	Visible light and the Solar System	
1.1	Describe how ideas about the structure of the Solar System have	
	changed over time, including the change from the geocentric to the	
	heliocentric models and the discovery of new planets	
1.2	Demonstrate an understanding of how scientists use waves to find out	
	information about our Universe, including:	
	a the Solar System	
	b the Milky Way	
1.3	Discuss how Galileo's observations of Jupiter, using the telescope,	
	provided evidence for the heliocentric model of the Solar System	
1.4	Compare methods of observing the Universe using visible light, including	
	the naked eye, photography and telescopes	
1.5	Explain how to measure the focal length of a converging lens using a	
	distant object	
1.6	Investigate the behaviour of converging lenses, including real and virtual	
	images	
1.7	Investigate the use of converging lenses to:	
	a measure the focal length using a distant object	
	b investigate factors which affect the magnification of a converging lens	
	(formulae are not needed)	
1.8	Explain how the eyepiece of a simple telescope magnifies the image of a	
	distant object produced by the objective lens (ray diagrams are not	
	necessary)	
1.9	Describe how a reflecting telescope works	
1.10	Recall that waves are reflected and refracted at boundaries between	
	different materials	
1.11	Explain how waves will be refracted at a boundary in terms of the	
	change of speed and direction	
1.12	Describe that waves transfer energy and information without transferring	
	matter	
1.13	Use the terms of frequency, wavelength, amplitude and speed to	
	describe waves	
1.14	Differentiate between longitudinal and transverse waves by referring to	
4.45	sound, electromagnetic and seismic waves	
1.15	Use both the equations below for all waves:	
	wave speed (metre/second, m/s) = frequency (nertz, Hz) vx wavelength	
	(meue, m)	
	$v = I \times \Lambda$	
	wave speed (metro/second m/s) - distance (metro m) / time (second s)	
	wave speed (metre/second, m/s) = distance (metre, m) / mre (second, s)	
	v - ~ t_	

	The electromagnetic spectrum	
2.1	Demonstrate an understanding of how Herschel and Ritter contributed to	
	the discovery of waves outside the limits of the visible spectrum	
2.2	Demonstrate an understanding that all electromagnetic waves are	
	transverse and that they travel at the same speed in a vacuum	
2.3	Describe the continuous electromagnetic spectrum including (in order)	
	radio waves, microwaves, infrared, visible (including the colours of the	
	visible spectrum), ultraviolet, X-rays and gamma rays	
2.4	Demonstrate an understanding that the electromagnetic spectrum is	
	continuous from radio waves to gamma rays, but the radiations within it	
	can be grouped in order of decreasing wavelength and increasing	
	frequency	
2.5	Demonstrate an understanding that the potential danger associated with	
	an electromagnetic wave increases with increasing frequency	
2.6	Relate the harmful effects, to life, of excessive exposure to the frequency	
	of the electromagnetic radiation, including:	
	a microwaves: internal heating of body cells	
	b infrared: skin burns	
	c ultraviolet: damage to surface cells and eyes, leading to skin cancer	
	and eye conditions	
	d X-rays and gamma rays: mutation or damage to cells in the body	
2.7	Describe some uses of electromagnetic radiation:	
	a radio waves: including broadcasting, communications and satellite	
	transmissions	
	b microwaves: including cooking, communications and satellite	
	transmissions	
	c infrared: including cooking, thermal imaging, short range	
	communications, optical fibres, television remote controls and security	
	systems	
	d visible light: including vision, photography and illumination	
	e ultraviolet: including security marking, fluorescent lamps, detecting	
	forged bank notes and disinfecting water	
	A rays: including observing the internal structure of objects, airport	
	security scamers and medical X-rays g gamma rays. Including stemising	
	aquinment and the detection of concer and its treatment	
20	Pocall that ionising radiations are emitted all the time by radioactive	
2.0		
2.0	Describe that ionising radiation includes alpha and beta particles and	
2.9	amma rays and that they transfer operay	
	ן פמווווום ומצא מווע נוומג נוופץ נומוואופו פוופוטץ	

	Waves and the Universe	
3.1	Recall that the Solar System is part of the Milky Way galaxy	
3.2	Describe a galaxy as a collection of stars	
3.3	Recall that the Universe includes all of the galaxies	
3.4	Compare the relative sizes of and the distances between the Earth, the	
	Moon, the planets, the Sun, galaxies and the Universe	
3.5	Describe the use of other regions of the electromagnetic spectrum by	
	some modern telescopes	
3.6	Describe the methods used to gather evidence for life beyond Earth,	
	including space probes, soil experiments by landers, Search for	
	Extraterrestrial Intelligence (SETI)	
3.7	Demonstrate an understanding of the impact of data gathered by modern	
	telescopes on our understanding of the Universe, including:	
	a the observation of galaxies because of improved magnification	
	b the discovery of objects not detectable using visible light	
0.0	c the ability to collect more data	
3.8	Construct a simple spectrometer, from a CD or DVD, and use it to	
2.0	Analyse common light sources	
3.9	Explain why some telescopes are located outside the Earth's atmosphere	
3.10	the Earth's atmosphere	
3 11	Describe the evolution of stars of similar mass to the Sun through the	
5.11	following stages:	
	a nebula	
	h star (main sequence)	
	c red giant	
	d white dwarf	
3.12	Describe the role of gravity in the life cycle of stars	
3.13	Describe how the evolution of stars with a mass larger than the Sun	
	is different, and may end in a black hole or neutron star	
3.14	Demonstrate an understanding of the Steady State and Big Bang	
	theories	
3.15	Describe evidence supporting the Big Bang theory, limited to red-shift	
	and the cosmic microwave background (CMB) radiation	
3.16	Recognise that as there is more evidence supporting the Big Bang theory	
	than the Steady State theory, it is the currently accepted model for the	
	origin of the Universe	
3.17	Describe that if a wave source is moving relative to an observer there will	
	be a change in the observed frequency and wavelength	
3.18	Demonstrate an understanding that if a wave source is moving	
	relative to an observer there will be a change in the observed	
0.40	frequency and wavelength	
3.19	Describe the red-shift in light received from galaxies at different	
2.00	distances away from the Earth	
3.20	Explain why the red-shift of galaxies provides evidence for the	
2.04	Universe expanding Explain how both the Dig Dang and Steady State theories of the	
J.21	Explain now both the big bang and Steady State theories of the origin of the Universe both account for rod shift of galaxies	
2 22	Explain how the discovery of the CMP rediction led to the Pig Pang	
3.22	theory becoming the currently accented model	
	Theory becoming the currently accepted model	L

	Waves and the Earth	
4.1	Recall that sound with frequencies greater than 20 000 hertz, Hz, is	
	known as ultrasound	
4.2	Describe uses of ultrasound, including:	
	a sonar	
	b communication between animals	
	c foetal scanning	
4.3	Calculate depth or distance from time and velocity of ultrasound	
4.4	Recall that sound with frequencies less than 20 hertz, Hz, is known as	
	infrasound	
4.5	Describe uses of infrasound, including:	
	a communication between animals	
	b detection of animal movement in remote locations	
	c detection of volcanic eruptions and meteors	
4.6	Recall that seismic waves are generated by earthquakes or explosions	
4.7	Investigate the unpredictability of earthquakes, through sliding blocks and	
	weights	
4.8	Explain why scientists find it difficult to predict earthquakes and tsunami	
	waves even with available data	
4.9	Recall that seismic waves can be longitudinal (P) waves and transverse	
	(S) waves and that they can be reflected and refracted at boundaries	
	between the crust, mantle and core	
4.10	Explain how data from seismometers can be used to identify the	
	location of an earthquake	
4.11	Demonstrate an understanding of how P and S waves travel inside	
	the Earth including reflection and refraction	
4.12	Explain how the Earth's outermost layer is composed of (tectonic) plates	
	and is in relative motion due to convection currents in the mantle	
4.13	Demonstrate an understanding of how, at plate boundaries, plates may	
	slide past each other, sometimes causing earthquakes	

	Generation and transmission of electricity	
5.1	Describe current as the rate of flow of charge and voltage as an electrical	
	pressure giving a measure of the energy transferred	
5.2	Define power as the energy transferred per second and measured in	
5.2	Walls	
5.5	Use the equation. electrical newer (watt M) – current (empered A) x potential difference	
	(volt V)	
	$P = I \times V$	
5.4	Investigate the power consumption of low-voltage electrical items	
5.5	Discuss the advantages and disadvantages of methods of largescale	
0.0	electricity production using a variety of renewable and non-renewable	
	resources	
5.6	Demonstrate an understanding of the factors that affect the size and	
	direction of the induced current	
5.7	Investigate factors affecting the generation of electric current by induction	
5.8	Explain how to produce an electric current by the relative movement of a	
	magnet and a coil of wire	
	a on a small scale	
	b in the large-scale generation of electrical energy	
5.9	Recall that generators supply current which alternates in direction	
5.10	Explain the difference between direct and alternating current	
5.11	Recall that a transformer can change the size of an alternating voltage	
5.12	Use the turns ratio equation for transformers to predict either the	
	missing voltage or the missing number of turns	
5.13	Explain why electrical energy is transmitted at high voltages, as it	
	improves the efficiency by reducing heat loss in transmission lines	
5.14	Explain where and why step-up and step-down transformers are used in	
- 1-	the transmission of electricity in the National Grid	
5.15	Describe the hazards associated with electricity transmission	
5.16	Recall that energy from the mains supply is measured in kilowatt-hours	
5.17	Use the equation:	
	cost (p) = power (knowatts, kw) x time (nour, n) x cost of T knowatt-nour (p/k/k b)	
5 1 8	(p/KW II)	
5.10	energy appliances	
5.19	Use data to compare and contrast the advantages and disadvantages of	
	energy-saving devices	
5.20	Use data to consider cost-efficiency by calculating payback times	
5.21	Use the equation:	
	power (watt, W) = energy used (joule, J) / time taken (second, s)	
	P = E/t	

	Energy and the future	
6.1	Demonstrate an understanding that energy is conserved	
6.2	Describe energy transfer chains involving the following forms of energy: thermal (heat), light, electrical, sound, kinetic (movement), chemical,	
	nuclear and potential (elastic and gravitational)	
6.3	Demonstrate an understanding of how diagrams can be used to	
	represent energy transfers	
6.4	Apply the idea that efficiency is the proportion of energy transferred to	
	useful forms to everyday situations	
6.5	Use the efficiency equation:	
	efficiency = (useful energy transferred by the device) x 100%	
	(total energy supplied to the device)	
6.6	Demonstrate an understanding that for a system to be at a constant	
	temperature it needs to radiate the same average power that it absorbs	
6.7	Investigate how the nature of a surface affects the amount of	
	thermal energy radiated or absorbed	