AQA GCSE Physics

Paper 2 (H) Revision

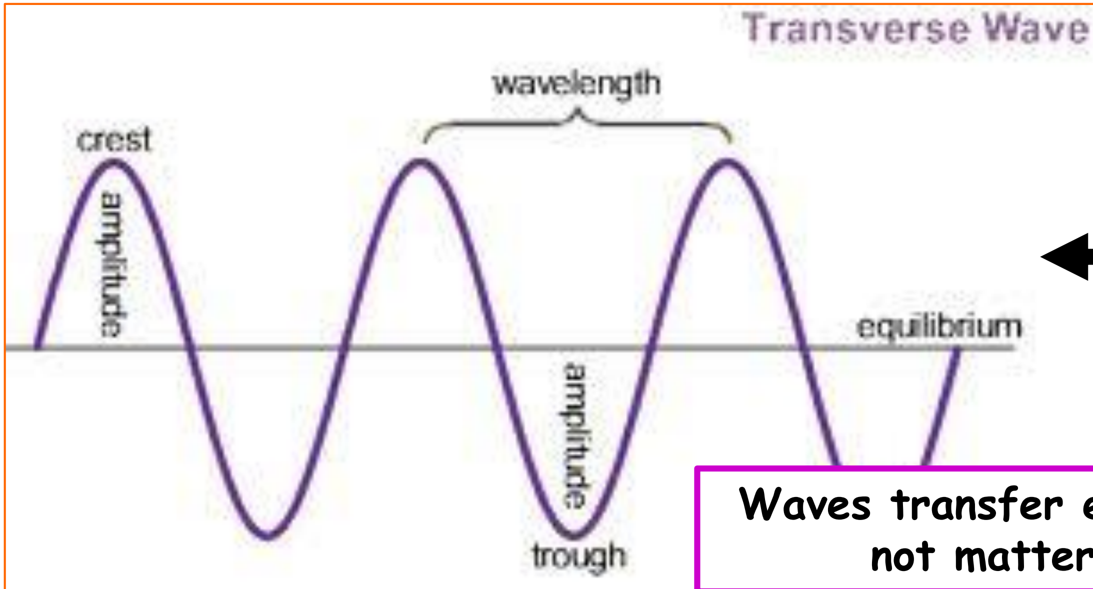
Topic 6: Waves

Name: ____________________________________

Form: 11 ___

AQA GCSE Physics
Paper 2 Revision
Topic 6: Waves

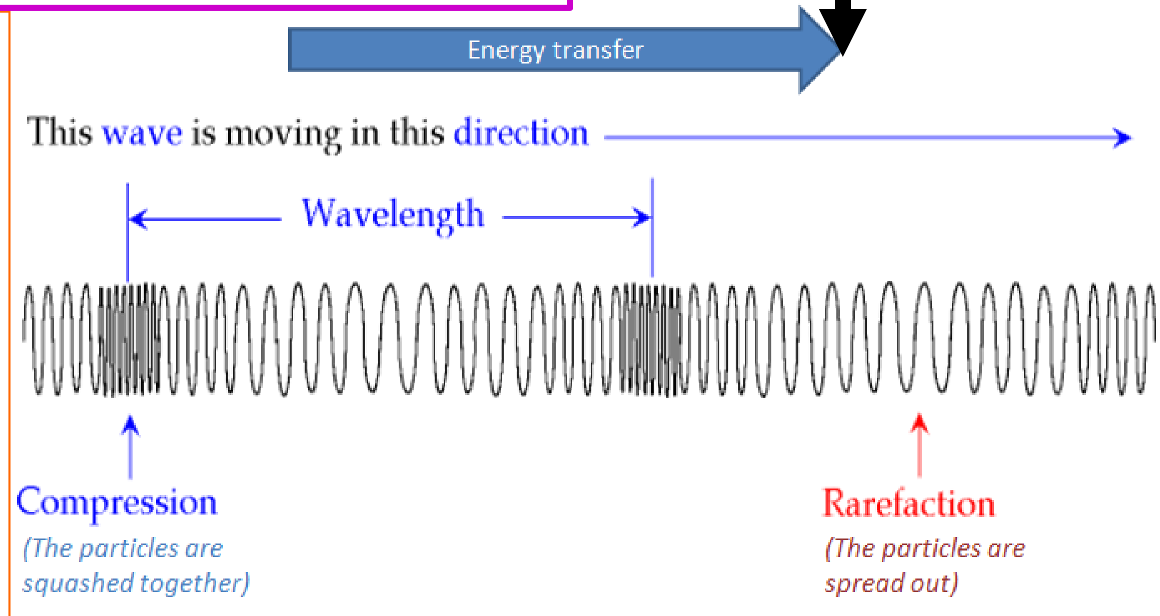
Wave Types



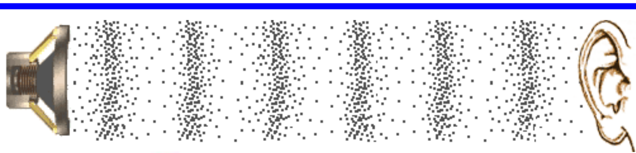
Transverse waves – Oscillations are perpendicular (at right angles) to the direction of energy transfer

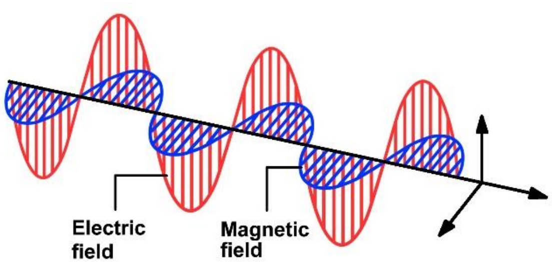
Longitudinal waves - Oscillations are parallel to the direction of energy transfer

Waves transfer energy, not matter!



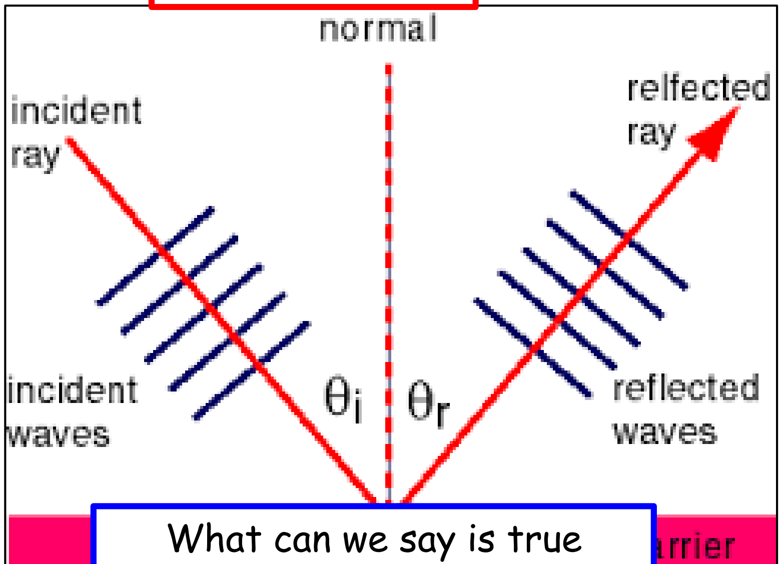
What is the difference between a mechanical and an electromagnetic wave?





Wave Phenomena

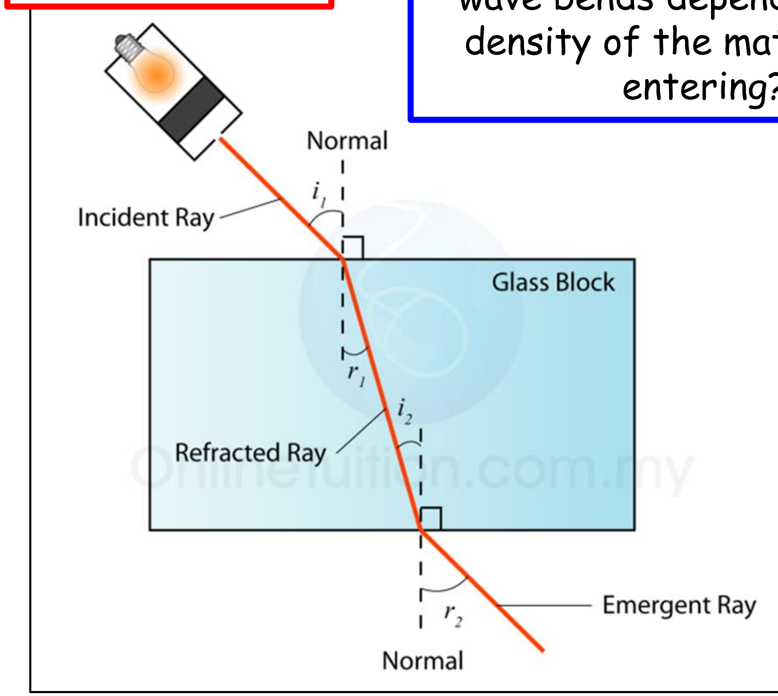
Reflection



What can we say is true about the angle of incidence and the angle of reflection?

Refraction

How does the way the light wave bends depend upon the density of the material it is entering?



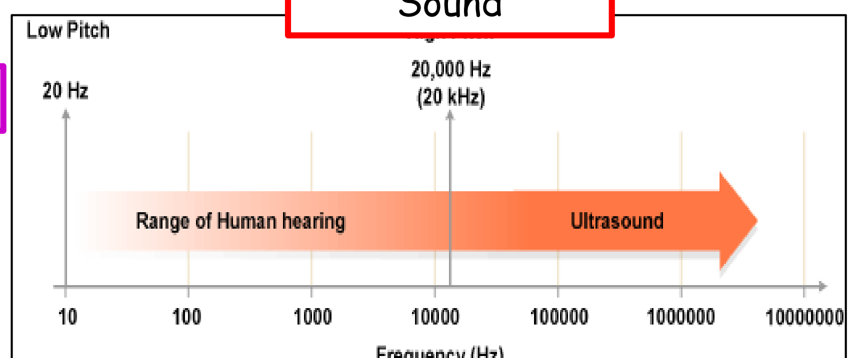
The Wave Equation

Wave speed = Frequency x Wavelength

V = f x ʎ

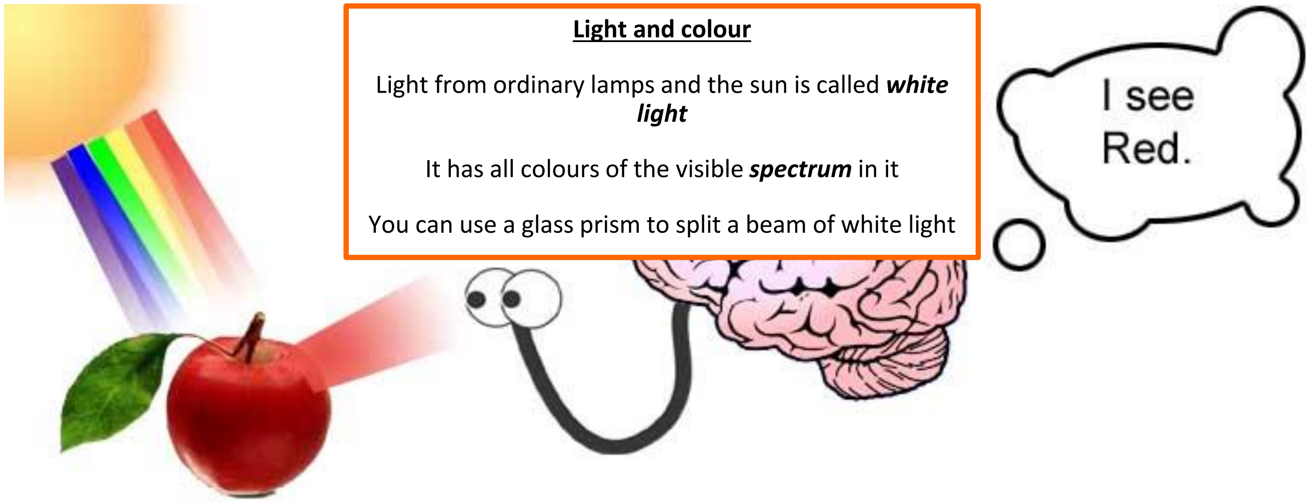
Example: Calculate the frequency of a light wave travelling at 300,000,000 m/s with a wavelength of 12cm

Sound



How does changing the frequency or wavelength of a wave affect its pitch or volume?
What is an echo?

Colour and Filters



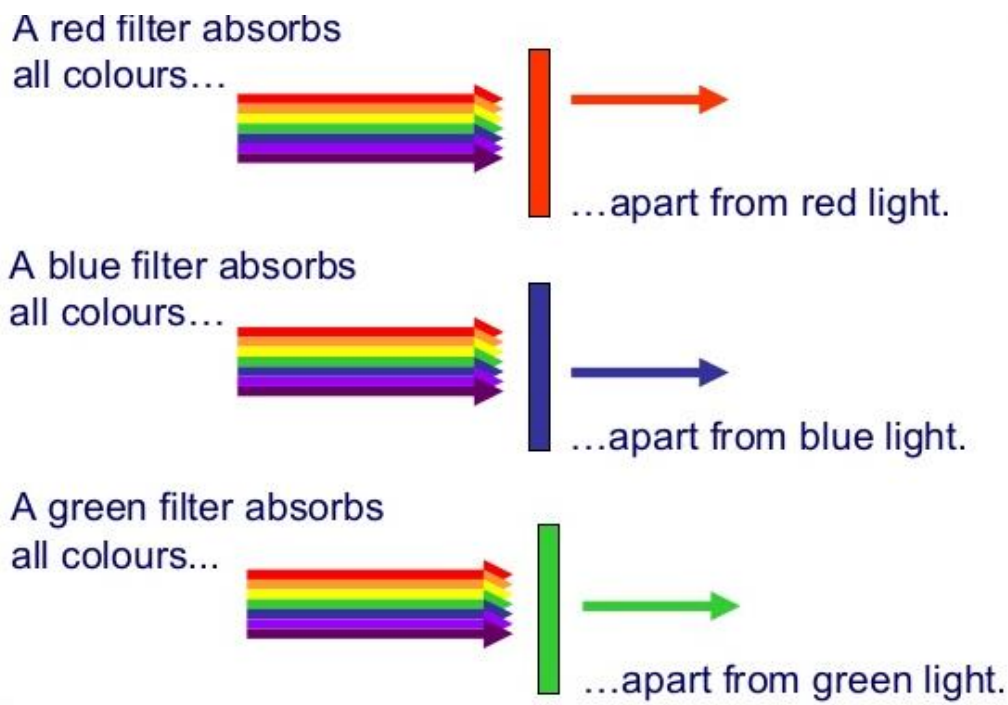
Light and colour

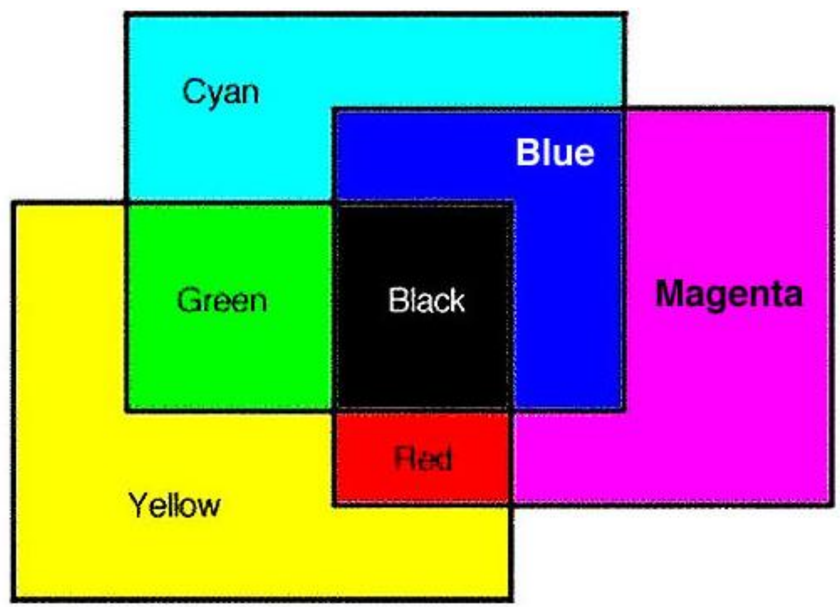
Light from ordinary lamps and the sun is called ***white light***

It has all colours of the visible ***spectrum*** in it

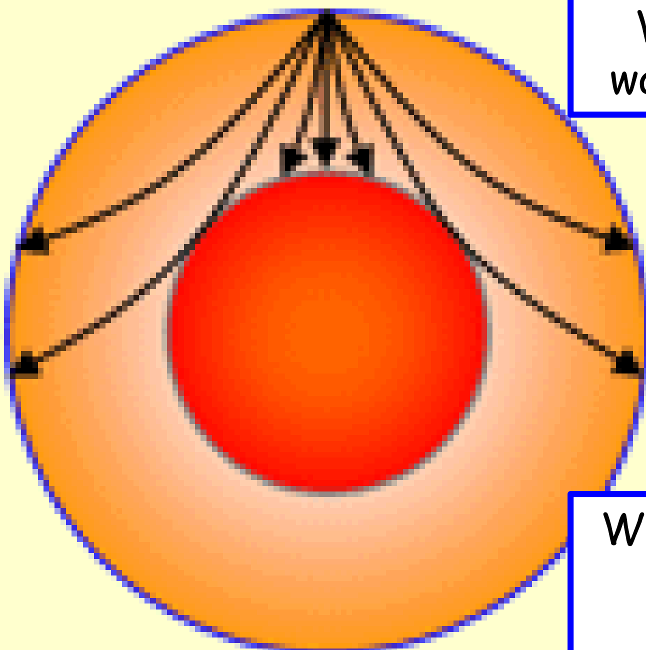
You can use a glass prism to split a beam of white light

What happens to the wavelengths that we don't see?

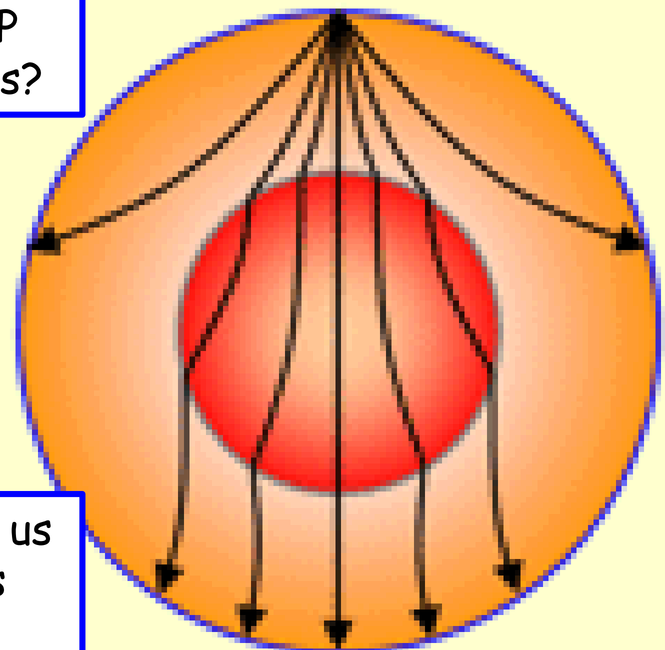




Earthquakes



What happens to P waves at boundaries?



What does this tell us about the Earth's structure?

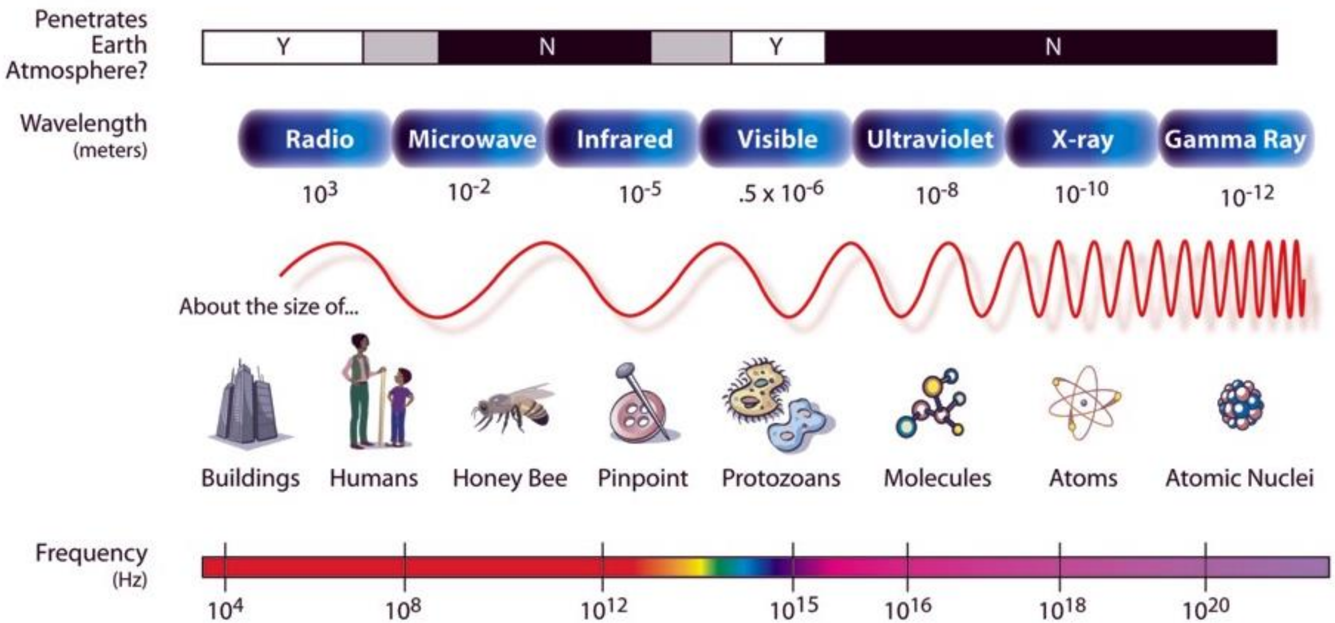
S waves
- transverse
- slow moving
- travel through solids only

P waves
- longitudinal
- fast moving
- travel through liquids and solids

AQA GCSE Physics
Paper 2 Revision
Topic 6: Waves

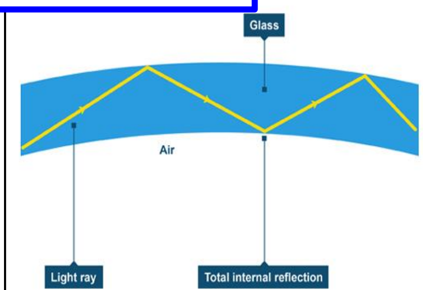
Electromagnetic Spectrum

The Electromagnetic Spectrum



All electromagnetic waves travel at the same speed in a vacuum, which is 300,000,000 m/s!

How does an optical fibre work?



What are the uses and dangers of each of these electromagnetic waves?

Communications

Microwaves and radio waves of different wavelengths are used for different purposes:

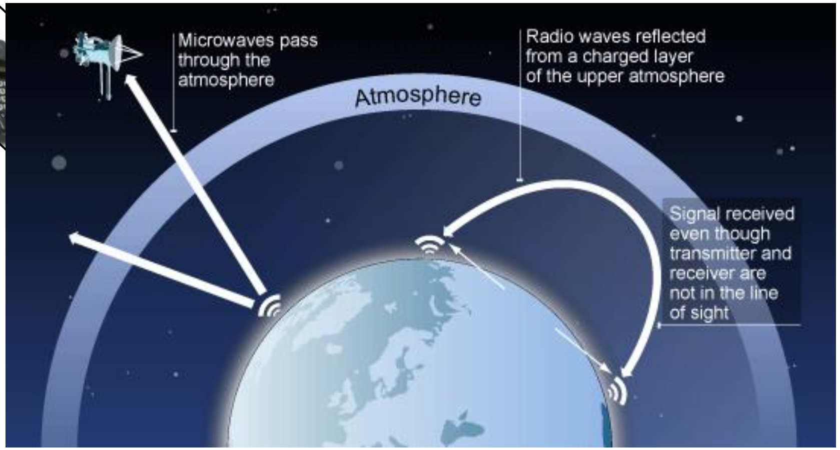
Shorter wavelengths: carry more information, diffract less, have a shorter range

Microwaves: satellite and TV as they diffract less and can travel between space and the ground

Radio waves of wavelength less than 1m: TV broadcasting as they carry more information than longer wavelengths

Radio waves of wavelength from 1-100m: local radio stations, emergency services as their range is limited

Radio waves of wavelength greater than 100m: national and international radio stations



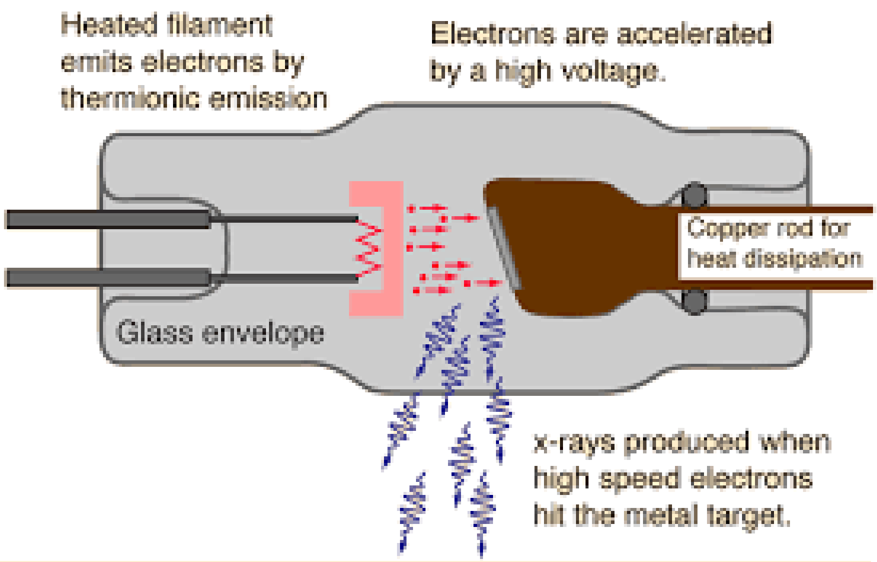
EM Wave Production

Radio waves are produced by passing an oscillating electric current through a long wire called an **aerial**.

The frequency of the radio wave produced is the same as the frequency of the oscillating current.

This allows radio waves of different wavelengths to be produced.

These radio waves have slightly different properties and are used for different purposes.



Ultraviolet radiation is emitted by very hot objects, such as the Sun.

Electrical sparks and arc welding also reach temperatures that are high enough to produce ultraviolet radiation.

Some gases emit ultraviolet radiation when an electric current is passed through them.

Tanning beds and the 'black lights' seen in night clubs use ultraviolet rays that have been produced in this way.

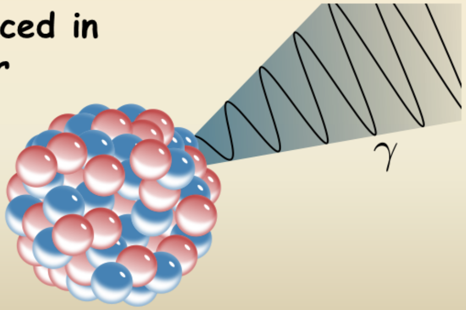
Gamma Ray Production

Gamma ray production (γ):

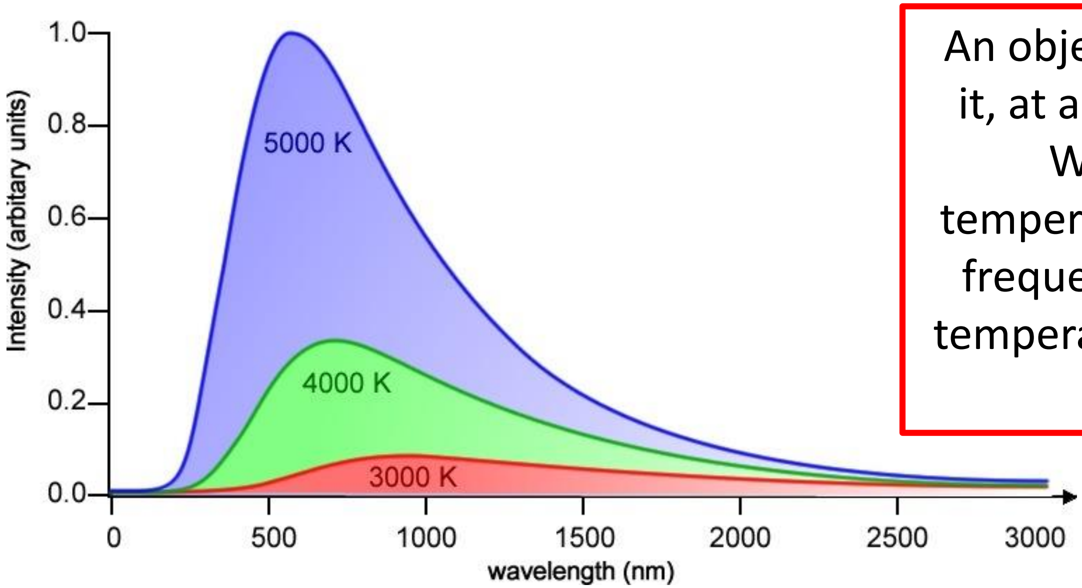
$$^{238}_{92}U \rightarrow \, ^{4}_{2}He + \, ^{234}_{90}Th + 2\,^{0}_{0}\gamma$$

Gamma rays are high energy photons produced in association with other forms of decay.

Gamma rays are massless and do not, by themselves, change the nucleus

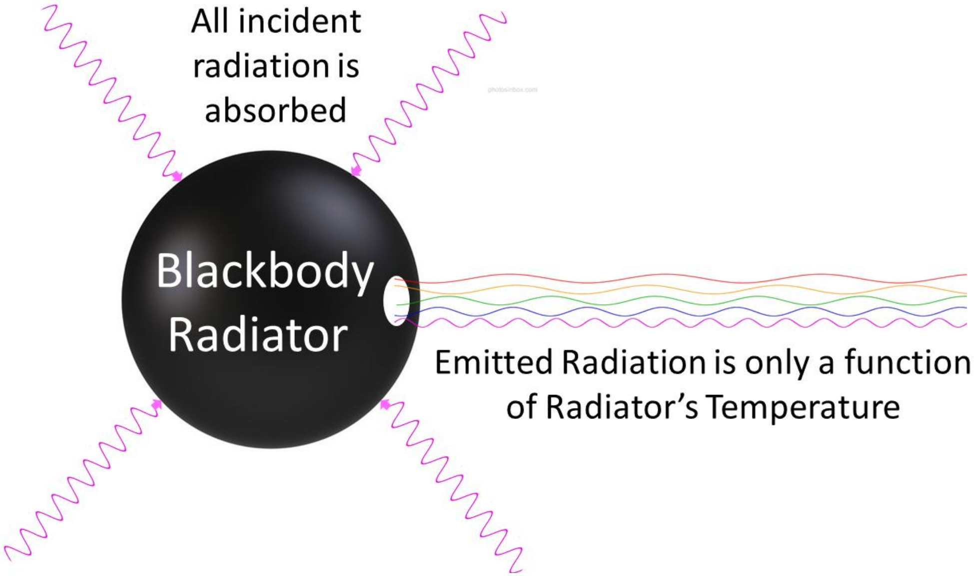


Black Body Radiation



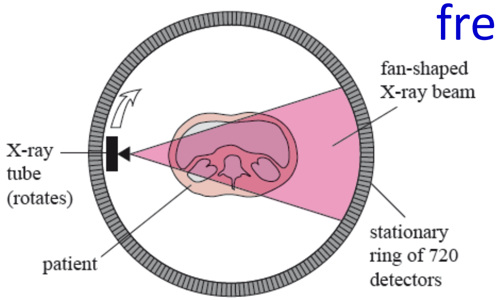
An object that absorbs all **radiation** falling on it, at all wavelengths, is called a **black body**. When a **black body** is at a uniform temperature, its **emission** has a characteristic frequency distribution that depends on the temperature. Its **emission** is called **black-body radiation**.

How does the **temperature** of the black body alter the **intensity/wavelength** of the radiation it emits?



X Rays

X-rays are used for imaging bones. They have a short wavelength, high frequency and are highly ionising.

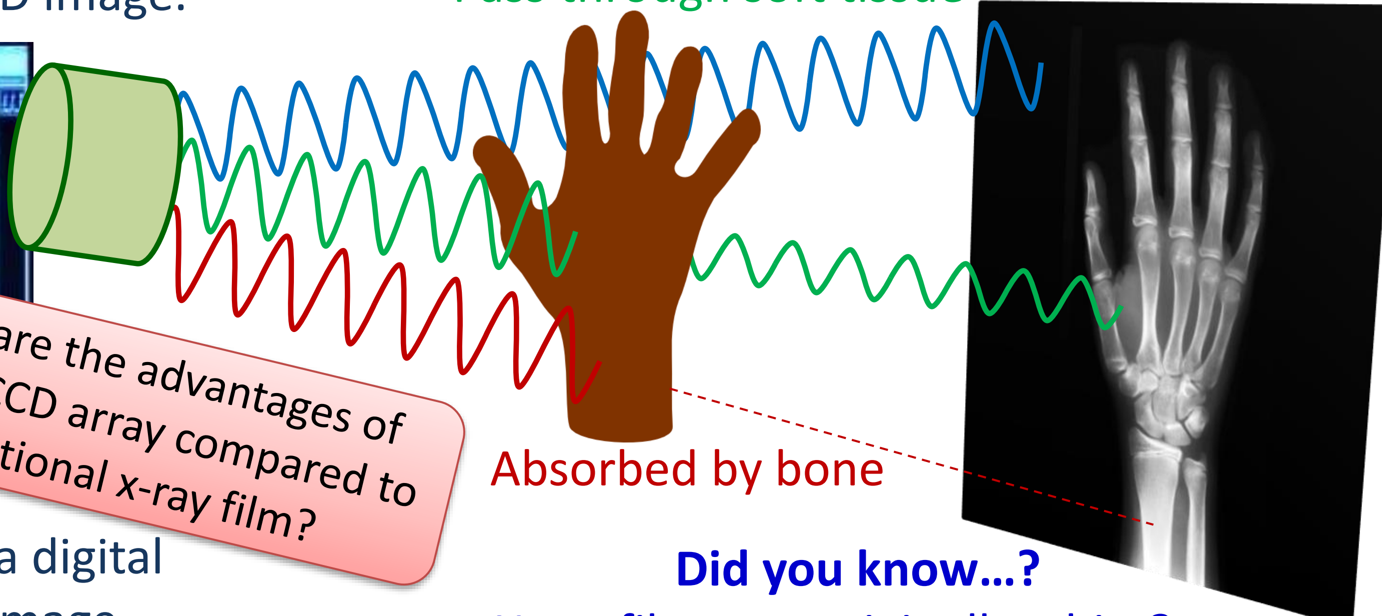


Why do radiographers stand behind a lead screen when carrying out x-rays?

Contrast media- swallow a chemical that makes your soft tissue absorb more X-rays so they appear on the x-ray image.

CT scans- take series of 2D scan 'slices' to build up a 3D image.

Pass through soft tissue



What are the advantages of using a CCD array compared to traditional x-ray film?

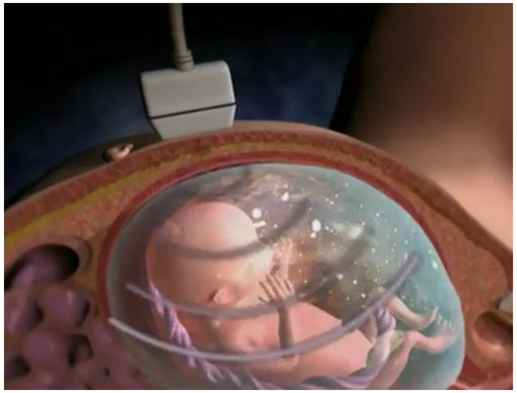
Absorbed by bone

CCD arrays- creates a digital version of the x-ray image

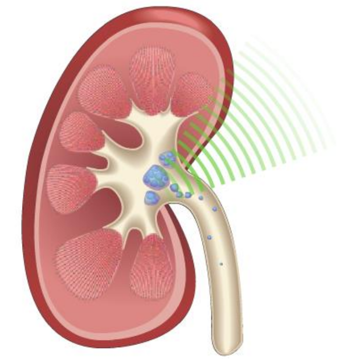
Did you know…?
X-ray films are originally white?

Ultrasound

Ultrasound waves are longitudinal waves with a frequency above the level of human hearing (20,000Hz)



Treating kidney stones- Ultrasound waves are used to make kidney stones vibrate, breaking them down so they are small enough to pass out in urine.



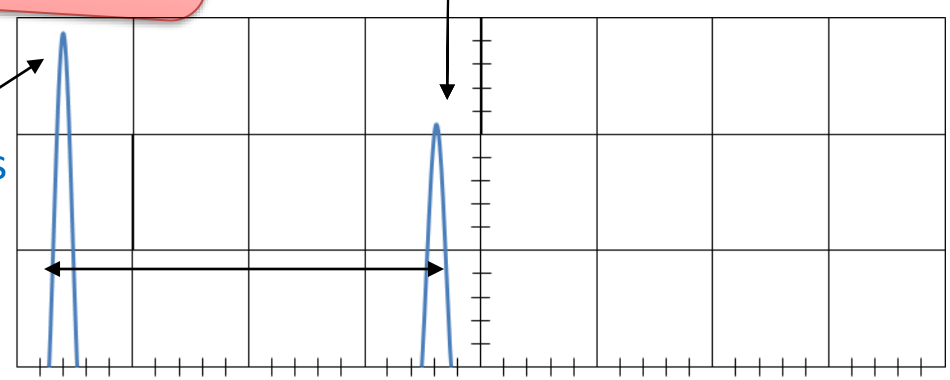
Prenatal scans- Ultrasound waves emitted from the transducer are partially reflected at boundaries between different tissues. The transducer detects these reflected waves and builds up an image.

Why is a coupling gel used when carrying out ultrasound scans?

What happens to ultrasound waves that aren't reflected?

Peak from reflection as ultrasound passes out of substance

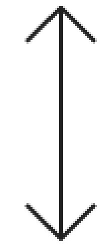
Peak from reflection as ultrasound passes into substance



The distance travelled in this time can then be calculated using *distance = speed x time*

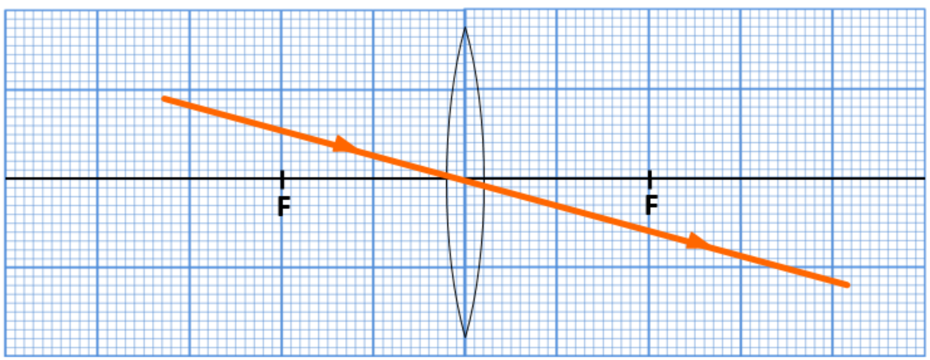
(hint: remember to half time as it is to boundary and back again)

Lenses: Convex

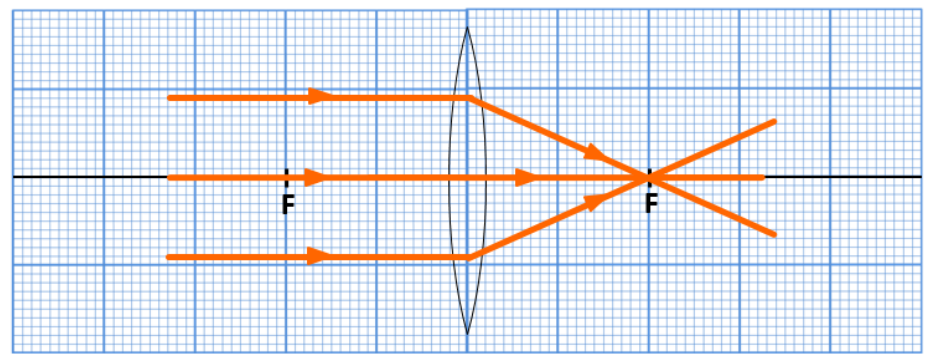


A lens is a transparent block that causes light to refract to form an image. A convex (or converging) lens curves outwards, and focuses light rays together

Convex lens rules



Any ray that passes through the origin carries on straight.

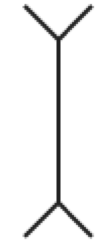


Any ray parallel to the axis will pass through the focus.

Convex lens image properties

Distance of object	Size	Orientation	Type	Position
Further than 2F	Diminished	Inverted	Real	Between 2F and F
2F	Same size	Inverted	Real	2F
Between 2F and F	Magnified	Inverted	Real	Further than 2F
F	No image because the emerging rays are parallel to the axis			
Closer than F	Magnified	Upright	Virtual	Same side as object

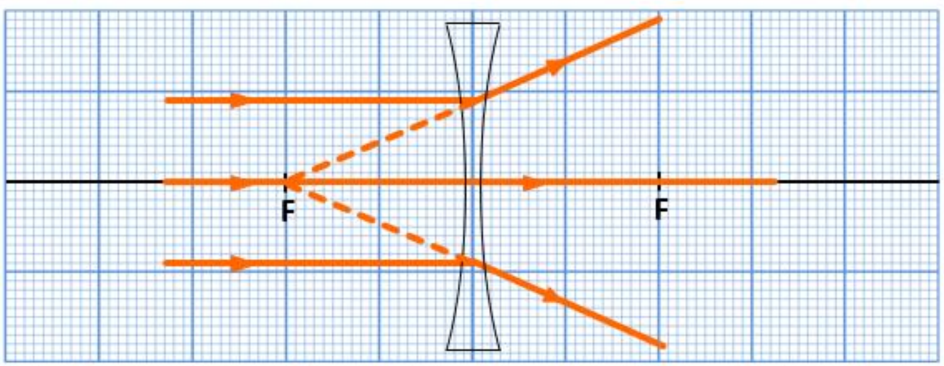
Lenses: Concave



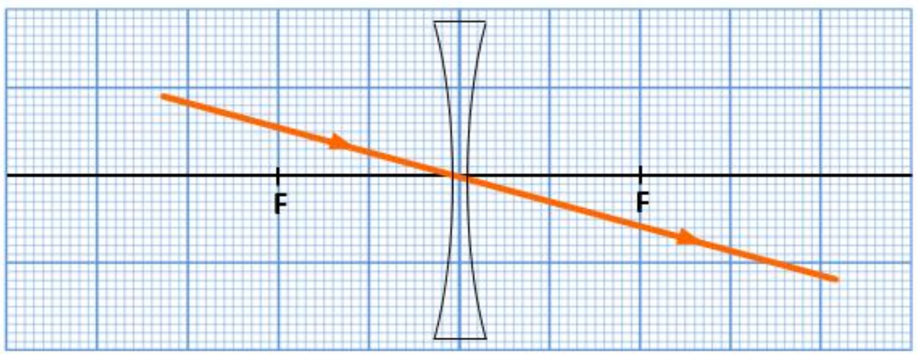
A lens is a transparent block that causes light to refract to form an image. A concave (or diverging) lens curves inwards, and spreads light rays apart

Concave lens rules

As the image is virtual the rays leaving the lens must be traced backwards in straight lines until they reach a point at which they cross



Any ray parallel to the axis will diverge and its virtual continuation will pass through the virtual focus.



Any ray that passes through the origin carries on straight.

What factors affect how much the light refracts due to the lens?

$$magnification = \frac{image\ height}{object\ height}$$

What does a negative magnification mean?

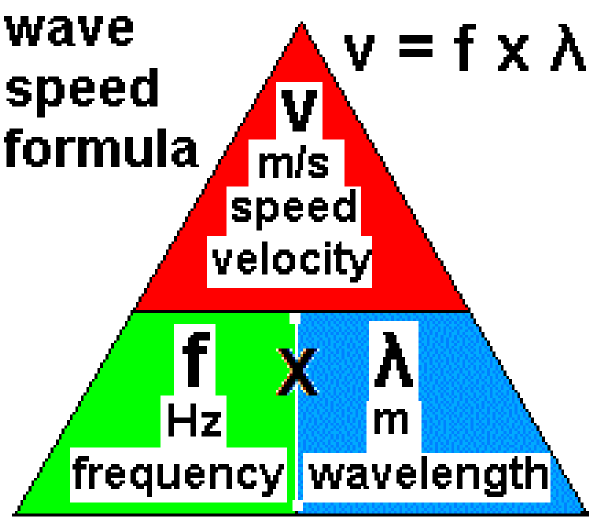
Magnification doesn't have a unit. Power has the unit of dioptres (D)

$$Power = \frac{1}{focal\ length}$$

Key Equations

On the Data Sheet

Not on the Data Sheet



Notes/Questions

Notes/Questions

Notes/Questions