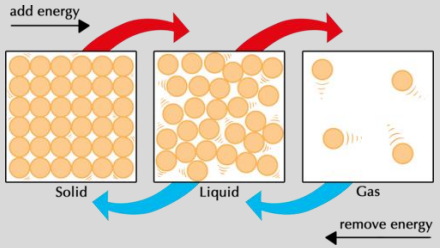
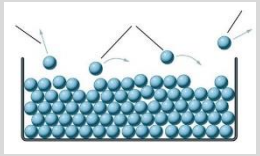
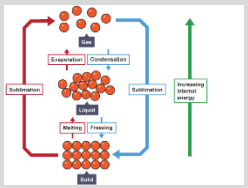
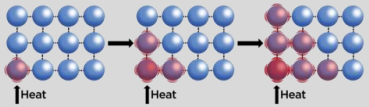
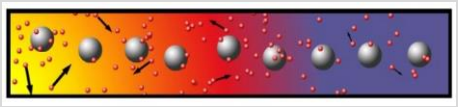
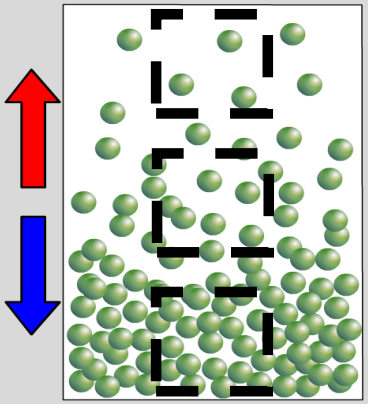
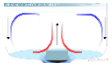
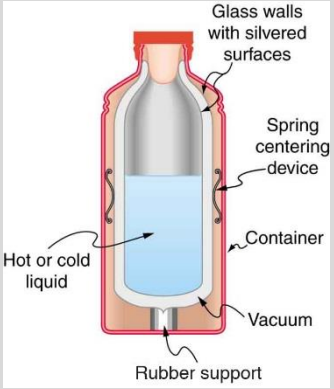
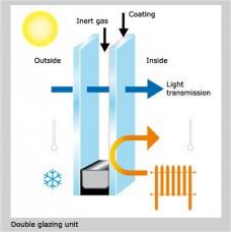
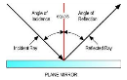
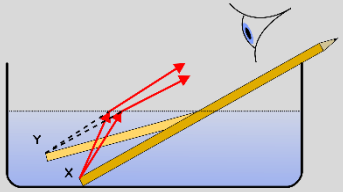
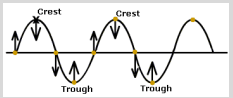
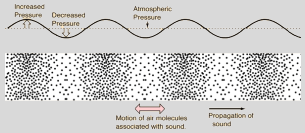
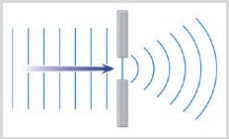
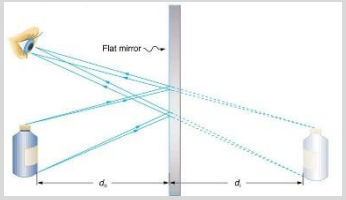
P1 Knowledge Organiser: Kinetic theory

Describe the movement of particles in a solid	Particles vibrate around their fixed positions.	Explain why particles in a solid are close together	Forces between the particles are strong
Properties of solids	Fixed shape, fixed volume, high density	Explain why particles in a liquid can slide past each other	Particles have more energy than those in a solid.
Describe the movement of particles in a liquid	Particles are able to slide past each other.	Give ways to speed up evaporation and explain why the processes speeds up evaporation	Create a draught: this pushes evaporated particles out of the way and makes space for more particles to leave the liquid. Increase the surface area of the liquid so more particles can escape from the surface.
Properties of a liquid	Fixed volume as the forces between the particles are still strong; take shape of the container		
Describe the movement of particles in a gas	Particles move quickly and at random because the forces between the particles are weak.	Explain why a hot liquid cools down 	Because the liquid is hot, some particles have a high energy. Those particles with very high energy are able to leave the liquid as they can overcome the forces between them. The average energy of the particles left behind is lower and therefore the temperature of the liquid has been lowered.
Properties of a gas	Gases fill their container, they have no fixed shape or volume, low density.		
Describe evaporation in terms of energy and particles 	Liquid is heated and particles gain energy. Particles with high energy near the surface of the liquid are able to overcome the forces between them and they leave the liquid.		
Describe condensation 	The particles in the steam lose energy and move closer together. The forces of attraction between the particles increase.	Give ways to speed up condensation	Reduce the temperature of the surface where condensation takes place or increase the surface area of the surface that condensation is taking place on.

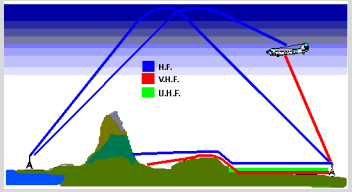
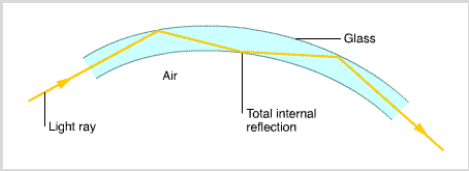
P1 Knowledge Organiser: Heat transfer

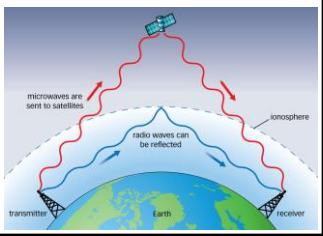
What is the law of conservation of energy?	Energy can be transferred, stored or spread out but not created or destroyed.	Give examples of conductors and insulators	Conductors: metals Insulators: gases, plastics, water, wood, fabric
Describe conduction 	Heat transfer in solids: heat makes the particles vibrate and knock into each other as the particles in solids are close together.	Explain why metals are good conductors of heat 	Metals have free electrons. When a metal is heated, the free electrons gain kinetic energy and collide with other free electrons and metal ions passing on the energy quickly.
Describe convection 	Heat transfer in liquids and gases. Particles near the bottom gain energy. The particles move up and apart. The density of the liquid or gas decreases. The hot liquid or gas is replaced by cold liquid or gas. When the particles lose energy, they move closer together and downwards. The density of the liquid or gas increases. Overall, a convection current is created. 	Describe how a thermos flask works 	Inside the flask is a double-walled glass container. Between the walls is a vacuum to prevent heat loss by convection and conduction. The glass walls are painted silver to reflect heat back inside and prevent heat loss via radiation. The container is placed on cork springs to prevent conduction. A plastic cap at the top prevents heat loss by convection.
Describe radiation	All warm objects emit infra red radiation (heat). IR can travel in all directions and through a vacuum.	Which type of heat transfer requires particles to pass on energy?	Convection and conduction
Explain how radiators work 	Radiators have fins to increase their surface area. Radiators heat the air above them and cause a convection current. Radiators emit IR radiation in all directions. A shiny piece of foil behind the radiator reflects the heat into the room.	Explain how double glazing works 	A vacuum between two glass panes prevents heat loss by conduction and convection.

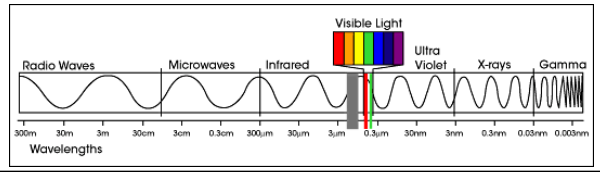
P1 Knowledge Organiser: Waves

What is a wave	A disturbance that transfers energy from one place to another	What is the law of reflection	The angle of incidence = the angle of reflection 
What is a mechanical wave	Vibration that disturb a medium such as water; e.g. sound waves	What is refraction 	When light travels from one medium to the other, it changes direction. This is because the light has changed speed due to the fact that the density of the medium has changed.
What is a transverse wave 	The oscillations of the wave are perpendicular to the direction of energy transfer. E.g. electromagnetic waves		
What is a longitudinal wave 	The vibration of the wave is parallel to the direction of energy transfer; e.g. sound wave	What is diffraction 	The spreading of waves as they pass through a gap or the edge of an obstacle. The smaller the gap, the greater diffraction.
What is an electromagnetic wave	Disturbance in an electric or magnetic field; e.g. light wave or radio wave	What is the speed of all electromagnetic waves	The speed of light: 300 000 000m/s
What are oscillations	Vibrations	Speed of wave formula	Speed=wavelength x frequency
What is compression	Where particles are pushed closely together	Define pitch	How high or low a sound is; short wavelength = high pitch
What is rarefaction	Where particles have moved apart again after being compressed	Define frequency	Number of waves per second; measured in Hz
Define amplitude	Height of a wave; distance from the rest position to the crest or trough of the wave	What is a virtual image? 	The image in the mirror is virtual. It is real, upright and formed behind the mirror. It is the same distance in the mirror as the real object is in front of the mirror.
Define wavelength	Distance between two peaks, two rest positions or two troughs		

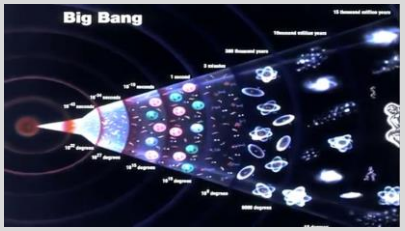
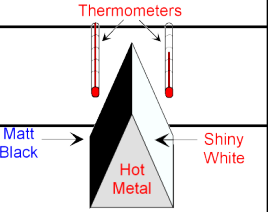
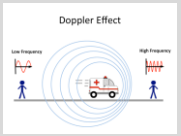
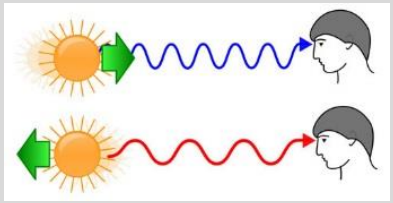
P1 Knowledge Organiser: The Electromagnetic Spectrum

What type of wave are EM waves?	Transverse waves
Name EM waves in order from longest to shortest	Radio, micro, IR, visible, UV, X-ray, gamma rays
How are all EM waves similar?	All travel at the speed of light (300 000 000 m/s) through a vacuum.
How are all EM waves different?	They differ in their wavelength, frequency and the energy they carry
Radiowaves uses	Communication; broadcasting
Long wavelength radiowaves uses 	International broadcasting due to long range and ability to diffract well. (Short wavelength radiowaves do not diffract well and this means reception in hilly areas might be poor)
IR waves uses	Remote controls, thermal imaging, optical fibres
Visible light uses	Photography, optical fibres
How optical fibres work 	Safe communication as no information can escape or enter the optical fibre. When IR ray reaches inside surface of optical fibre it is reflected back into the fibre. This way large amounts of information can be transferred securely.

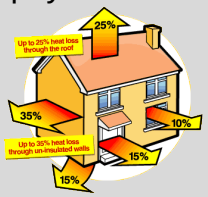
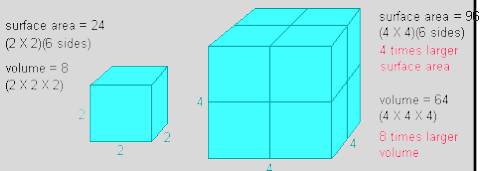
Microwave uses	Cooking; satellite communication (for TV, mobiles, GPS tracking).
How microwaves are used for communication	Microwaves, unlike radiowaves, can pass through the Earth's Iono-sphere: 
Why people worry about using mobile phones	Microwaves have a heating effect. Mobile phones might be able to penetrate the skin and skull and reach body cells. These body cells might be heated by microwaves. The heat might change DNA and lead to tumours. Children might be particularly at risk as their body cells divide much faster and any tumours would grow much more rapidly.
Other dangers of EM waves	X-ray, Gamma rays: cancer UV: skin cancer IR: burning Visible: blinding



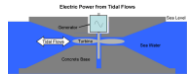
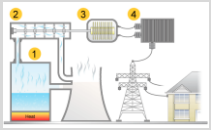
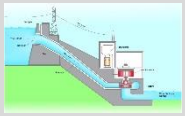
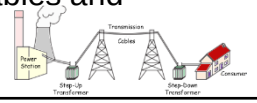
P1 Knowledge Organiser: Redshift; IR Radiation

As an ambulance drives towards you, the pitch of the siren does what?	Pitch becomes higher	How does redshift provide evidence for Big Bang? 	Redshift determines the distance of a galaxy from Earth as well as the speed the galaxy is moving at. Edwin Hubble discovered that distance galaxies are red shifted and that the further the galaxy is, the bigger the redshift. This proves that the Universe is expanding and must have started from one point.
As an ambulance drives away from you, the pitch of the siren does what?	Pitch becomes lower		
What happens to the observed wavelength of the sound wave as the ambulance drives towards you?	The observed wavelength decreases and frequency increases		
What happens to the observed wavelength of the sound wave as the ambulance drives away from you?	The observed wavelength increases and the frequency decreases	What does every hot object emit?	IR radiation 
		White, Shiny surfaces are good at	Reflecting IR
What is the Doppler effect? 	A change in frequency of light, sound or other waves as the object moves away from or towards an observer	White, Shiny surfaces are bad at	Absorbing and emitting IR
		Matt, Black surfaces are good at	Absorbing and emitting IR
What is red shift? What is blue shift? 	The wavelength of a star moving away from the observer appears stretched. The wavelength of a star moving towards and observer appears shortened	How IR cameras work 	They detect the difference in temperature between a body and its environment. The larger the temperature difference, the clearer the IR image.
		How do scientists believe the Universe began?	Big Bang
What can we still detect now that provides evidence for the Big Bang?	Cosmic Microwave Background Radiation CMBR created after the Big Bang	Describe the greenhouse effect	Gases in the atmosphere absorb IR radiation warming the atmosphere.

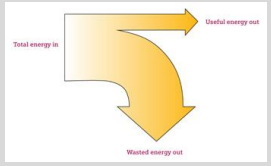
P1 Knowledge Organiser: Insulating buildings

How to make ice cubes quickly	Place warm water in the freezer. The bigger the temperature difference between an object and its surroundings, the faster the rate of energy transfer.	What is payback time? 	The time taken to save as much money as it cost originally to install the energy saving measure.
Advantages of double glazing	Prevents heat loss by convection and conduction; adds security & value, keeps noise out	Payback time formula	Payback time = installation cost/ annual savings made e.g. It costs £200 to install a carpet. Annual savings made as a result of installing carpet = £40; payback time = £200/£40 = 5 years.
Disadvantages of double glazing	Expensive to install		
How to prevent heat loss through the roof	Loft insulation using fibre glass to prevent convection	Why do large animals lose heat less quickly than small animals?	The ratio of surface area to volume is small to ensure the rate of heat loss is reduced.
How to prevent heat loss through gaps between wall and window	Draught excluders		
How to prevent heat loss through the walls	Cavity wall insulation to prevent conduction and convection. The cavity wall insulation traps air in small pockets.	Why do elephants have such large ears? 	They have a small surface area compared to their volume. They lose heat to their surroundings more slowly and could overheat. Elephants have large ears with a large surface area compared to their volume. These allow heat to be transferred from the elephant to its surroundings, helping to keep the animal cool.
How to prevent heat loss through the floor	Carpet		
Why should you place aluminium foil behind radiators?	To reflect heat into the room		
A material with a low U value is….	A good insulator		

P1 Knowledge Organiser: Generating Electricity

Non-renewable fuel definition	Fuel that comes from fossils and took millions of years to form	Disadvantages of wave generators	Relies on weather; might damage habitats and marine life
Renewable fuel definition	Fuel that come from renewable resources	Advantages of tidal power stations	No CO_2 released 
Non-renewable fuel examples	Coal, oil, gas, nuclear fuel	Disadvantages of tidal power stations	Harm river estuary habitats
Renewable fuels examples	Wind, sun, waves, plants	Disadvantages of hydroelectric schemes	Habitat is destroyed and flooded to create dam
How energy is created inside a power station 	Fuel is burned to produce heat. Heat boils water and creates steam. Steam turns a turbine attached to a generator producing electricity.	How energy is created hydroelectric schemes 	Water collects behind a dam. Water then flows downhill and turns a series of turbines.
Advantages of nuclear power stations	Nuclear fuel is a concentrated source of energy. No CO_2 waste	How energy is created by wind turbines	Wind turns blades. Blades are attached to a turbine which is attached to a generator.
Disadvantages of nuclear power stations	Radioactive waste left behind; expensive to decommission power plant.	What is the National Grid?	Network of cables and transformers. 
Advantages of solar power	No CO_2 and can be used in remote areas	Advantages of biofuels	Renewable, reduces need for landfill space
Disadvantages of solar power	No sun = no electricity; expensive to install	Disadvantages of biofuels	Release CO_2 when burned
Advantages of wind turbines	No CO_2 released 	Advantages of Gas Power stations 	Short start up time so energy available when there are surges in demand; e.g. when there is a TV ad break and many people switch the kettle on at the same time.
Disadvantages of wind turbines	Weather dependent		
Advantages of wave generators	No CO_2 released		

P1 Knowledge Organiser: Specific Heat Capacity

When a substance is heated, its temperature rise depends on which 3 factors?	Amount of energy supplied to substance Mass of the substance Material the substance is made of	What does a Sankey diagram show? 	It shows the energy transfer in devices. The width of each arrow represents the proportion of energy. It shows the energy input, useful and waste energy output.
What is specific heat capacity?	The energy required to raise the temperature of 1kg of a substance by 1^{o}C	What are the 9 forms of energy?	Sound, light, thermal, nuclear, chemical PE, elastic PE, kinetic, GPE, electrical
Why oil is used inside some radiators instead of water	Water has a higher specific heat capacity than oil. That means that if the same amount of energy is supplied to both, the oil will reach a higher temperature.	What is the formula for power?	Power = energy (J)/time(s)
		What is power measured in?	Watts
How do storage heaters work? 	Electricity is used to heat bricks inside the radiator. The bricks have a high specific heat capacity. This means they store a lot of energy. They warm up slowly when the heater is switched on and release energy slowly when the heater is switched off.	How do you calculate efficiency?	(Useful energy output / total energy input) x 100
		How do you calculate energy transferred?	Power (kW) x time (hrs)
		What is the unit of energy transferred?	kWh 
Specific heat capacity formula	Energy = mass x specific heat capacity x temperature rise	How do you calculate the cost of electricity?	kWh used x cost per kWh
What is the job of a step-up transformer?	It increases the voltage in the power cables and reduces the current. This is to prevent energy loss through the cables.	What is the job of a step down transformer?	It reduces the voltage so that electricity is supplied at a safe 230V to homes.