



GCSE Science – Schemes of Work

Physics

Unit 1: Physics 1

Spec Reference	Summary of the Specification Content	Learning Outcomes <i>What most candidates should be able to do</i>	Suggested timing (hours)	<i>Opportunities to develop Scientific Communication skills</i>	Opportunities to develop and apply Practical and Enquiry skills	Self/Peer assessment Opportunities & resources <i>reference to past questions that indicate success</i>
P1.2.1 Energy transfers and efficiency						
a	Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed.	Describe the energy transfers and the main energy wastages that occur in a range of situations or appliances.	3	Presenting and writing descriptions and explanations Drawing of Sankey diagrams, having identified major sources of “wasted” energy. Describe what a given Sankey diagram shows. Use a Sankey diagram to explain how efficiency can be calculated Explain why energy is “wasted” but never lost	Obtaining and presenting primary evidence Design and build a sequence of energy transfers. eg heat water to allow steam to turn wheel to trigger movement etc. Working critically with primary and secondary evidence <i>How much energy is in a bread crouton?</i> Do some research to find out the published figures and then investigate it practically. Planning an approach <i>How much energy is “wasted” by an electric kettle?</i> Plan how this could be worked out.	BBC learning zone clip “energy efficiency in a leisure centre” http://www.bbc.co.uk/learningzone/clips/energy-efficiency-in-a-leisure-centre/269.html Useful information on ‘Heat transfer and efficiency’ can be found on the BBC website at www.bbc.co.uk/schools/gcsebitesize/science/aga/energy P1 2.1 Energy transfers and efficiency powerpoint
b	When energy is transferred only part of it may be usefully transferred, the rest is ‘wasted’.	Interpret and draw a Sankey diagram.				
c	Wasted energy is eventually transferred to the surroundings, which become warmer. The wasted energy becomes increasingly spread out and so becomes less useful.	Explain the concept of efficiency and why efficiency can never be greater than 100%.		Presenting and writing arguments Evaluate the design of everyday appliances that transfer energy by heating, including economic considerations.		

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d	To calculate the efficiency of a device using: Efficiency = $\frac{\text{useful energy out}}{\text{total energy in}}$ Efficiency = $\frac{\text{useful power out}}{\text{total power in}}$	Use the equation to calculate efficiency as a decimal or percentage.		Calculations of efficiency		

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P1.1.3 Energy transfer by heating						
a	<p>The transfer of energy by conduction and convection involves particles, and how this transfer takes place.</p> <p>The transfer of energy by evaporation and condensation involves particles, and how this transfer takes place.</p>	<p>Describe in simple terms how the arrangement and movement of particles.</p> <p>Determine whether a material is a conductor or an insulator.</p> <p>Explain the role of free electrons in conduction through a metal.</p> <p>Explain convection using the idea of particles moving apart to make a fluid less dense and to describe simple applications of convection. Explain evaporation and the cooling effect this causes using the kinetic theory.</p>	4	<p>Presenting and writing descriptions and explanations Describe applications of evaporation and condensing, eg sweating, fridges, scalds etc.</p> <p>Explanation Use the kinetic theory to explain how evaporation and condensation transfer energy</p> <p>Developing argument Survey and evaluate the advantages and disadvantages of the material used in the take-away food industry in terms of energy transfer.</p> <p>Presenting and writing descriptions and explanations Summarise the factors affecting the rate at which an object transfers energy by heating.</p>	<p><i>What is the best conductor?</i> Planning an approach Design an experiment to compare the rate of conduction through different metal rods <i>What do convection currents look like?</i> <i>Are 'radiators' correctly named?</i> <i>Does heat rise in a spacecraft?</i></p> <p>Obtaining and presenting primary evidence Research and design a demonstration of convection, in air or water</p> <p><i>How can we cool off quickly?</i> Investigations about evaporation causing cooling, eg thermometer bulb wrapped in wet tissue.</p>	<p>P1.1.3 Energy transfer by heating powerpoint</p> <p>Video clips on heat transfer can be found on the BBC website at: http://www.bbc.co.uk/learningzone/clips/frying-an-egg-with-a-paper-pan/8762.html or http://www.bbc.co.uk/learningzone/clips/convection-and-radiation/10589.html</p>
b	The factors that affect the rate of evaporation and condensation.					

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c	The rate at which an object transfers energy by heating depends on a number of factors.	State the factors that affect the rate at which an object transfers energy by heating : <ul style="list-style-type: none"> • surface area and volume • the material from which the object is made • the nature of the surface with which the object is in contact. • the temperature difference between the object and its surroundings. 		Explain how machines are designed to keep cool Applications and implications Research and explain in a presentation how animals in cold and hot climates are adapted to their environments	<i>Which take-away coffee cup works best?</i> Investigations to compare the effectiveness of different commercially available take-away coffee cups. <i>How do machines cool down?</i> Research and find examples of parts of machinery showing cooling fins increasing surface area, eg motorbike engines, fridge cooling fins etc. Create an imaginary animal, which has evolved to deal with certain climatic conditions.	Video clips about keeping cool in the desert using evaporation to help survival. http://dsc.discovery.com/videos/planet-earth-deserts-red-kangaroos.html http://videos.howstuffworks.com/discovery/28213-man-vs-wild-staying-cool-in-the-moab-desert-video.htm
d	The bigger the temperature difference between an object and its surroundings, the faster the rate at which energy is transferred by heating.	Be able to explain the design of devices in terms of energy transfer, eg cooling fins. Be able to explain animal adaptations in terms of energy transfer, eg relative ear size of animals in cold and warm climates.				

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P1.1.1 Infrared radiation						
a	All objects emit infrared radiation.	State what infrared radiation is.	2	Presenting and writing descriptions and explanations	<i>Why are marathon runners wrapped in foil blankets following a race and why are kettles light coloured? What is the best colour for an ice-cream van? Is it hot or cold in space? Would it best to use a black or white tent in an Antarctic expedition?</i>	Video clip about the discovery of infrared radiation http://www1.teachertube.com/viewVideo.php?title=Discovery_of_infrared_radiation&video_id=189860
b	The hotter an object is the more infrared radiation it radiates in a given time.	Describe the factors which affect the rate at which an object radiates infrared radiation		Explain the difference between radiation and absorption of infrared		
c	Dark, matt surfaces are good emitters of infrared radiation.	Explain the difference between radiation and absorption of infrared radiation.		Explain how various factors affect the amount of infrared radiation emitted and absorbed		
d	Light, shiny surfaces are poor emitters of infrared radiation. All objects absorb infrared radiation. Dark, matt surfaces are good absorbers of infrared radiation.	Describe the factors which affect the rate at which an object absorbs infrared radiation.		Developing argument Evaluate the use of thermographic imaging to detect tumours, or to locate bodies following natural disasters. Reaching agreement on scientific explanations Describe how infrared radiation was first identified beyond the visible spectrum.	Obtaining and presenting primary evidence Investigation using Leslie's cube and infrared detector or similar apparatus.	P1.1.1 Infrared radiation success criteria items powerpoint

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	<p>Light, shiny surfaces are poor absorbers of infrared radiation.</p> <p>Light, shiny surfaces are good reflectors of infrared radiation.</p>					

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P1.1.4 Heating and insulating buildings						
a	U-values measure how effective a material is as an insulator.	State what a U-value is and what it tells us about the material as an insulator.	2	Presenting and writing descriptions and explanations Describe how the U value relates to a material's effectiveness as an insulator. Describe how a solar panel works. Presenting and writing arguments Evaluate the effectiveness of different types of material used for insulation, including U-values and economic factors including payback time. Evaluate the efficiency and cost effectiveness of methods used to reduce 'energy consumption' e.g. by using solar panels Applications and implications <i>How should I insulate my home?</i> Research U-values of common insulating materials, and their costs.	Obtaining and presenting primary evidence <i>Do solar panels provide free hot water? How can a solar panel work in England?</i> Demonstration of model/real solar panel water heater. Plan and carry out an investigation by constructing a model house, using sensors and data logger to measure temperatures with and without various types of insulation.	P1.1.4 Heating and insulating buildings success criteria items powerpoint.
b	The lower the U-value, the better the material is as an insulator.	Be able to evaluate the effectiveness of different types of material used for insulation, including U-values and economic factors including payback time.				
c	Solar panels may contain water that is heated by radiation from the Sun. This water may then be used to heat buildings or provide domestic hot water.	Be able to evaluate the efficiency and cost effectiveness of methods used to reduce 'energy consumption'.				

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d	<p>The specific heat capacity of a substance is the amount of energy required to change the temperature of one kilogram of the substance by one degree Celsius.</p> $E = m \times c \times \theta$	<p>Define specific heat capacity.</p> <p>Evaluate different materials according to their specific heat capacities, eg water, which has a very high specific heat capacity; oil filled radiators and electric storage heaters containing concrete.</p>		<p>Explain why the filling in hot pies feels hotter than the pastry when removed from the oven, or similar example.</p> <p>Calculations involving specific heat capacity.</p>	<p><i>Why do some foods with a filling of differing specific heat capacity sometimes warn about the filling being hot?</i></p> <p>Practical calculation of the specific heat capacity using small immersion heaters to heat blocks of metal/containers of water.</p>	

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<p>P1.2 Energy and efficiency Appliances transfer energy but they rarely transfer all of the energy to the place we want. We need to know the efficiency of appliances so that we can choose between them, including how cost effective they are, and try to improve them.</p> <p>P1.3 The usefulness of electrical appliances We often use electrical appliances because they transfer energy at the flick of a switch. We can calculate how much energy is transferred by an appliance and how much the appliance costs to run.</p> <p>P1.4 Methods we use to generate electricity Various energy sources can be used to generate the electricity we need. We must carefully consider the advantages and disadvantages of using each energy source before deciding which energy source(s) it would be best to use in any particular situation. Electricity is distributed via the National Grid.</p>						
P1.3.1 Transferring electrical energy						
a	Examples of energy transfers that everyday electrical appliances are designed to bring about.	Describe the energy transfers that occur in electrical appliances.	2	Presenting and writing descriptions and explanations Use a Sankey diagram to describe the energy transfers that occur in electrical appliances.	Obtaining and presenting primary evidence <i>How much power does a device use?</i> Using an electrical joulemeter, measurement of energy transferred by electrical items such as low voltage bulbs of different powers, low voltage motors and low voltage immersion heaters. <i>How much does it cost to use an electrical device? What are we paying for when we use electricity?</i>	P1.3.1 Transferring electrical energy success criteria items powerpoint
b	The amount of energy an appliance transfers depends on how long the appliance is switched on and its power.					

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c	To calculate the amount of energy transferred from the mains using the equation: $E = P \times t$	Use the equation to calculate the energy transferred from the mains to an electrical appliance, either in joules or kilowatt-hours.		Calculation Calculate of energy transferred and cost using typical power values of common household appliances. Explanation Explain some consequences of using lower power devices in terms of cost or the environment.	Find out the power of several electrical appliances in the home; estimate the cost of using these appliances in a typical week Or Keep a diary of the numbers on your electricity meter for a week. Why are there two sets of numbers? What does your electricity provider charge per kWh?	
d	To calculate the cost of mains electricity given the cost per kilowatt-hour (kWh).	Calculate the cost of using individual appliances and also to interpret electricity meter readings to calculate total cost over a period of time.				

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P1.4.1 Generating electricity						
a	In some power stations an energy source is used to heat water. The steam produced drives a turbine that is coupled to an electrical generator.	<p>Describe the purpose of the main parts of a power station.</p> <p>Relate the different energy sources which heat the water. These include:</p> <ul style="list-style-type: none"> ▪ the fossil fuels (coal, oil and gas) which are burned to heat water or air ▪ uranium and plutonium, when energy from nuclear fission is used to heat water ▪ biofuels that can be burned to heat water. <p>State that, of the fossil fuel power stations, gas-fired have the shortest start-up time.</p>	4	<p>Presenting and writing descriptions and explanations Describe the structure and purpose of the main parts of a power station</p> <p>Explain the advantages and disadvantages of the different energy sources used to heat the water</p> <p>Draw a map of the country and mark on it the power stations showing what energy source they use, relating that to the geographical features</p> <p>Communication for audience and purpose Applications and implications <i>How is mains electricity always available?</i> Research into different types of power stations for booklet or presentation on generating electricity.</p>	<p>Working critically with primary evidence <i>Can we get electricity for nothing?</i> Design and build a model water/wind turbine linked to a generator. Investigate the factors that will affect the voltage produced.</p>	<p>P1.4.1 Generating electricity success criteria items powerpoint</p> <p>BBC learning zone video clip on renewable energy sources http://www.bbc.co.uk/learningzone/clips/renewable-energy-sources/474.html</p>

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b	Water and wind can be used to drive turbines directly.	<p>Explain the advantages of pumped storage systems in order to meet peak demand, and as a means of storing energy for later use.</p> <p>Describe the basic principles by which wind turbines operate.</p> <p>State the ways that water can be used to drive turbines. These include, but are not limited to, waves, tides and the falling of water in hydroelectric schemes.</p>		<p>Presenting and writing descriptions and explanations Describe how a pumped storage system works. Explain the advantages of pumped storage systems Describe how wind and water can be used to turn turbines to generate electricity</p> <p>Explain the advantages and disadvantages of the different ways that water sources are used to generate electricity</p>		<p>Video clips of renewable energy sources can be found at www.brainpop.com by searching for 'biofuels'.</p> <p>BBC GCSE Bitesize revision material can be found at www.bbc.co.uk/schools/gcsebitesize/science/aqa/energy</p> <p>An interactive game called 'Energities', can be found at www.energities.eu</p>
d	In some volcanic areas hot water and steam rise to the surface. The steam can be tapped and used to drive turbines. This is known as geothermal energy.	Describe the basic principles of how geothermal energy is used.		<p>Describe the basic principles of how geothermal energy is used.</p> <p>Explain the advantages and disadvantages of the using geothermal energy to generate electricity</p>		

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c	Electricity can be produced directly from the Sun's radiation.	State that solar cells can be used to generate electricity.		Explain the advantages and disadvantages of using solar cells to generate electricity especially related to applications in different circumstances	<i>How can we get the most from the sunshine?</i> Investigate the factors affecting the output of a solar cell.	
e	Small-scale production of electricity may be useful in some areas and for some uses, eg hydroelectricity in remote areas and solar cells for roadside signs.	Describe the advantages and disadvantages of the use of solar cells in generating electricity.				
f	Using different energy resources has different effects on the environment.	Describe effects on the environment such as: <ul style="list-style-type: none"> the release of substances into the atmosphere the production of waste materials noise and visual pollution the destruction of wildlife habitats. 		Explain how the use of different energy resources to generate electricity can have effects on the environment. Developing argument Evaluate different methods of generating electricity		BBC learning zone video clip about the best way to provide energy in the future http://www.bbc.co.uk/learningzone/clips/what-is-the-best-way-to-provide-energy-in-the-future/1446.html

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		<p>Explain how carbon-capture and storage is a rapidly evolving technology.</p> <p>Explain that to prevent carbon dioxide building up in the atmosphere we can catch and store it; some of the best natural containers are old oil and gas fields, such as those under the North Sea.</p> <p>Evaluate different methods of generating electricity given data including start-up times, costs of electricity generation and the total cost of generating electricity when factors such as building and decommissioning are taken into account. The reliability of different methods should also be understood.</p>		<p>Applications and implications <i>How is my electricity generated?</i> Research to find out what power sources are used by pupils' domestic energy providers.</p>		

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P1.4.2 The National Grid						
a	Electricity is distributed from power stations to consumers along the National Grid.	Identify and label the essential parts of the National Grid.	2	Presenting and writing descriptions and explanations Use a diagram to identify and describe the function of the essential parts of the national grid	Working critically with primary evidence <i>Why do we need to change the voltage up, only to change it back down?</i> Demonstration model of overhead transmission lines.	P1.4.2 The National Grid success criteria items powerpoint BBC learning zone video clip about working to maintain the National Grid http://www.bbc.co.uk/learningzone/clips/working-to-maintain-the-national-grid/7407.html video clip about model transmission lines http://www.nationalstemcentre.org.uk/elibrary/resource/2085/power-lines
b	For a given power, increasing the voltage reduces the current required and this reduces the energy losses in the cables.					
c	The uses of step-up and step-down transformers in the National Grid.	Explain why transformers are an essential part of the National Grid.		Explain the role that transformers play in distributing electricity		

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<p>P1.5 The use of waves for communication and to provide evidence that the universe is expanding. Electromagnetic radiations travel as waves and move energy from one place to another. They can all travel through a vacuum and do so at the same speed. The waves cover a continuous range of wavelengths called the electromagnetic spectrum. Sound waves and some mechanical waves are longitudinal, and cannot travel through a vacuum. Current evidence suggests that the universe is expanding and that matter and space expanded violently and rapidly from a very small initial 'point', ie the universe began with a 'Big Bang'.</p>						
<p>P1.5.2 Reflection</p>						
a	The 'normal' is a construction line perpendicular to the reflecting surface at the point of incidence.	Draw diagrams showing rays of light being reflected from a plane mirror, labelling incident and reflected rays, angles of incidence and reflection, and the normal.	2	<p>Presenting and writing descriptions and explanations</p> <p>Draw accurate and labelled ray diagrams to describe reflection</p>	<p>Obtaining and presenting primary evidence</p> <p><i>Is there a law of reflection?</i></p> <p>Investigation to confirm the law of reflected light at different angles off a plane mirror.</p>	<p>P1.5.2 Reflection success criteria items powerpoint</p> <p>A video clip on wave reflection can be found on the BBC website at http://www.bbc.co.uk/learningzone/clips/wave-reflection/4554.html</p>
b	The angle of incidence is equal to the angle of reflection.					
c	The image produced in a plane mirror is virtual.	Explain how an image is formed by a plane mirror, and why it is virtual.		<p>Use a ray diagram to explain the nature of a reflected image</p> <p><i>Can we be fooled by mirrors?</i></p> <p>Illustrative experiment showing how "Pepper's ghost works"</p>		

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P1.5.1 General properties of waves						
a	Waves transfer energy.		3	Presenting and writing descriptions and explanations Use diagrams to identify and describe the essential features of transverse and longitudinal waves	Working critically with primary evidence <i>What do waves look like?</i> Demonstration of transverse and longitudinal waves using slinky springs or other equipment.	P1.5.1 General properties of waves success criteria items powerpoint BBC learning zone clip about transverse and longitudinal waves http://www.bbc.co.uk/learningzone/clips/transverse-and-longitudinal-waves/10674.html BBC learning zone clip about the electromagnetic spectrum http://www.bbc.co.uk/learningzone/clips/the-electromagnetic-spectrum/10676.html
b	Waves may be either transverse or longitudinal.	Describe that in a transverse wave the oscillations are perpendicular to the direction of energy transfer.				
c	Electromagnetic waves are transverse, sound waves are longitudinal and mechanical waves may be either transverse or longitudinal.	Describe that in a longitudinal wave the oscillations are parallel to the direction of energy transfer.				
d	All types of electromagnetic waves travel at the same speed through a vacuum (space).	Explain the terms 'compression' and 'rarefaction' and how they are formed.		List the waves of the electromagnetic spectrum in the correct order and describe their basic properties. Make up an illustrated mnemonic or acronym to help you remember the order of the electromagnetic spectrum.		

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e f i	<p>Electromagnetic waves form a continuous spectrum.</p> <p>Longitudinal waves show areas of compression and rarefaction.</p> <p>The terms 'frequency', 'wavelength' and 'amplitude'.</p>	<p>Explain the terms 'frequency', 'wavelength' and 'amplitude' and be able to annotate a diagram to show these terms.</p> <p>State the order of electromagnetic waves within the spectrum, in terms of energy, frequency and wavelength.</p>		<p>Developing explanations using ideas and models</p> <p><i>Is there more than just light?</i></p> <p>Research into properties and uses of electromagnetic waves.</p>		

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g	Waves can be reflected, refracted and diffracted.	Describe the circumstances where a wave is reflected, refracted or diffracted.		Presenting and writing descriptions and explanations Use a ray diagram to describe what happens during refraction Use a wave-front diagram to explain how refraction might occur. Applications and implications Explain why various waves are appropriate for their use in communication Research frequencies of local and national radio stations.	<i>What do waves do?</i> Demonstration of properties of waves using a ripple tank.	A video clip on wave refraction can be found on the BBC website at http://www.bbc.co.uk/learningzone/clips/wave-refraction/4555.html Interactive video clip can be found on BBC GCSE Bitesize 'An introduction to waves' at www.bbc.co.uk/schools/gcsebitesize/science/aqa/radiation
h	Waves undergo a change of direction when they are refracted at an interface.	Complete wave-front diagrams for reflection, refraction and diffraction. State that waves are not refracted if travelling along the normal.			Demonstration of refraction effects such as a bent pencil and/or disappearing coin. Illustrative experiment to create a ray diagram of refraction of light using ray boxes and glass blocks.	
l	The terms frequency, wavelength and amplitude	Use the equation, knowing that v is speed in metres per second (m/s) f is frequency in hertz (Hz) and λ is wavelength in metres (m).			<i>What does wavelength depend on?</i> Illustrative experiment using transverse waves along a length of rope to show the relationship between frequency and wavelength.	
j	All waves obey the wave equation: $v = f \times \lambda$					

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k	Radio waves, microwaves, infrared and visible light can be used for communication.	Describe situations in which waves are typically used for communication, eg: <ul style="list-style-type: none"> ▪ radio waves – TV and radio (including diffraction effects) ▪ microwaves – mobile phones and satellite television ▪ infrared – remote controls ▪ visible light – photography. 		Research into using waves for communication, including the concerns surrounding possible risks related to mobile phones. Developing argument mini debate regarding the siting of a mobile phone mast.	Demonstration of microwave properties using microwave transmitter and detector. Investigate the range of Bluetooth or infrared communications between mobile phones and laptops	'Sending Information' can be found on BBC GCSE Bitesize at www.bbc.co.uk/schools/gcsebitesize/science/aqa/radiation

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P1.5.3 Sound						
a	Sound waves are longitudinal waves and cause vibrations in a medium, which are detected as sound.	Explain how sound waves are produced.	2	Presenting and writing descriptions and explanations Describe the basic properties of sound waves and the relationships between pitch and frequency	Working critically with primary evidence <i>Why can nobody hear you scream in space? What does sound look like?</i> Demonstration of properties of sound using signal generator, loudspeaker and Cathode Ray Oscilloscope (CRO). Demonstration of waveforms of sound from musical instruments using a CRO. Demonstration of 'electric bell in bell jar' type apparatus to show the need for a medium. Demonstration of echoes from an outside wall. Planning an approach <i>Will sound travel faster in hot air or cold?</i> Plan an investigation to measure the speed of sound in air of different temperatures.	P1.5.3 Sound success criteria items powerpoint Video clip on echoes and their use in sonar can be found on the BBC website at www.bbc.co.uk/learningzone/clips by searching for clip '14'.
b	The pitch of a sound is determined by its frequency and loudness by its amplitude.	State the relationship between the pitch of a sound and the frequency of the sound wave.				
c	Echoes are reflections of sounds.	Describe how echoes are formed.		Use the kinetic theory to suggest and explain how the speed of sound might vary according to the state of the medium or its temperature.		

Spec Reference	Summary of the Specification Content	Learning Outcomes <i>What most candidates should be able to do</i>	Suggested timing (hours)	<i>Opportunities to develop Scientific Communication skills</i>	Opportunities to develop and apply Practical and Enquiry skills	Self/Peer assessment Opportunities & resources <i>reference to past questions that indicate success</i>
P1.5.4 Red-shift						
a	If a wave source is moving relative to an observer there will be a change in the observed wavelength and frequency. This is known as the Doppler effect.	<p>Explain the Doppler effect.</p> <p>Describe that when the source moves away from the observer, the observed wavelength increases and the frequency decreases; when the source moves towards the observer, the observed wavelength decreases and the frequency increases.</p> <p>Explain the term 'red- shift'.</p>	2	<p>Presenting and writing descriptions and explanations Describe the Doppler shift in the context of sound and light Describe the "Big Bang" theory</p> <p>Explain how the Doppler effect provides evidence for the movement of stars and galaxies</p> <p>Explain how CMBR relates to the big bang theory</p>	<p>Obtaining and presenting primary evidence Demonstration of Doppler effect using sound eg length of tubing swung in a circle.</p>	<p>P1.5.4 Red-shift success criteria items powerpoint Video clips of 'red-shift', the 'Big Bang' theory, and CMBR can be found at www.pbs.org/wgbh/nova/programs/ht/q/3114_01.html</p> <p>BBC learning zone clip on the Big Bang http://www.bbc.co.uk/learningzone/clips/the-big-bang/12236.html</p>
b	There is an observed increase in the wavelength of light from most distant galaxies. This effect is called the 'red-shift'.	State that the further away the galaxies are, the faster they are moving, and the bigger the observed increase in wavelength.		<p>Developing explanations using ideas and models Reaching agreement on scientific explanations Research into the development of theories of the origins of the universe</p>		
c	How the observed 'red-shift' provides evidence that the universe is expanding	Explain how 'red-shift' provides evidence that the universe is expanding. Explain that the 'Big Bang'				

