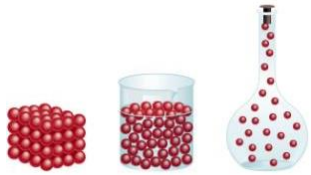
Kinetic theory

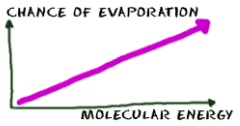
In **solids** the particles are packed very close together. They vibrate about fixed positions

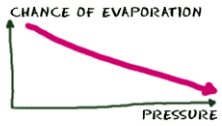
In **liquids** the particles are close together but not as close as they are in solids. They can move around in any direction and are not fixed in position.

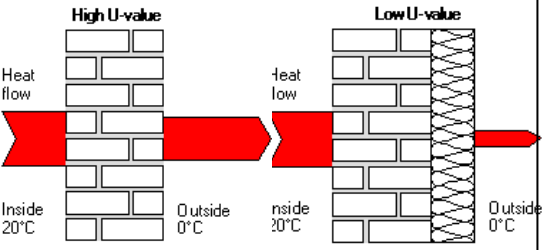
In **gases** the particles are very far apart with large distances between them. They move around very quickly in all directions

More energy = more vibrations

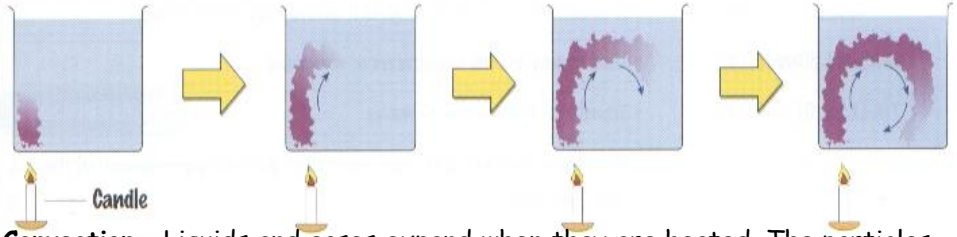






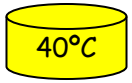


The lower the U-value, the better the material is as an insulator



Convection- Liquids and gases expand when they are heated. The particles move faster and the gap between particles widens. The liquid or gas in hot areas is less dense than the liquid or gas in cold areas, so it rises into the cold areas. The denser cold liquid or gas falls into the warm areas. In this way, convection currents are set up

Here the liquid will cool down faster since there is a 30°C difference between it's temperature and the surroundings



10°C

Here the liquid will cool down slowly since there is only a 5°C difference between it's temperature and the surroundings

35°C

The Energy Law

Energy can't be created or destroyed it is just transferred into different forms. It is measured in Joules (J)

Electrical → Heat (useful)

Light/sound (wasted)

Emitters of radiation

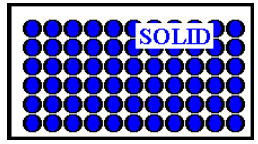
White/silver surfaces emit less thermal radiation. Polar bears are white so they emit less thermal radiatio

Radiation

Travel as waves, known as thermal/infra red radiation. The heat from the sun reaches us in this way,

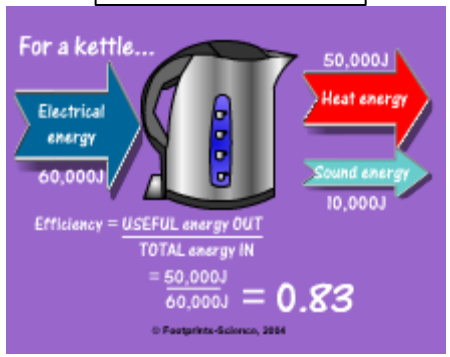
the waves can travel through a vacuum.

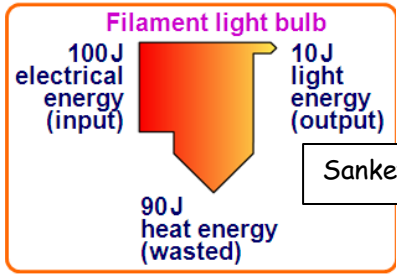
Conduction- energy is transferred via particles colliding. It happens quicker in solids due to particles being close together. It is quick in metals as electrons are free to move throughout metal.



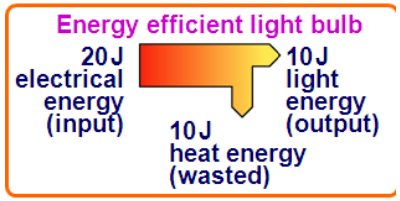
Heat ↑ Heat moves →

Efficiency





Sankey



Reducing Heat Loss Examples

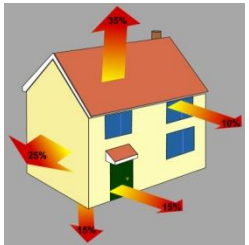
-Flasks have a vacuum layer so conduction and convection don't occur.

-Silver materials used so less thermal radiation emitted.

-Larger objects have a smaller surface area : volume ratio so less heat is lost.

-Loft insulation as hot air rises (convection)

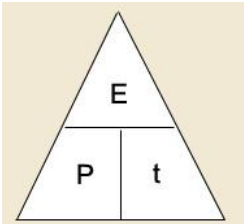
-Double glazing has a layer of air as conduction is slower in gases.



Physics 1 summary sheet

Power

Power (W)= energy (J) / time (s)



Power is the rate at which energy is transferred.

1 watt means 1 joule of energy is transferred every second.

Electricity Costs

Measured in kilowatt-hours (kWh) the cost per unit also needs to be known.

Energy used (kWh) = power (kW) x time (hours)

Take care with units!

Fossil Fuels

Coal (highest start up time), oil and gas (shortest start up time). Disadvantages
-Carbon dioxide produced –global warming
-Sulphur dioxide produced (acid rain)
-Non renewable

Nuclear

Chemical reactions involving uranium and plutonium release heat which is used to boil water in power stations.

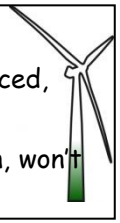
Advantages – no Greenhouse gases produced

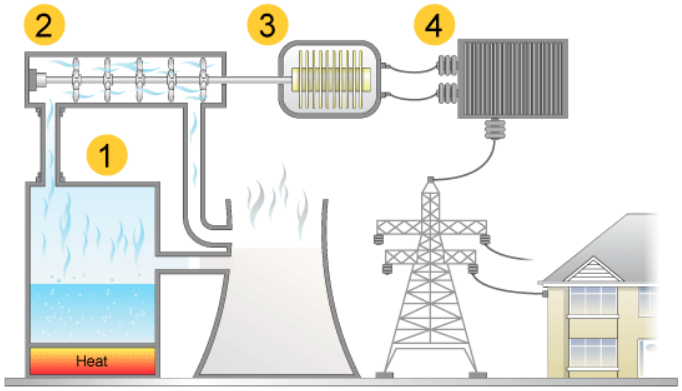
Disadvantages – non renewable, hazardous waste produced which must be dealt with.

Wind

Advantages – no Greenhouse gases produced, renewable, no fuel costs

Disadvantages – noise and visual pollution, won't always work





Electricity and The National Grid

1- Fuel is burnt to heat water to make steam

2- The steam is used to spin a turbine

3-The spinning turbine spins a generator which produces electricity.

4- The electricity goes to transformers to produce the correct voltage

Step up transformers increase the voltage, step down transformers reduce voltage. The National Grid carries energy at a low current as this means less energy is lost as heat, but it requires a high voltage.

Water (tidal, wave & hydroelectric)

The movement of water is used to drive turbines.

Advantages – no Greenhouse gases produced, renewable, hydroelectric and tidal are reliable

Disadvantages – can only be used in certain locations, loss of habitats and farmland.

Geothermal

Cold water is heated using rocks within the Earth, the resulting steam is used to drive turbines.

Advantages – renewable, no fuel costs, no harmful gases

Disadvantages – very few suitable sites.

Solar

Solar cells convert light into electricity. Solar panels are used to heat water

Advantages – renewable, no fuel costs, no harmful gases produced

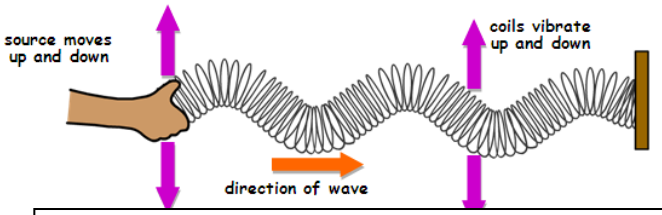
Disadvantages – expensive and inefficient, need a sunny climate, won't work at night.

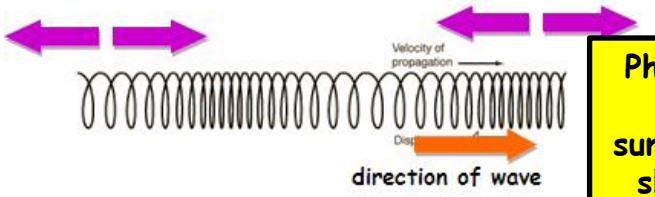
Colours

Dark colours absorb more heat.

Light colours reflect more heat

Physics 1 summary sheet



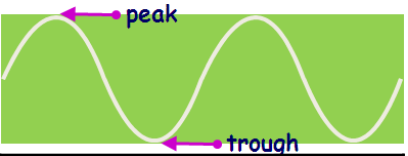


Physics 1 summary sheet

Transverse waves
Transverse waves move up and down whilst the energy moves forward

Longitudinal waves
Longitudinal waves move sideways as the energy moves forward

Radio waves
- Have the longest wavelengths
- Used in communications
- Radio waves - smallest long waves - 300,000Hz+
- Carry radio, TV, mobile phone signals
- Alternating voltage → ariel → receiver
- Frequency of radio wave = alternating voltage of carrier wave
- High frequency radio waves-
  - Carry more information
  - Have a shorter range
  - Less diffraction



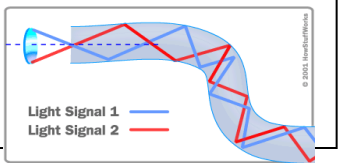
A peak is the tip of the wave, a trough is the bottom of a wave

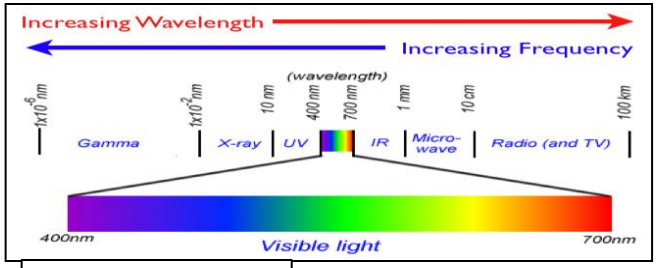
X-rays are used in hospitals to take radiographs.

X-rays and gamma rays damage living tissue when they pass through it.

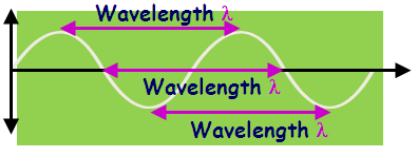
Large doses can kill cells, small doses can cause cancer

Optical Fibres
- Visible light and IR carry signals
- Carry more info than wires
- More secure, signal stays in wire



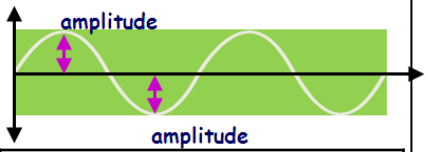


Properties of light waves



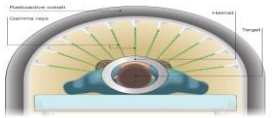
Wavelength is the length of one wave

X-rays and gamma rays are absorbed by dense material such as bone and metal but pass through soft tissue

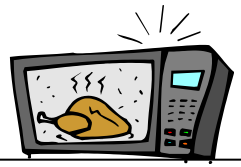


Amplitude is the height of the wave, the greater the amplitude, the greater the energy

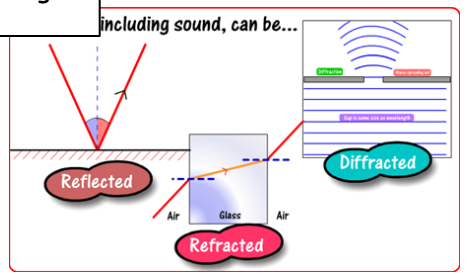
Gamma rays
- Have the shortest wavelengths
- used to kill bacteria in food, sterilise surgical equipment and kill cancer cells.



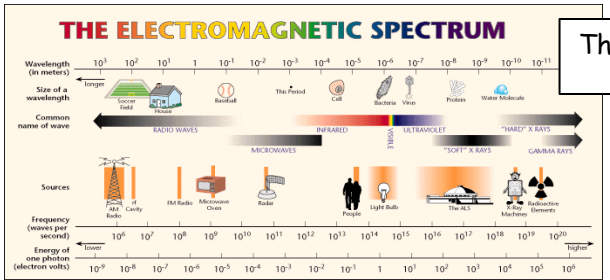
Microwaves
- Short waves
- Can pass through atmosphere for satellite communications
- Used in cooking, microwave ovens - heat water molecules



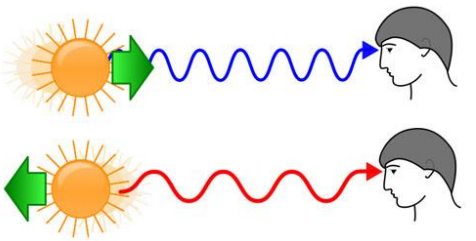
Infrared-IR
- All objects emit IR. The hotter the object the more IR it emits
- IR heat objects.
- Uses: heaters, IR scanners, IR cameras, remote controls, optical fibres and communications



frequency = number of waves past a point / time



The EM spectrum



Speed = frequency (Hz) × Wavelength (λ)

Red shift There is an observed increase in the wavelength of light from most distant galaxies. The further away the galaxies are, the faster they are moving, and the bigger the observed increase in wavelength. This effect is called red-shift.