for example dark mass and dark energy, observations allow models to be improved.
		Use (after rearranging if needed) the equations for efficiency and be able to explain how this relates to dissipated (or 'wasted') energy, as well as how to reduce this: for example, by insulation.	Describe in detail the varying resistance of LDRs and thermistors, linking this to their possible applications.	Use (after rearranging if needed) the specific latent heat equation. Explain heating and cooling graphs that include a change of state.	Explain the concept of half-life and calculate the value for an unknown sample, given data in numerical or graphical form. Calculate the net decline, expressed as a ratio, of the activity of a sample after a specified number of half-lives. Explain that half-life varies widely between isotopes and is relevant to discussion of the risk a sample poses to the environment.	Explain the difference between elastic and inelastic deformation. Define the elastic limit. Use (after rearranging if needed) the force-extension equation.	Explain Newton's First Law and apply this to explain the motion of objects with uniform velocity. Define inertia.	Describe how wave behaviour in solids and liquids allows detection and exploration of structures hidden from direct observation. Explain the use of ultrasound in medical diagnosis and industrial situations as well as echo sounding for deep water investigation. Describe how information from P and S waves, linked to their characteristics, provides evidence about the Earth's structure.	Define the generator effect and explain the factors that affect the size and direction of the induced potential difference. State that an alternator induces ac and a dynamo dc, and interpret or draw graphs of potential difference against time for these. Explain how a moving-coil microphone works.	
		Describe advantages and disadvantages of various energy resources, to include their use for transport, heating and generating electricity, as well as patterns and trends in their use.	Describe the difference between series and parallel connections in a circuit. Explain how potential difference and current can be measured at various points in circuits. Calculate total resistance in a series circuit with several components.	Explain how the motion of particles in a gas is related to both its temperature and pressure. Explain that the pressure and temperature are related when volume is kept constant.	Explain the difference between irradiation and contamination, identifying which is appropriate in a given situation. Compare these effects and explain that peer review of studies into repeated samples gives the best basis for decisions.	Describe the difference between a linear and non-linear relationship, and calculate the spring constant if linear. Use (after rearranging if needed) the equation for elastic potential energy.	Explain Newton's Second Law in words. Use (after rearranging if needed) the equation. Define inertial mass. Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.	Describe the electromagnetic spectrum in order of energy or wavelength and give examples of the transfer of energy by EM waves. Describe the applications of different parts of the EM spectrum. Explain why each type is particularly appropriate for the application.	Explain the process and parts involved in a basic transformer. Use (after rearranging if needed) the turns ratio equation and describe transformers as step-up or step-down. State that for 100% efficiency power input would equal output, and use (after rearranging if needed) the transformer power equation.	
			Explain the difference between direct and alternating potential difference, and state standard UK values for mains supply.	Use (after rearranging if needed) Boyle's Law (pV=constant). Use the particle model to explain that increasing the pressure will reduce the volume if temperature is kept constant.	Explain that background radiation dose varies depending on location and occupation. Describe natural and artificial sources of background radiation. Describe uses of nuclear radiation including medical diagnosis and treatment.	Describe examples in which forces cause rotation. Use (after rearranging if needed) the equation for the moment of a force. Work out the overall effect of clockwise and anti-clockwise moments. Explain how levers and gears transmit the rotational effects of forces.	Explain Newton's Third Law and apply it to examples of equilibrium situations.	State the consequences of the absorption of electromagnetic waves including heating, ionisation or an induced alternating current, as well as longer term effects such as cancer from some wavelengths. Analyse data on the risks and consequences of exposure to radiation. Describe the emission of EM waves due to alternating currents and nuclear changes.	Use the previous equations to explain the advantages of power transmission at high potential differences.	
			Interpret and explain the connections in a UK mains plug, including colours of insulation and safety features.	Use the concept of work done to explain how exerting a force on a gas will lead to an increase in temperature.	Describe the process of nuclear fission, explaining why the parts of a nuclear reactor are important. Annotate a diagram as part of an explanation of a chain reaction. Define nuclear fusion.	Use (after rearranging if needed) the equation for fluid pressure. Use (after rearranging if needed) the pressure at depth equation. Describe the factors which influence floating and sinking. Describe a simple model of the Earth's atmosphere and atmospheric pressure, and why atmospheric pressure varies with height above a surface.	Define stopping distance as the sum of thinking and braking distance. Explain the factors that change thinking distance and state the range of typical values for reaction times, as well as describing experiments to measure this for a specific person. Interpret graphs and data for various situations relating to stopping distance.	Construct and interpret ray diagrams to illustrate the similarities and differences between convex and concave lenses. Label the features of a ray diagram. Use (after rearranging if needed) the magnification equation.		
			Use (after rearranging if needed) the equations for power and explain that the potential difference and current affect the rate of energy transfer.				Explain the factors that change braking distance and link this to implications for safety. Estimate the increase in stopping distance as speed increases. Explain the forces acting when a vehicle decelerates and how this leads to the transfer of energy between stores. Explain the dangers caused by large decelerations and estimate the forces involved in typical highway situations.	Distinguish between specular (linear) reflection and diffuse (scattering) reflection. Explain how the colour of an object is related to the different wavelengths (i.e. colours of light) which it absorbs and reflects. Explain the effect on light passing through filters.		
			Use (after rearranging if needed) the equations for energy transferred and explain the pathways involved in common household devices, as well as how their power ratings affect changes to energy stores.				Define momentum. Use (after rearranging if needed) the equation for momentum. State the principle of conservation of momentum when no external forces act, describing events and calculating changes using the equation. Use the impulse equation to link changes of momentum with an external force.	Describe a perfect black body in terms of absorption and emission. Explain that all objects emit radiation but that the intensity and wavelength distribution depends on the temperature. Compare the radiation absorbed with that emitted to show a net change, positive or negative. State the factors affecting absorption and emission and so the temperature of the Earth, and analyse data and diagrams on this process.		
			Give non-mathematical descriptions of the National Grid, explaining why step-up and -down transformers are needed for increased efficiency.							

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Old GCSE Grade	GCSE equivalent	1 Energy	2 Electricity	3 Particle model	4 Atomic structure	5a Forces	5b Motion	6 Waves	7 Magnetism and electromagnetism	8 Space physics
C	5 and 4	Describe energy transfers between stores and the pathways and processes involved.	Draw circuit diagrams using standard symbols.	Use the equation for density. State the measurements needed for density calculations.	Describe the components of the nuclear atom including typical accepted values. Describe differences between isotopes.	Give examples of scalar and vector quantities. Use arrows to show magnitude and direction for vectors. Give examples of contact and non-contact forces.	State the difference between distance and displacement, and express a displacement in terms of direction and magnitude. Recall typical values for speed. Describe the measurements needed (distance travelled, time taken) so speed can be calculated. Use (after rearranging if needed) the equation for speed.	Describe the difference between longitudinal and transverse waves, giving examples. Describe wave motion in terms of their amplitude, wavelength, frequency and period. Use the inverse relationship between period and frequency.	Describe attraction and repulsion using the ideas of magnetic poles. State the difference between permanent and induced magnets. Describe the effects seen in a magnetic field including the strength and direction of the force. Describe the method for plotting a magnetic field using a compass.	Describe the current understanding of the solar system as part of the Milky Way galaxy. State that, at the start of a star's life cycle, the dust and gas drawn together by gravitational attraction causes fusion reactions.
		Use the equations for kinetic, gravitational and thermal energy stores. Use the equation for an elastic energy store.	Use the equation for current as a rate of flow of charge and be able to explain why the current is the same at each point in a single-loop (series) circuit.	Describe states of matter using the particle model and state that mass is conserved when the state changes. Use diagrams to show differences between particle arrangements in each state of matter.	Describe the main stages in the development of modern atomic model. Give a comparison between models, in particular plum pudding vs. nuclear atom.	Define weight as the force that acts on all objects with mass because of gravity. Use the weight equation. Describe the use of a newton-meter to measure weight, which is proportional to mass.	State the difference between speed and velocity, and use simple examples to show that motion in a circle involves constant speed but changing velocity. Plot and interpret distance-time graphs, finding velocity at specified points.	Use the wave equation. Identify amplitude and wavelength from diagrams. Describe methods for measuring wave speed including sound in air, ripples on water and waves in a solid.	Describe how the magnetic effect of a current can be demonstrated. Draw the magnetic field patterns for a straight wire and a solenoid carrying current. State that the solenoid arrangement increases the strength of the magnetic field.	State that fusion reactions, which produce new elements, lead to an equilibrium between gravitational collapse and expansion due to heating. Briefly describe the life cycle of a star including variations due to size. State that elements heavier than iron are produced during a supernova, which then distributes these elements through the universe.
		Use the equation for work done and be able to explain how this relates to current in a circuit.	Use the equation linking potential difference, current and resistance and be able to explain how a potential difference causes current to flow against resistance.	Explain the effect of changing the energy of a system (by heating or cooling) on the particles of that system.	Identify nuclear radiation from limited characteristics. Choose an appropriate source for a particular application, linking to required properties.	Use free-body diagrams to describe interacting forces on an object. Calculate the resultant of two forces acting in a straight line.	Use the equation for acceleration. Plot and interpret velocity-time graphs, finding acceleration using the gradient, and estimate area 'below the line' to find distance travelled.	Describe the effects of reflection, refraction, transmission and absorption at boundaries, using wave diagrams where appropriate. Describe an experiment to investigate the effect of surface on absorption or transmission of infra-red radiation.	Define the motor effect and Fleming's Left Hand Rule. List the factors that affect the size of the force acting on the conductor. Use the equation for the force on a conductor.	State that gravity provides the force which maintains circular orbits, for planets around the sun and satellites around planets. Identify planets, their moons and artificial satellites by their characteristics.
		Use the equations for power and be able to explain how this relates to the transfer of energy between stores, giving examples.	Correctly describe wires, resistors, filament lamps and diodes as ohmic or non-ohmic components. Describe an experiment to find the resistance of a component by measuring potential difference applied and the resulting current.	Use the specific heat capacity equation. Describe how to collect measurements when heating a sample that allow the specific heat capacity to be calculated.	Interpret balanced equations of nuclear decay, describing the changes in mass and atomic number.	Use the equation for work done. Describe the energy transfers between stores when work is done. Convert between joules and newton-metres.	Use the equation for uniform motion (v2-u2 = 2as). State the effects of air resistance on a falling object and factors affecting how it reaches terminal velocity. Identify main features of velocity-time graphs for objects that reach terminal velocity.	Describe processes which convert sound waves in air to waves in solids, such as those in the ear. State that human hearing is limited to 20Hz to 20kHz.	State that the force on a conductor in a magnetic field causes the rotation of a coil in an electric motor. Describe briefly how a moving-coil loudspeaker and headphones work.	Describe qualitatively the red-shift effect, which supports the Big Bang theory by providing evidence for an expanding universe. State that although much about the universe is not yet understood, observations allow models to be improved.
		Use the equations for efficiency and be able to explain how this relates to dissipated (or 'wasted') energy.	Describe the varying resistance of LDRs and thermistors, linking this to their possible applications.	Use the specific latent heat equation. Identify change of state on a heating or cooling graph.	Explain the concept of half-life and calculate the value for an unknown sample, given data in numerical or graphical form. State that half-life varies widely between isotopes.	Describe the difference between elastic and inelastic deformation. Define the elastic limit. Use the force-extension equation.	State Newton's First Law and apply this to describe the motion of objects with uniform velocity. Define inertia.	Describe how wave behaviour in solids and liquids allows detection and exploration of structures hidden from direct observation. Define P and S waves. Describe the use of ultrasound in medical diagnosis and industrial situations as well as echo sounding for deep water investigation.	Define the generator effect and explain the factors that affect the size and direction of the induced potential difference. State that an alternator induces ac and a dynamo dc, and interpret or draw graphs of potential difference against time for these. Explain how a moving-coil microphone works.	
		Describe advantages and disadvantages of various energy resources, to include their use for transport, heating and generating electricity.	Describe the difference between series and parallel connections in a circuit. Explain how potential difference and current can be measured at various points in circuits. Calculate total resistance in a series circuit with several components.	Explain how the motion of particles in a gas is related to both its temperature and pressure.	Explain the difference between irradiation and contamination, identifying which is appropriate in a given situation. State that peer review of studies into repeated samples gives the best basis for decisions.	Describe a relationship as linear or non-linear, and calculate the spring constant if linear. Use the equation for elastic potential energy.	Explain Newton's Second Law in words and use the equation. Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.	Describe the electromagnetic spectrum in order of energy or wavelength and give examples of the transfer of energy by EM waves. Describe the applications of different parts of the EM spectrum.	Explain the process and parts involved in a basic transformer. Use (after rearranging if needed) the turns ratio equation and describe transformers as step-up or step-down. State that for 100% efficiency power input would equal output, and use (after rearranging if needed) the transformer power equation.	
			Explain the difference between direct and alternating potential difference, and state standard UK values for mains supply.	Use Boyle's Law (pV=constant). State that increasing the pressure will reduce the volume if temperature is kept constant.	State that background radiation dose varies depending on location and occupation. Describe natural and artificial sources of background radiation. Describe uses of nuclear radiation including medical diagnosis and treatment.	State examples in which forces cause rotation. Use the equation for the moment of a force. Work out the overall effect of clockwise and anti-clockwise moments. State that levers and gears transmit the rotational effects of forces.	State Newton's Third Law and apply it to simple examples of equilibrium situations.	State that absorption of electromagnetic waves causes heating, ionisation or an induced alternating current, as well as longer term effects such as cancer from some wavelengths. Describe the emission of EM waves due to alternating currents and nuclear changes.	State the advantages of power transmission at high potential differences.	
			Describe the connections in a UK mains plug, including colours of insulation and safety features.	Link the concept of work done to exerting a force on a gas. State that this will lead to an increase in temperature.	Describe the process of nuclear fission, and state the important parts of a nuclear reactor. Annotate a diagram as part of an explanation of a chain reaction. Define nuclear fusion.	Use the equation for fluid pressure. Use the pressure at depth equation. State the factors which influence floating and sinking. Describe a simple model of the Earth's atmosphere and atmospheric pressure.	Define stopping distance as the sum of thinking and braking distance. State the factors that change thinking distance and the range of typical values for reaction times. Describe experiments to measure this for a specific person.	Construct and interpret ray diagrams to illustrate the similarities and differences between convex and concave lenses. Label the features of a ray diagram. Use the magnification equation.		
			Use the equations for power and explain that the potential difference and current affect the rate of energy transfer.				State the factors that change braking distance and link this to implications for safety. Estimate the increase in stopping distance as speed increases. Identify the forces acting when a vehicle decelerates. State the dangers caused by large decelerations and estimate the forces involved in typical highway situations.	Define specular (linear) reflection and diffuse (scattering) reflection. Explain how the colour of an object is related to the different wavelengths (i.e. colours of light) which it absorbs and reflects. Describe the effect on light passing through filters.		
			Use the equations for energy transferred. Suggest the pathways involved in common household devices, and how their power ratings affect changes to energy stores.				Use the equation for momentum. State the principle of conservation of momentum when no external forces act.	Describe a perfect black body in terms of absorption and emission. Explain that all objects emit radiation but that the intensity and wavelength distribution depends on the temperature. Compare the radiation absorbed with that emitted to show a net change, positive or negative.		
			Give non-mathematical descriptions of the National Grid. State that step-up and -down transformers are needed for increased efficiency.							
			Explain the effects of static electricity, including attraction and repulsion, in terms of positive and negative charges. Describe the electric field around a charged object and draw a diagram to show the field pattern.							
D and E	3 and 2	Briefly describe energy transfers between stores and some of the pathways and processes involved.	Match components with the standard symbols.	Use the equation for density. Identify the measurements needed for density calculations.	Describe the components of the nuclear atom including typical accepted values. State the definition of an isotope.	Give examples of scalar and vector quantities. Label arrows to show magnitude and direction for vectors. Give examples of contact and non-contact forces.	Define distance and displacement, and express a displacement in terms of direction and magnitude. Recall typical values for speed. Use the equation for speed.	Describe longitudinal and transverse waves, giving examples. Describe wave motion in terms of their amplitude, wavelength, frequency and period.	Describe attraction and repulsion using the ideas of magnetic poles. Briefly describe the effects seen in a magnetic field. Describe the method for plotting a magnetic field using a compass.	Identify the solar system as part of the Milky Way galaxy. State that, at the start of a star's life cycle, the dust and gas drawn together by gravitational attraction causes fusion reactions.
		Use the equations for kinetic, gravitational and thermal energy stores. Use the equation for an elastic energy store.	Use the equation for current as a rate of flow of charge. State that the current is the same at each point in a single-loop (series) circuit.	Briefly describe states of matter using the particle model and state that mass is conserved when the state changes. Use diagrams to show differences between particle arrangements in each state of matter.	Describe the main stages in the development of modern atomic model. Give differences between plum pudding vs. nuclear atom.	Define weight as the force that acts on all objects with mass because of gravity. Use the weight equation. Describe the use of a newton-meter to measure weight.	Define speed and velocity. Plot distance-time graphs and identify their main features.	Use the wave equation. Identify amplitude and wavelength from diagrams. Briefly describe methods for measuring wave speed including sound in air, ripples on water and waves in a solid.	Describe how the magnetic effect of a current can be demonstrated. Label the magnetic field patterns for a straight wire and a solenoid carrying current. State that the solenoid arrangement increases the strength of the magnetic field.	State that fusion reactions in a star produce new elements. Identify events in the life cycle of a star including variations due to size. State that elements heavier than iron are produced during a supernova, which then distributes these elements through the universe.
		Use the equation for work done and state that this is linked to current in a circuit.	Use the equation linking potential difference, current and resistance. State that a potential difference causes current to flow against resistance.	Explain the effect of heating or cooling on the particles of a system.	Identify nuclear radiation from limited characteristics. Choose an appropriate source for a particular application.	Calculate the resultant of two forces acting in a straight line.	Use the equation for acceleration. Plot velocity-time graphs and identify their main features.	Identify reflection, refraction, transmission and absorption at boundaries, using wave diagrams where appropriate. Briefly describe an experiment to investigate the effect of surface on absorption or transmission of infra-red radiation.	HT only	State that gravity provides the force which maintains circular orbits, for planets around the sun and satellites around planets. Define planets, their moons and artificial satellites.
		Use the equations for power and be able to state that this describes the transfer of energy between stores, giving examples.	Correctly describe wires, resistors, filament lamps and diodes as ohmic or non-ohmic components. Describe how to measure potential difference applied and the resulting current.	Use the specific heat capacity equation. Identify values that allow the specific heat capacity to be calculated.	Interpret balanced equations of nuclear decay, describing the changes in mass and atomic number.	Use the equation for work done. State the energy transfers between stores when work is done. Convert between joules and newton-metres.	State the effects of air resistance on a falling object and factors affecting how it reaches terminal velocity. Identify main features of velocity-time graphs for objects that reach terminal velocity.	HT only	HT only	State that the red-shift effect provides evidence for an expanding universe, which supports the Big Bang Theory. State that although much about the universe is not yet understood, observations allow models to be improved.
		Use the equations for efficiency and be able to briefly explain how this relates to dissipated (or 'wasted') energy.	Describe the varying resistance of LDRs and thermistors and give examples of possible applications.	Use the specific latent heat equation. Label features on a heating or cooling graph.	Explain the concept of half-life. State that half-life varies widely between isotopes.	State the difference between elastic and inelastic deformation. Define the elastic limit. Use the force-extension equation.	State Newton's First Law and apply this to describe the motion of objects with uniform velocity.	HT only	HT only	
		Briefly describe advantages and disadvantages of various energy resources, to include their use for transport, heating and generating electricity.	Describe the difference between series and parallel connections in a circuit. Explain how potential difference and current can be measured.	State that the motion of particles in a gas is related to both its temperature and pressure.	State the difference between irradiation and contamination. State that peer review of studies into repeated samples gives the best basis for decisions.	Describe a relationship as linear or non-linear. Use the equation for elastic potential energy.	Use the equation. Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.	Describe the electromagnetic spectrum in order of energy or wavelength. Describe the applications of different parts of the EM spectrum.	HT only	
			State that mains supply is an alternating voltage while cells provide direct voltage. State standard UK values for mains supply.	Use Boyle's Law (pV=constant). State that increasing the pressure will reduce the volume if temperature is kept constant.	State that background radiation dose varies depending on location and occupation. Describe natural and artificial sources of background radiation. Describe uses of nuclear radiation including medical diagnosis and treatment.	State examples in which forces cause rotation. Use the equation for the moment of a force. State that levers and gears transmit the rotational effects of forces.	State Newton's Third Law.	State that absorption of electromagnetic waves can cause heating and ionisation, as well as longer term effects such as cancer from some wavelengths.	HT only	
			Describe the connections in a UK mains plug, including colours of insulation and safety features.	HT only	Describe the process of nuclear fission. Annotate a diagram as part of an explanation of a chain reaction. Define nuclear fusion.	Use the equation for fluid pressure. Describe a simple model of the Earth's atmosphere and atmospheric pressure.	Define stopping distance as the sum of thinking and braking distance. State the factors that change thinking distance and the range of typical values for reaction times.	Label the features of a ray diagram. Use the magnification equation.		
			Use the equations for power. State that the potential difference and current affect the rate of energy transfer.				State the factors that change braking distance and link this to implications for safety. Identify the forces acting when a vehicle decelerates. State the dangers caused by large decelerations.	Define specular (linear) reflection and diffuse (scattering) reflection. State that the colour of an object is related to the different wavelengths (i.e. colours of light) which it absorbs and reflects. Describe the effect on light passing through filters.		
			Use the equations for energy transferred. Suggest the pathways involved in common household devices.				HT only	Describe a perfect black body in terms of absorption and emission. State that all objects emit radiation but that the intensity and wavelength distribution depends on the temperature.		
			Give non-mathematical descriptions of the National Grid. State that step-up and -down transformers are needed for increased efficiency.							
			Explain the effects of static electricity, including attraction and repulsion. Describe or draw a diagram to show the electric field pattern.							
F and G	1	Identify energy stores and some of the pathways and processes involved.	Match components with the standard symbols.	Use the equation for density. Describe density in words.	Describe the components of the nuclear atom. State the definition of an isotope.	Give examples of scalar and vector quantities. Label arrows to show magnitude and direction for vectors. Give examples of contact and non-contact forces.	Define distance and displacement, and express a displacement in terms of direction and magnitude. Recall typical values for speed.	Define longitudinal and transverse waves, giving examples. Describe wave motion in terms of their amplitude, wavelength, frequency and period.	Describe attraction and repulsion using the ideas of magnetic poles. Briefly describe the effects seen in a magnetic field. Describe the method for plotting a magnetic field using a compass.	Identify the solar system as part of the Milky Way galaxy. State that dust and gas drawn together by gravitational attraction causes fusion reactions.
		Use the equations for kinetic, gravitational and thermal energy stores. Use the equation for an elastic energy store.	Use the equation for current as a rate of flow of charge. State that the current is the same at each point in a single-loop (series) circuit.	State that mass is conserved when the state changes. Use diagrams to show differences between particle arrangements in each state of matter.	Give differences between plum pudding vs. nuclear atom.	Define weight as the force that acts on all objects with mass because of gravity. Describe the use of a newton-meter to measure weight.	Define speed and velocity. Identify the main features of a distance-time graph.	Identify amplitude and wavelength from diagrams. Briefly describe methods for measuring wave speed including sound in air, ripples on water and waves in a solid.	Describe how the magnetic effect of a current can be demonstrated. Label the magnetic field patterns for a straight wire and a solenoid carrying current.	State that fusion reactions in a star produce new elements. Identify events in the life cycle of a star including variations due to size.
		Use the equation for work done.	Use the equation linking potential difference, current and resistance. State that a potential difference causes current.	State the effect of heating or cooling on the particles of a system.	Identify nuclear radiation from limited characteristics.	Calculate the resultant of two forces acting in a straight line.	Identify the main features of a velocity-time graph.	Identify reflection, refraction, transmission and absorption at boundaries, using wave diagrams where appropriate.	HT only	State that gravity provides the force which maintains circular orbits, for planets around the sun and satellites around planets. Define planets, their moons and artificial satellites.
		Use the equations for power. State that the transfer of energy between stores can be fast or slow.	Correctly describe wires, resistors, filament lamps and diodes as ohmic or non-ohmic components.	Use the specific heat capacity equation.	State changes in mass and atomic number for each kind of nuclear decay.	State the energy transfers between stores when work is done. Convert between joules and newton-metres.	State factors affecting how a falling object reaches terminal velocity.	HT only	HT only	State that the red-shift effect provides evidence for an expanding universe, which supports the Big Bang Theory.
		Use the equations for efficiency and state that this relates to dissipated (or 'wasted') energy.	State factors affecting resistance of LDRs and thermistors and give examples of possible applications.	Label features on a heating or cooling graph.	State the definition of half-life. State that half-life varies widely between isotopes.	State the difference between elastic and inelastic deformation. Label the elastic limit on a graph.	State Newton's First Law. Describe the motion of objects with uniform velocity.	HT only	HT only	
		Identify advantages and disadvantages of various energy resources. Describe their use for transport, heating and generating electricity.	Describe the difference between series and parallel connections in a circuit. State how potential difference and current can be measured.	State that the motion of particles in a gas is related to both its temperature and pressure.	State the difference between irradiation and contamination. State that peer review of studies into repeated samples gives the best basis for decisions.	Describe a relationship as linear or non-linear.	Estimate the speed, accelerations and forces involved in large accelerations for everyday road transport.	Describe the electromagnetic spectrum in order of energy or wavelength. Link applications to specific parts of the EM spectrum.	HT only	
			State that mains supply is an alternating voltage while cells provide direct voltage. State standard UK values for mains supply.	State that increasing the pressure will reduce the volume if temperature is kept constant.	Describe natural and artificial sources of background radiation. Describe uses of nuclear radiation including medical diagnosis and treatment.	State examples in which forces cause rotation. State that levers and gears transmit the rotational effects of forces.	State Newton's Third Law.	State that absorption of electromagnetic waves can cause heating and ionisation, as well as longer term effects such as cancer from some wavelengths.	HT only	
			Describe the connections in a UK mains plug, including colours of insulation and safety features.	HT only	Define nuclear fission. Define nuclear fusion.	Describe a simple model of the Earth's atmosphere and atmospheric pressure.	Define stopping distance as the sum of thinking and braking distance. State the factors that change thinking distance and the range of typical values for reaction times.	Label the features of a ray diagram.		
			State that the potential difference and current affect the rate of energy transfer.				State the factors that change braking distance. Identify the forces acting when a vehicle decelerates. State the dangers caused by large decelerations.	State that the colour of an object is related to the different wavelengths (i.e. colours of light) which it absorbs and reflects. Describe the effect on light passing through filters.		
			Use the equations for energy transferred.				HT only	Describe a perfect black body in terms of absorption and emission. State that all objects emit radiation but that the intensity and wavelength distribution depends on the temperature.		
			Give simple non-mathematical descriptions of the parts of the National Grid.							
			Explain the effects of static electricity, including attraction and repulsion.							