GCSE Physics Separates: PERSONALISED LEARNING CHECKLIST				
	Red	Amber	Green	Revised Tick ☑
Area of Study: Energy - Changes in Energy				
Students should be able to calculate the amount of energy associated with a moving object, a stretched spring and an object raised above ground level.				
The kinetic energy of a moving object can be calculated using the equation: $E_K = \frac{1}{2} m v^2$				
The amount of elastic potential energy stored in a stretched spring can be calculated using the equation: $E_e = \frac{1}{2} k e^2$				
The amount of gravitational potential energy gained by an object raised above ground level can be calculated using the equation: E=mgh				
Gravitational field strength, g, in newtons per kilogram, N/kg (In any calculation the value of the gravitational field strength (g) will be given.) height, h, in metres, m				
	Red	Amber	Green	Revised Tick ☑
Area of Study: Energy - Energy changes in systems				
The amount of energy stored in or released from a system as its temperature changes can be calculated using the equation: $\Delta E = m c \Delta \theta$				
The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.				
	Red	Amber	Green	Revised

PERSONALISED LEARNING CHECKLISTS

	Red	Amber	Green	Tick ☑
Area of Study: Energy - Power				
Power is defined as the rate at which energy is transferred or the rate at which work is done. P = E/t P = W/t				
An energy transfer of 1 joule per second is equal to a power of 1 watt.				
Students should be able to give examples that illustrate the definition of power eg comparing two electric motors that both lift the same weight through the same height but one does it faster than the other.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Energy - Conservation and dissipation of energy				
Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed.				
Students should be able to describe with examples where there are energy transfers in a closed system, that there is no net change to the total energy.				
Students should be able to describe, with examples, how in all system changes energy is dissipated, so that it is stored in less useful ways. This energy is often described as being ‘wasted’.				
Students should be able to explain ways of reducing unwanted energy transfers, for example through lubrication and the use of thermal insulation.				
The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.				
Students should be able to describe how the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Energy - Efficiency				
The energy efficiency for any energy transfer can be calculated				

PERSONALISED LEARNING CHECKLISTS

using the equation: $$efficiency = \frac{useful...energy...output...transfer}{Total...input...energy...transfer}$$				
Efficiency may also be calculated using the equation: $$efficiency = \frac{useful...power...output}{Total...power...input}$$				
Students should be able to describe ways to increase the efficiency of an intended energy transfer.				
The main energy resources available for use on Earth include: fossil fuels (coal, oil and gas), nuclear fuel, bio-fuel, wind, hydroelectricity, geothermal, the tides, the Sun and water waves.				
A renewable energy resource is one that is being (or can be) replenished as it is used.				
The uses of energy resources include: transport, electricity generation and heating.				
describe the main energy sources available				
distinguish between energy resources that are renewable and energy resources that are non-renewable				
compare ways that different energy resources are used, the uses to include transport, electricity generation and heating				
understand why some energy resources are more reliable than others				
describe the environmental impact arising from the use of different energy resources				
explain patterns and trends in the use of energy resources.				
consider the environmental issues that may arise from the use of different energy resources				
show that science has the ability to identify environmental issues arising from the use of energy resources but not always the				

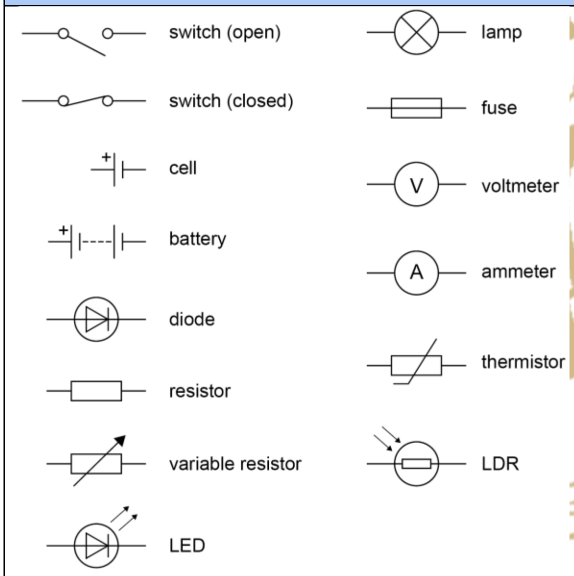
power to deal with the issues because of political, social, ethical or economic considerations.				

I am most confident with the following topic/topics:

I have struggled most with the following topic/topics:

	Red	**Amber**	**Green**	**Revised** Tick ☑

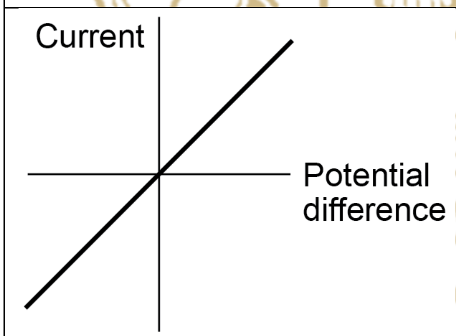
Area of Study: Electricity – Standard Circuit Diagram Symbols

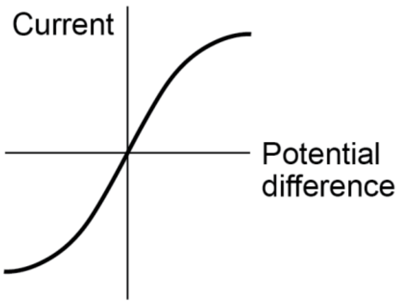
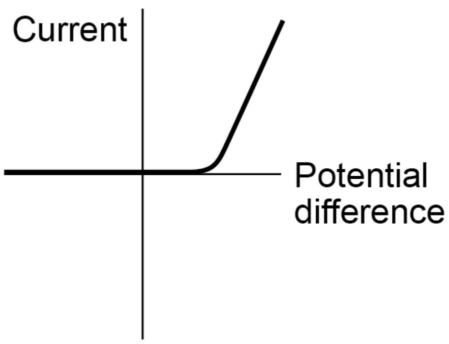


Students should be able to draw and interpret circuit diagrams.				
	Red	**Amber**	**Green**	**Revised** Tick ☑

Area of Study: Electricity – Electrical charge and current

For electrical charge to flow through a closed circuit the circuit must include a source of potential difference.				
Electric current is a flow of electrical charge. The size of the electric current is the rate of flow of electrical charge. Charge flow, current and time are linked by the equation: $Q = It$				
A current has the same value at any point in a single closed loop.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Electricity –Current, resistance and potential difference				
The current (I) through a component depends on both the resistance (R) of the component and the potential difference (V) across the component. The greater the resistance of the component the smaller the current for a given potential difference (pd) across the component.				
Questions will be set using the term potential difference. Students will gain credit for the correct use of either potential difference or voltage.				
Current, potential difference or resistance can be calculated using the equation: V = IR				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electricity – Resistors				
Students should be able to explain that, for some resistors, the value of R remains constant but that in others it can change as the current changes.				
The current through an ohmic conductor (at a constant temperature) is directly proportional to the potential difference across the resistor. This means that the resistance remains constant as the current changes.				
				
The resistance of components such as lamps, diodes, thermistors and LDRs is not constant; it changes with the current through the component.				
The resistance of a filament lamp increases as the temperature of the filament increases.				

				
The current through a diode flows in one direction only. The diode has a very high resistance in the reverse direction. 				
The resistance of a thermistor decreases as the temperature increases.				
The applications of thermistors in circuits eg a thermostat is required.				
The resistance of an LDR decreases as light intensity increases.				
The application of LDRs in circuits eg switching lights on when it gets dark is required.				
explain the design and use of a circuit to measure the resistance of a component by measuring the current through, and potential difference across, the component				
draw an appropriate circuit diagram using correct circuit symbols.				

Students should be able to use graphs to explore whether circuit elements are linear or non-linear and relate the curves produced to their function and properties.				
	Red	Amber	Green	Revised Tick ☑
Area of Study: Electricity – Series and parallel circuits				
There are two ways of joining electrical components, in series and in parallel. Some circuits include both series and parallel parts.				
For components connected in series: • there is the same current through each component • the total potential difference of the power supply is shared between the components • the total resistance of two components is the sum of the resistance of each component. $R_T = R_1 + R_2$				
For components connected in parallel: • the potential difference across each component is the same • the total current through the whole circuit is the sum of the currents through the separate components • the total resistance of two resistors is less than the resistance of the smallest individual resistor.				
use circuit diagrams to construct and check series and parallel circuits that include a variety of common circuit components				
describe the difference between series and parallel circuits				
explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance				
explain the design and use of dc series circuits for measurement and testing purposes				
calculate the currents, potential differences and resistances in dc				

series circuits				
solve problems for circuits which include resistors in series using the concept of equivalent resistance.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electricity – Direct and alternating potential difference				
Mains electricity is an ac supply. In the United Kingdom the domestic electricity supply has a frequency of 50 Hz and is about 230 V.				
Students should be able to explain the difference between direct and alternating potential difference.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electricity – Mains Electricity				
Most electrical appliances are connected to the mains using three core cable.				
The insulation covering each wire is colour coded for easy identification: live wire – brown neutral wire – blue earth wire – green and yellow stripes.				
The live wire carries the alternating potential difference from the supply. The neutral wire completes the circuit. The earth wire is a safety wire to stop the appliance becoming live.				
The potential difference between the live wire and earth (0 V) is about 230 V. The neutral wire is at, or close to, earth potential (0 V). The earth wire is at 0 V, it only carries a current if there is a fault.				
• that a live wire may be dangerous even when a switch in the mains circuit is open • the dangers of providing any connection between the live wire and earth.				

I am most confident with the following topic/topics:

I have struggled most with the following topic/topics:

	Red	Amber	Green	Revised Tick ☑
Area of Study: The Particle Model – Density of materials				
The density of a material is defined by the equation: $\rho = \frac{m}{V}$				
The particle model can be used to explain • the different states of matter • differences in density.				
Students should be able to recognise/draw simple diagrams to model the difference between solids, liquids and gases.				
Students should be able to explain the differences in density between the different states of matter in terms of the arrangement of atoms or molecules.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model – Changes of state				
Students should be able to describe how, when substances change state (melt, freeze, boil, evaporate, condense or sublimate), mass is conserved.				
Changes of state are physical changes which differ from chemical changes because the material recovers its original properties if the change is reversed.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model – Internal Energy				
Energy is stored inside a system by the particles (atoms and molecules) that make up the system. This is called internal energy.				

Internal energy is the total kinetic energy and potential energy of all the particles (atoms and molecules) that make up a system.				
Heating changes the energy stored within the system by increasing the energy of the particles that make up the system. This either raises the temperature of the system or produces a change of state.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model –Temperature Changes in a system and specific heat capacity				
If the temperature of the system increases, the increase in temperature depends on the mass of the substance heated, the type of material and the energy input to the system.				
The following equation applies: $\Delta E = m\,c\,\Delta\theta$				
The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model – Changes of heat and specific latent heat				
The energy needed for a substance to change state is called latent heat. When a change of state occurs, the energy supplied changes the energy stored (internal energy) but not the temperature.				
The specific latent heat of a substance is the amount of energy required to change the state of one kilogram of the substance with no change in temperature.				
energy for a change of state = mass × specific latent heat $E = mL$				
Specific latent heat of fusion – change of state from solid to liquid				
Specific latent heat of vaporisation – change of state from liquid to vapour				
Students should be able to interpret heating and cooling graphs that include changes of state.				

Students should be able to distinguish between specific heat capacity and specific latent heat.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model – Particle motion in gases				
The molecules of a gas are in constant random motion. The temperature of the gas is related to the average kinetic energy of the molecules.				
Changing the temperature of a gas, held at constant volume, changes the pressure exerted by the gas.				
explain how the motion of the molecules in a gas is related to both its temperature and its pressure				
explain qualitatively the relation between the temperature of a gas and its pressure at constant volume.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model – Pressure in gases (physics Only)				
A gas can be compressed or expanded by pressure changes. The pressure produces a net force at right angles to the wall of the gas container (or any surface).				
Students should be able to use the particle model to explain how increasing the volume in which a gas is contained, at constant temperature, can lead to a decrease in pressure.				
For a fixed mass of gas held at a constant temperature: pressure × volume = constant $pV = k$				
Students should be able to calculate the change in the pressure of a gas or the volume of a gas (a fixed mass held at constant temperature) when either the pressure or volume is increased or decreased.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: The Particle Model – Increasing the pressure of a gas (physics only) (HT only)				
Work is the transfer of energy by a force.				

Doing work on a gas increases the internal energy of the gas and can cause an increase in the temperature of the gas.				
Students should be able to explain how, in a given situation eg a bicycle pump, doing work on an enclosed gas leads to an increase in the temperature of the gas.				
I am most confident with the following topic/topics: ***I have struggled most with the following topic/topics:***				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Atomic Structure – The structure of an atom				
Atoms are very small, having a radius of about 1×10^{-10} metres				
The basic structure of an atom is a positively charged nucleus composed of both protons and neutrons surrounded by negatively charged electrons.				
The radius of a nucleus is less than 1/10000 of the radius of an atom. Most of the mass of an atom is concentrated in the nucleus.				
The electrons are arranged at different distances from the nucleus (different energy levels). The electron arrangements may change with the absorption of electromagnetic radiation (move further from the nucleus; a higher energy level) or by the emission of electromagnetic radiation (move closer to the nucleus; a lower energy level).				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Atomic Structure – Mass number, atomic number and isotopes				
In an atom the number of electrons is equal to the number of protons in the nucleus. Atoms have no overall electrical charge.				
The All atoms of a particular element have the same number of protons.				

number of protons in an atom of an element is called its atomic number.				
The total number of protons and neutrons in an atom is called its mass number.				
Atoms can be represented as shown in this example: (Mass number) 23 (Atomic number) 11 $^{23}_{11}Na$				
Atoms of the same element can have different numbers of neutrons; these atoms are called isotopes of that element.				
Atoms turn into positive ions if they lose one or more outer electron(s).				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Atomic Structure – The development of the model of the atom (common content with chemistry)				
Before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided.				
The discovery of the electron led to the plum pudding model of the atom. The plum pudding model suggested that the atom is a ball of positive charge with negative electrons embedded in it.				
The results from the alpha particle scattering experiment led to the conclusion that the mass of an atom was concentrated at the centre (nucleus) and that the nucleus was charged. This nuclear model replaced the plum pudding model.				
Niels Bohr adapted the nuclear model by suggesting that electrons orbit the nucleus at specific distances. The theoretical calculations of Bohr agreed with experimental observations.				
Later experiments led to the idea that the positive charge of any nucleus could be subdivided into a whole number of smaller particles, each particle having the same amount of positive charge. The name proton was given to these particles.				
The experimental work of James Chadwick provided the evidence to show the existence of neutrons within the nucleus. This was about 20 years after the nucleus became an accepted scientific idea.				

Students should be able to describe: • why the new evidence from the scattering experiment led to a change in the atomic model • the difference between the plum pudding model of the atom and the nuclear model of the atom.				
	Red	**Amber**	**Green**	**Revised** Tick ☑

Area of Study: Atomic Structure – Radioactive decay and nuclear radiation

Some atomic nuclei are unstable. The nucleus gives out radiation as it changes to become more stable. This is a random process called radioactive decay.				
Activity is the rate at which a source of unstable nuclei decays.				
Activity is measured in becquerel (Bq).				
Count-rate is the number of decays recorded each second by a detector (eg Geiger-Muller tube).				
The nuclear radiation emitted may be: • an alpha particle (α) – this consists of two neutrons and two protons, it is the same as a helium nucleus, • a beta particle (β) – a high speed electron ejected from the nucleus as a neutron turns into a proton, • a gamma ray (γ) – electromagnetic radiation from the nucleus, • a neutron (n).				
Know how penetrating the types of radiation are for materials, range in air and ionising power.				
	Red	**Amber**	**Green**	**Revised** Tick ☑

Area of Study: Atomic Structure – Nuclear equations

Nuclear equations are used to represent radioactive decay.				
In a nuclear equation an alpha particle may be represented by the symbol: ${}^{4}_{2}He$ and a beta particle by the symbol: ${}^{0}_{-1}e$				

PERSONALISED LEARNING CHECKLISTS

The emission of the different types of nuclear radiation may cause a change in the mass and /or the charge of the nucleus. For example: $^{219}_{86}\text{radon} \longrightarrow {}^{215}_{84}\text{polonium} + {}^{4}_{2}\text{He}$ So alpha decay causes both the mass and charge of the nucleus to decrease.				
$^{14}_{6}\text{carbon} \longrightarrow {}^{14}_{7}\text{nitrogen} + {}^{0}_{-1}\text{e}$ So beta decay does not cause the mass of the nucleus to change but does cause the charge of the nucleus to increase.				
Students should be able to use the names and symbols of common nuclei and particles to write balanced equations that show single alpha (α) and beta (β) decay. This is limited to balancing the atomic numbers and mass numbers.				
The emission of a gamma ray does not cause the mass or the charge of the nucleus to change.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Atomic Structure – Radiative contamination				
Radioactive contamination is the unwanted presence of materials containing radioactive atoms on other materials. The hazard from contamination is due to the decay of the contaminating atoms. The type of radiation emitted affects the level of hazard.				
Irradiation is the process of exposing an object to nuclear radiation. The irradiated object does not become radioactive.				
Students should be able to compare the hazards associated with contamination and irradiation.				
Suitable precautions must be taken to protect against any hazard that the radioactive source used in the process of irradiation may present.				
Students should understand that it is important for the findings of studies into the effects of radiation on humans to be published and shared with other scientists so that the findings can be checked by peer review.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Atomic Structure – Background radiation				

Background radiation is around us all of the time. It comes from: • natural sources such as rocks and cosmic rays from space • man-made sources such as the fallout from nuclear weapons testing and nuclear accidents. The level of background radiation and radiation dose may be affected by occupation and/or location.				
Radiation dose is measured in sieverts (Sv) 1000 millisieverts (mSv) = 1 sievert (Sv) Students will not need to recall the unit of radiation dose.				
	Red	**Amber**	**Green**	**Revised** Tick ☑

Area of Study: Atomic Structure – Different half-lives of radioactive isotopes

Radioactive isotopes have a very wide range of half-life values.				
Students should be able to explain why the hazards associated with radioactive material differ according to the half-life involved.				
	Red	**Amber**	**Green**	**Revised** Tick ☑

Area of Study: Atomic Structure – Uses of nuclear radiation

Nuclear radiations are used in medicine for the: • exploration of internal organs • control or destruction of unwanted tissue.				
Students should be able to: • describe and evaluate the uses of nuclear radiations for exploration of internal organs, and for control or destruction of unwanted tissue • evaluate the perceived risks of using nuclear radiations in relation to given data and consequences.				
	Red	**Amber**	**Green**	**Revised** Tick ☑

Area of Study: Atomic Structure – Nuclear fission

Nuclear fission is the splitting of a large and unstable nucleus (eg uranium or plutonium).				
Spontaneous fission is rare. Usually, for fission to occur the unstable nucleus must first absorb a neutron.				
The nucleus undergoing fission splits into two smaller nuclei, roughly equal in size, and emits two or three neutrons plus gamma rays. Energy is released by the fission reaction.				
All of the fission products have kinetic energy.				
The neutrons may go on to start a chain reaction.				
The chain reaction is controlled in a nuclear reactor to control the energy released. The explosion caused by a nuclear weapon is caused by an uncontrolled chain reaction.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Atomic Structure – Nuclear fusion				
Nuclear fusion is the joining of two light nuclei to form a heavier nucleus. In this process some of the mass may be converted into the energy of radiation.				
I am most confident with the following topic/topics: ***I have struggled most with the following topic/topics:***				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Forces – scalar and vector qualities				
Scalar quantities have magnitude only. Vector quantities have magnitude and an associated direction.				
A vector quantity may be represented by an arrow. The length of the arrow represents the magnitude, and the direction of the arrow the direction of the vector quantity.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Forces – Contact and non-contact forces				
A force is a push or pull that acts on an object due to the interaction with another object. All forces between objects are either: • contact forces – the objects are physically touching • non-contact forces – the objects are physically separated.				
Examples of contact forces include friction, air resistance, tension and normal contact force.				
Examples of non-contact forces are gravitational force, electrostatic force and magnetic force.				
Force is a vector quantity.				
Students should be able to describe the interaction between pairs of objects which produce a force on each object. The forces to be represented as vectors.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Forces – Gravity				
Weight is the force acting on an object due to gravity. The force of gravity close to the Earth is due to the gravitational field around the Earth.				
The weight of an object depends on the gravitational field strength at the point where the object is.				
The weight of an object can be calculated using the equation: weight = mass × gravitational field strength				
The weight of an object may be considered to act at a single point referred to as the object's 'centre of mass'.				
The weight of an object and the mass of an object are directly proportional.				
Weight is measured using a calibrated spring-balance (a Newton meter).				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Forces – Resultant forces				
A number of forces acting on an object may be replaced by a single force that has the same effect as all the original forces acting together. This single force is called the resultant force. Students should be able to calculate the resultant of two forces that act in a straight line.				
describe examples of the forces acting on an isolated object or system				
use free body diagrams to describe qualitatively examples where several forces lead to a resultant force on an object, including balanced forces when the resultant force is zero.				
A single force can be resolved into two components acting at right angles to each other. The two component forces together have the same effect as the single force.				
Students should be able to use vector diagrams to illustrate resolution of forces, equilibrium situations and determine the resultant of two forces, to include both magnitude and direction (scale drawings only).				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Forces – Work done and energy transfer				
When a force causes an object to move through a distance work is done on the object. So a force does work on an object when the force causes a displacement of the object.				
The work done by a force on an object can be calculated using the equation: work done = force × distance moved along the line of action				
One joule of work is done when a force of one newton causes a displacement of one metre. 1 joule = 1 newton-metre				
Students should be able to describe the energy transfer involved when work is done.				

Students should be able to convert between newton-metres and joules.				
Work done against the frictional forces acting on an object causes a rise in the temperature of the object.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Forces – Forces and elasticity				
Students should be able to: • give examples of the forces involved in stretching, bending or compressing an object • explain why, to change the shape of an object (by stretching, bending or compressing), more than one force has to be applied – this is limited to stationary objects only • describe the difference between elastic deformation and inelastic deformation caused by stretching forces.				
The extension of an elastic object, such as a spring, is directly proportional to the force applied, provided that the limit of proportionality is not exceeded.				
force = spring constant × extension				
A force that stretches (or compresses) a spring does work and elastic potential energy is stored in the spring. Provided the spring is not inelastically deformed, the work done on the spring and the elastic potential energy stored are equal.				
Students should be able to: • describe the difference between a linear and non-linear relationship between force and extension • calculate a spring constant in linear cases				
interpret data from an investigation of the relationship between force and extension				
calculate work done in stretching (or compressing) a spring (up to the limit of proportionality) using the equation: $E_E = \frac{1}{2} k e^2$				

PERSONALISED LEARNING CHECKLISTS

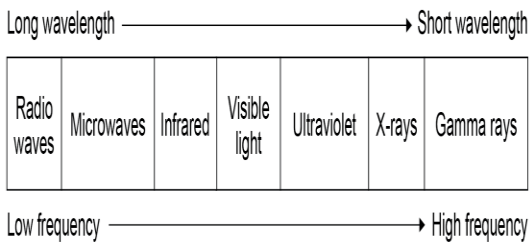
Students should be able to calculate relevant values of stored energy and energy transfers.				
I am most confident with the following topic/topics: ***I have struggled most with the following topic/topics:***				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Waves – Transverse and longitudinal waves				
Waves may be either transverse or longitudinal.				
The ripples on a water surface are an example of a transverse wave.				
Longitudinal waves show areas of compression and rarefaction.				
Sound waves travelling through air are longitudinal.				
Students should be able to describe the difference between longitudinal and transverse waves.				
Students should be able to describe evidence that, for both ripples on a water surface and sound waves in air, it is the wave and not the water or air itself that travels.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Waves – Properties of waves				
Students should be able to describe wave motion in terms of their amplitude, wavelength, frequency and period.				
The amplitude of a wave is the maximum displacement of a point on a wave away from its undisturbed position.				
The wavelength of a wave is the distance from a point on one wave to the equivalent point on the adjacent wave.				
The frequency of a wave is the number of waves passing a point each second.				
Tf = 1				

The wave speed is the speed at which the energy is transferred (or the wave moves) through the medium.				
All waves obey the wave equation: wave speed = frequency × wavelength $v = f\lambda$				
identify amplitude and wavelength from given diagrams				
describe a method to measure the speed of sound waves in air				
describe a method to measure the speed of ripples on a water surface.				
Students should be able to show how changes in velocity, frequency and wavelength, in transmission of sound waves from one medium to another, are inter-related.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Reflections of waves (Physics Only)				
Waves can be reflected at the boundary between two different materials.				
Waves can be absorbed or transmitted at the boundary between two different materials.				
Students should be able to construct ray diagrams to illustrate the reflection of a wave at a surface.				
Students should be able to describe the effects of reflection, transmission and absorption of waves at material interfaces.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Sound waves (Physics Only) (HT only)				
Sound waves can travel through solids causing vibrations in the solid.				
Within the ear, sound waves cause the ear drum and other parts to vibrate which causes the sensation of sound. The conversion of sound waves to vibrations of solids works over a limited frequency range. This restricts the limits of human hearing.				
describe, with examples, processes which convert wave disturbances between sound waves and vibrations in solids. Examples may include the effect of sound waves on the ear drum				

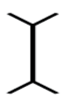
explain why such processes only work over a limited frequency range and the relevance of this to human hearing.				
Students should know that the range of normal human hearing is from 20 Hz to 20 kHz.				
	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Waves for detection and exploration (Physics Only) (HT only)				
Students should be able to explain in qualitative terms, how the differences in velocity, absorption and reflection between different types of wave in solids and liquids can be used both for detection and exploration of structures which are hidden from direct observation.				
Ultrasound waves have a frequency higher than the upper limit of hearing for humans. Ultrasound waves are partially reflected when they meet a boundary between two different media. The time taken for the reflections to reach a detector can be used to determine how far away such a boundary is. This allows ultrasound waves to be used for both medical and industrial imaging.				
Seismic waves are produced by earthquakes. P-waves are longitudinal, seismic waves. P-waves travel at different speeds through solids and liquids. S-waves are transverse, seismic waves. S-waves cannot travel through a liquid. P-waves and S-waves provide evidence for the structure and size of the Earth's core.				
Echo sounding, using high frequency sound waves is used to detect objects in deep water and measure water depth.				
Students should be aware that the study of seismic waves provided new evidence that led to discoveries about parts of the Earth which are not directly observable.				
	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Types of Electromagnetic waves				
Electromagnetic waves are transverse waves that transfer energy from the source of the waves to an absorber.				
Electromagnetic waves form a continuous spectrum and all types of electromagnetic wave travel at the same velocity through a vacuum (space) or air.				

The waves that form the electromagnetic spectrum are grouped in terms of their wavelength and their frequency. Going from long to short wavelength (or from low to high frequency) the groups are: radio, microwave, infrared, visible light (red to violet), ultraviolet, Xrays and gamma rays.				
				
Our eyes only detect visible light and so detect a limited range of electromagnetic waves.				
Students should be able to give examples that illustrate the transfer of energy by electromagnetic waves.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Waves – Properties of electromagnetic waves 1				
(HT only) Different substances may absorb, transmit, refract or reflect electromagnetic waves in ways that vary with wavelength.				
(HT only) Some effects, for example refraction, are due to the difference in velocity of the waves in different substances.				
Students should be able to construct ray diagrams to illustrate the refraction of a wave at the boundary between two different media.				
(HT only) Students should be able to use wave front diagrams to explain refraction in terms of the change of speed that happens when a wave travels from one medium to a different medium.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Waves – Properties of electromagnetic waves 2				
(HT only) Radio waves can be produced by oscillations in electrical circuits.				

(HT only) When radio waves are absorbed they may create an alternating current with the same frequency as the radio wave itself, so radio waves can themselves induce oscillations in an electrical circuit.				
Changes in atoms and the nuclei of atoms can result in electromagnetic waves being generated or absorbed over a wide frequency range. Gamma rays originate from changes in the nucleus of an atom.				
Ultraviolet waves, X-rays and gamma rays can have hazardous effects on human body tissue. The effects depend on the type of radiation and the size of the dose. Radiation dose (in sieverts) is a measure of the risk of harm resulting from an exposure of the body to the radiation.				
Ultraviolet waves can cause skin to age prematurely and increase the risk of skin cancer. X-rays and gamma rays are ionizing radiation that can cause the mutation of genes and cancer.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Uses and applications of electromagnetic waves				
Electromagnetic waves have many practical applications. For example: • radio waves – television and radio • microwaves – satellite communications, cooking food • infrared – electrical heaters, cooking food, infrared cameras • visible light – fibre optic communications • ultraviolet – energy efficient lamps, sun tanning • X-rays and gamma rays – medical imaging and treatments.				
(HT only) Students should be able to give brief explanations why each type of electromagnetic wave is suitable for the practical application.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Lenses (Physics only)				
A lens forms an image by refracting light. In a convex lens, parallel rays of light are brought to a focus at the principal focus. The distance from the lens to the principal focus is called the				

focal length. Ray diagrams are used to show the formation of images by convex and concave lenses.				
The image produced by a convex lens can be either real or virtual. The image produced by a concave lens is always virtual.				
Students should be able to construct ray diagrams to illustrate the similarities and differences between convex and concave lenses.				
The magnification produced by a lens can be calculated using the equation: $M = \frac{I_h}{O_h}$				
Magnification is a ratio and so has no units. Image height and object height should both be measured in either mm or cm.				
In ray diagrams a convex lens will be represented by: 				
A concave lens will be represented by: 				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Waves – Visible Light (Physics only)				
Each colour within the visible light spectrum has its own narrow band of wavelength and frequency.				
Reflection from a smooth surface in a single direction is called specular reflection. Reflection from a rough surface causes scattering: this is called diffuse reflection.				

	Red	Amber	Green	Revised Tick ☑
Colour filters work by absorbing certain wavelengths (and colour) and transmitting other wavelengths (and colour).				
The colour of an opaque object is determined by which wavelengths of light are more strongly reflected. Wavelengths that are not reflected are absorbed. If all wavelengths are reflected equally the object appears white. If all wavelengths are absorbed the objects appears black.				
Objects that transmit light are either transparent or translucent.				
how the colour of an object is related to the differential absorption, transmission and reflection of different wavelengths of light by the object				
the effect of viewing objects through filters or the effect on light of passing through filters				
why an opaque object has a particular colour.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Waves – Emission and absorption of infrared radiation				
All bodies (objects), no matter what temperature, emit and absorb infrared radiation. The hotter the body, the more infrared radiation it radiates in a given time.				
A perfect black body is an object that absorbs all of the radiation incident on it. A black body does not reflect or transmit any radiation. Since a good absorber is also a good emitter, a perfect black body would be the best possible emitter.				
• that all bodies (objects) emit radiation • that the intensity and wavelength distribution of any emission depends on the temperature of the body.				
(HT only) A body at constant temperature is absorbing radiation at the same rate as it is emitting radiation. The temperature of a body increases when the body absorbs radiation faster than it emits radiation.				
(HT only) The temperature of the Earth depends on many factors including: the rates of absorption and emission of radiation, reflection of radiation into space.				
(HT only) Students should be able to explain how the temperature of a body is related to the balance between incoming radiation				

absorbed and radiation emitted, using everyday examples to illustrate this balance, and the example of the factors which determine the temperature of the Earth.				
(HT only) Students should be able to use information, or draw/ interpret diagrams to show how radiation affects the temperature of the Earth's surface and atmosphere.				

I am most confident with the following topic/topics:

I have struggled most with the following topic/topics:

	Red	Amber	Green	Revised Tick ☑
Area of Study: Electromagnetism – Poles of a magnet				
The poles of a magnet are the places where the magnetic forces are strongest. When two magnets are brought close together they exert a force on each other. Two like poles repel each other. Two unlike poles attract each other. Attraction and repulsion between two magnetic poles are examples of non-contact force.				
A permanent magnet produces its own magnetic field. An induced magnet is a material that becomes a magnet when it is placed in a magnetic field. Induced magnetism always causes a force of attraction. When removed from the magnetic field an induced magnet loses most/all of its magnetism quickly.				
• the attraction and repulsion between unlike and like poles for permanent magnets • the difference between permanent and induced magnets.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Electromagnetism – Magnetic Fields				
The region around a magnet where a force acts on another magnet or on a magnetic material (iron, steel, cobalt and nickel) is called the magnetic field.				
The force between a magnet and a magnetic material is always one of attraction.				

	Red	Amber	Green	Revised Tick ☑
The strength of the magnetic field depends on the distance from the magnet. The field is strongest at the poles of the magnet.				
The direction of the magnetic field at any point is given by the direction of the force that would act on another north pole placed at that point. The direction of a magnetic field line is from the north (seeking) pole of a magnet to the south(seeking) pole of the magnet.				
A magnetic compass contains a small bar magnet. The Earth has a magnetic field. The compass needle points in the direction of the Earth's magnetic field.				
• describe how to plot the magnetic field pattern of a magnet using a compass • draw the magnetic field pattern of a bar magnet showing how strength and direction change from one point to another • explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic.				

	Red	Amber	Green	Revised Tick ☑
Area of Study: Electromagnetism – Electromagnetism				
When a current flows through a conducting wire a magnetic field is produced around the wire. The strength of the magnetic field depends on the current through the wire and the distance from the wire.				
Shaping a wire to form a solenoid increases the strength of the magnetic field created by a current through the wire. The magnetic field inside a solenoid is strong and uniform.				
The magnetic field around a solenoid has a similar shape to that of a bar magnet. Adding an iron core increases the strength of the magnetic field of a solenoid. An electromagnet is a solenoid with an iron core.				
• describe how the magnetic effect of a current can be demonstrated • draw the magnetic field pattern for a straight wire carrying a current and for a solenoid (showing the direction of the field) • explain how a solenoid arrangement can increase the magnetic effect of the current.				

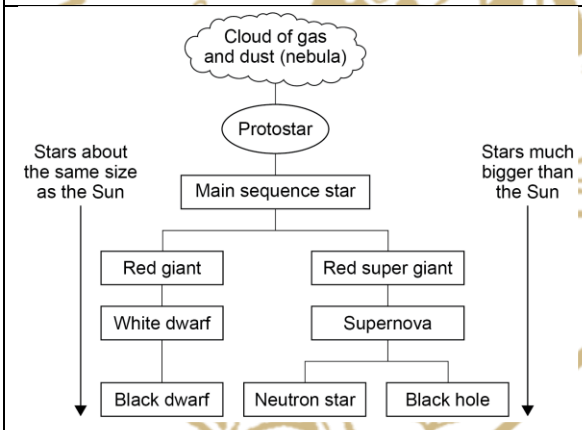
(Physics only) Students should be able to interpret diagrams of electromagnetic devices in order to explain how they work.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electromagnetism – Fleming's left hand rule (HT only)				
When a conductor carrying a current is placed in a magnetic field the magnet producing the field and the conductor exert a force on each other. This is called the motor effect.				
Students should be able to show that Fleming's left-hand rule represents the relative orientation of the force, the current in the conductor and the magnetic field.				
Students should be able to recall the factors that affect the size of the force on the conductor.				
For a conductor at right angles to a magnetic field and carrying a current: $F = BIL$				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electromagnetism Electric motors (HT only)				
A coil of wire carrying a current in a magnetic field tends to rotate. This is the basis of an electric motor.				
Students should be able to explain how the force on a conductor in a magnetic field causes the rotation of the coil in an electric motor.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electromagnetism Loudspeakers (HT only)				
Loudspeakers and headphones use the motor effect to convert variations in current in electrical circuits to the pressure variations in sound waves.				
Students should be able to explain how a moving-coil loudspeaker and headphones work.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electromagnetism Induced potential, transformers and the National Grid (Physics only) (HT Only)				
If an electrical conductor moves relative to a magnetic field or if				

PERSONALISED LEARNING CHECKLISTS

there is a change in the magnetic field around a conductor, a potential difference is induced across the ends of the conductor. If the conductor is part of a complete circuit, a current is induced in the conductor. This is called the generator effect.				
An induced current generates a magnetic field that opposes the original change, either the movement of the conductor or the change in magnetic field.				
Students should be able to recall the factors that affect the size of the induced potential difference/induced current.				
Students should be able to recall the factors that affect the direction of the induced potential difference/induced current.				
Students should be able to apply the principles of the generator effect in a given context.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Electromagnetism Uses of the generator effect (HT only)				
The generator effect is used in an alternator to generate ac and in a dynamo to generate dc.				
explain how the generator effect is used in an alternator to generate ac and in a dynamo to generate dc				
draw/interpret graphs of potential difference generated in the coil against time.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Microphones (HT only)				
Microphones use the generator effect to convert the pressure variations in sound waves into variations in current in electrical circuits.				
Students should be able to explain how a moving-coil microphone works.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Transformers (HT only)				
A basic transformer consists of a primary coil and a secondary coil wound on an iron core.				
Iron is used as it is easily magnetised.				

Knowledge of laminations and eddy currents in the core is not required.				
The ratio of the potential differences across the primary and secondary coils of a transformer Vp and Vs depends on the ratio of the number of turns on each coil, np and ns.				
$\frac{V_p}{V_s} = \frac{N_p}{N_s}$				
If transformers were 100% efficient, the electrical power output would equal the electrical power input.				
$V_s \times I_s = V_p \times I_p$				
Students should be able to: • explain how the effect of an alternating current in one coil in inducing a current in another is used in transformers • explain how the ratio of the potential differences across the two coils depends on the ratio of the number of turns on each • calculate the current drawn from the input supply to provide a particular power output				
apply the equation linking the p.d.s and number of turns in the two coils of a transformer to the currents and the power transfer involved, and relate these to the advantages of power transmission at high potential differences.				
I am most confident with the following topic/topics: ***I have struggled most with the following topic/topics:***				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Solar System – Our Solar System				
Within our solar system there is one star, the Sun, plus the eight planets and the dwarf planets that orbit around the Sun. Natural				

PERSONALISED LEARNING CHECKLISTS

satellites, the moons that orbit planets, are also part of the solar system.				
Our solar system is a small part of the Milky Way galaxy.				
The Sun was formed from a cloud of dust and gas (nebula) pulled together by gravitational attraction.				
how, at the start of a star's life cycle, the dust and gas drawn together by gravity causes fusion reactions				
that fusion reactions lead to an equilibrium between the gravitational collapse of a star and the expansion of a star due to fusion energy.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Solar System – The Life cycle of a star				
A star goes through a life cycle. The life cycle is determined by the size of the star. Students should be able to describe the life cycle of a star: • the size of the Sun • much more massive than the Sun.				
				
Fusion processes in stars produce all of the naturally occurring elements. Elements heavier than iron are produced in a supernova.				
The explosion of a massive star (supernova) distributes the elements throughout the universe.				
Students should be able to explain how fusion processes lead to the formation of new elements.				
	Red	**Amber**	**Green**	**Revised**

				Tick ☑
Area of Study: Solar System – Orbital motion, natural and artificial satellites				
Gravity provides the force that allows planets and satellites (both natural and artificial) to maintain their circular orbits.				
Students should be able to describe the similarities and distinctions between the planets, their moons, and artificial satellites.				
(HT only) for circular orbits, the force of gravity can lead to changing velocity but unchanged speed				
(HT only) for a stable orbit, the radius must change if the speed changes.				
	Red	**Amber**	**Green**	**Revised** Tick ☑
Area of Study: Solar System – Red-shift (Physics Only)				
There is an observed increase in the wavelength of light from most distant galaxies. The further away the galaxies, the faster they are moving and the bigger the observed increase in wavelength. This effect is called red-shift.				
The observed red-shift provides evidence that space itself (the universe) is expanding and supports the Big Bang theory.				
The Big Bang theory suggests that the universe began from a very small region that was extremely hot and dense.				
Since 1998 onwards, observations of supernovae suggest that distant galaxies are receding ever faster.				
• qualitatively the red-shift of light from galaxies that are receding				
• that the change of each galaxy's speed with distance is evidence of an expanding universe				
• how red-shift provides evidence for the Big Bang model				
• how scientists are able to use observations to arrive at theories such as the Big Bang theory				
that there is still much about the universe that is not understood, for example dark mass and dark energy.				

I am most confident with the following topic/topics:

I have struggled most with the following topic/topics: