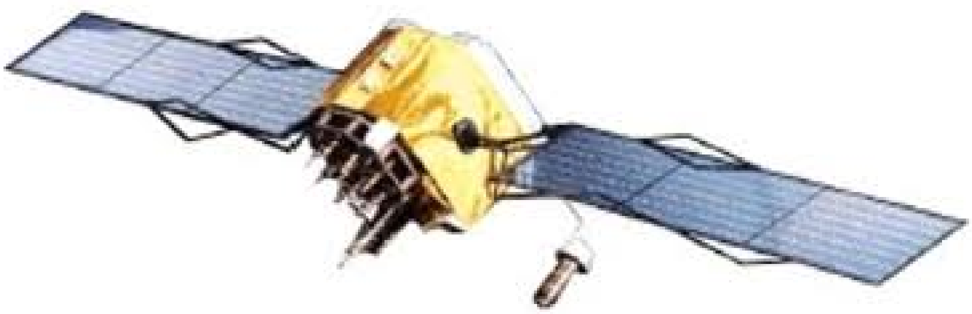
Satellites

Used for: Monitoring weather, Communications, Space research, Spying, Navigation.

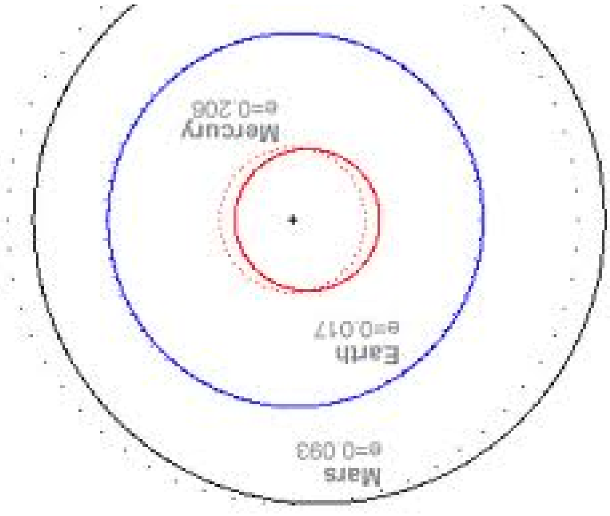
- Communication satellites stay over the same point; this is geostationary orbiting- the Earth Rotates with them.
- Low orbit satellites use low polar orbits, the Earth rotates and the satellites moves from pole to pole over it. It may only take a few hours to do a full orbit.
- GPS and the Hubble telescope are in other stable orbits.



Gravity and Orbits

Gravity makes things accelerate towards the ground at (10m/s)2. It gives everything a weight, and gives moons, planets and satellites in orbit. It provides centripetal force which balances the force between the pull towards the centre and the forward motion.

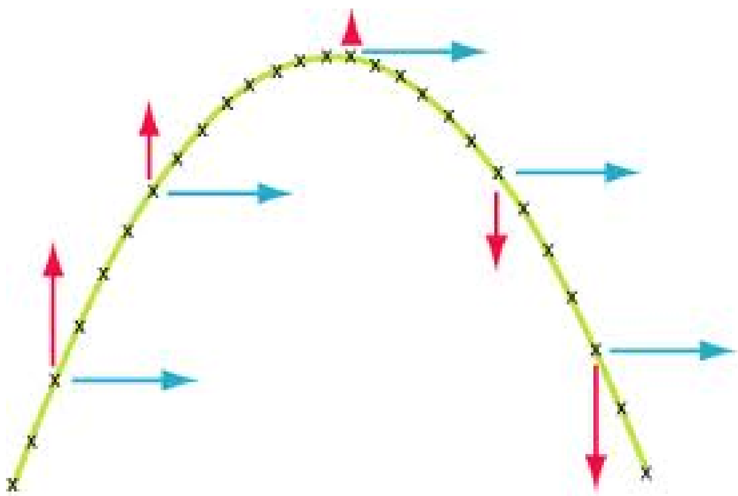
Gravity decreases the further away you get from an object at F is proportional to 1/d squared. This is why comets speed up and slow down as they orbit in an elliptical shape. Its faster the closer it is to the object.



Projectile Motion

The path of projectile motion is a parabola.

Horizontal and Vertical motions are separate, they use equations of motions (SUVAT)



Momentum

- Momentum= mass x velocity.
- The greater the mass of an object, the greater the velocity.
- Forces cause changes in momentum.
- Force acting (N)= change in momentum(kgm/s) / time taken for change.

Speed and Velocity

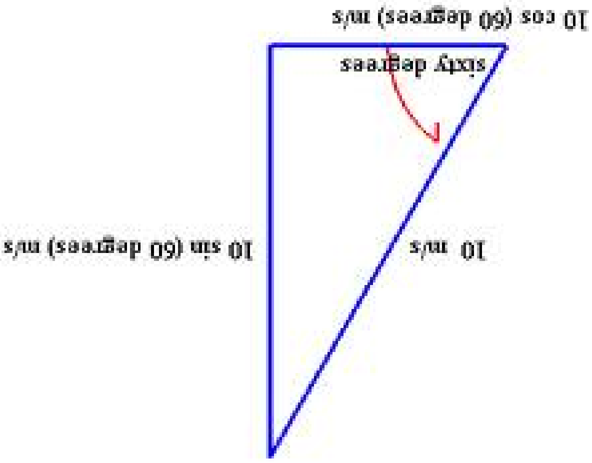
- Speed is just a number, velocity is direction as well as a number.
- Scalar Quantities:- mass, temperature, time, length, speed, etc...
- Vector Quantities:- force, displacement, acceleration, momentum, velocity, etc...
- Relative speed compares objects two different speeds.

Combining Force and Velocity

With/ Against current = combine e.g.

---> 100km/h + <---20km/h = ----> 80km/h across the current.

It is the same with force and velocity, we use Pythagoras and trigonometry to solve it:



Equations of Motion

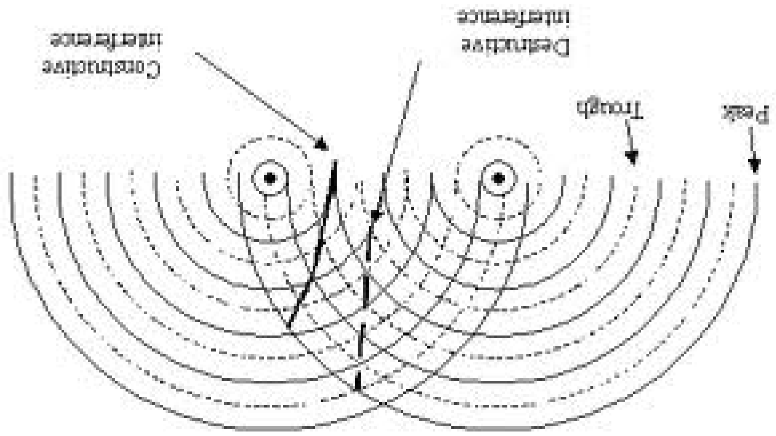
- S= Speed (displacement.)
- U= Initial Velocity.
- V= Final Velocity.
- A= Acceleration.
- T= Time.

1. Work out what you have.
2. Work out what you want to find out.
3. Find the equation you need to use.
4. Put the numbers into the equation
5. Do the maths!!!

$$v = u + at \quad (1)$$
$$s = \tfrac{1}{2}(u + v)t \quad (2)$$
$$s = ut + \tfrac{1}{2}at^2 \quad (3)$$
$$s = vt - \tfrac{1}{2}at^2 \quad (4)$$
$$v^2 = u^2 + 2as \quad (5)$$
$$a = \frac{v - u}{t} \quad (6)$$

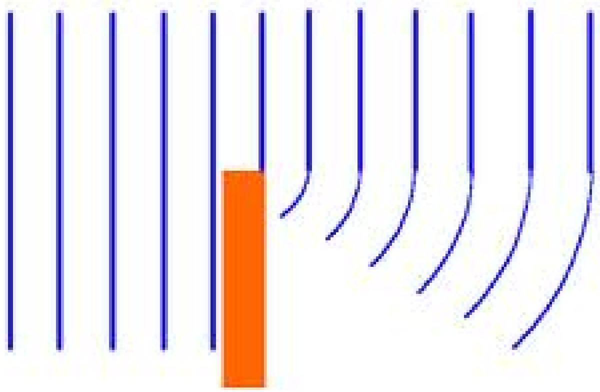
Wave Interference

- When waves meet they cause disturbance either constructively or destructively.
- If sound interferes constructively it creates 'loud bits.'
- If light interferes constructively it creates 'bright bits.'
- If sound interferes destructively it creates 'quiet or silent bits.'
- If light interferes constructively it created 'dark bits.'



Radio Waves and Communications

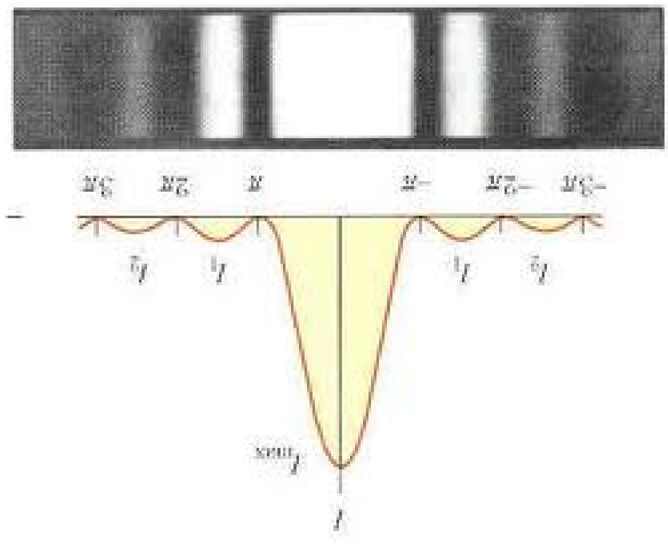
- AM= amplitude modulation
- 1. Ground waves.   2. Sky waves.   3. Space waves.
- Space waves e.g. microwaves easily pass through the atmosphere reflecting off satellites.
- Long wave length radio waves diffract- the smaller the gap the more it diffracts through to the other side. Also long waves are used to diffract over hills.



Diffraction Pattens and Polarisation

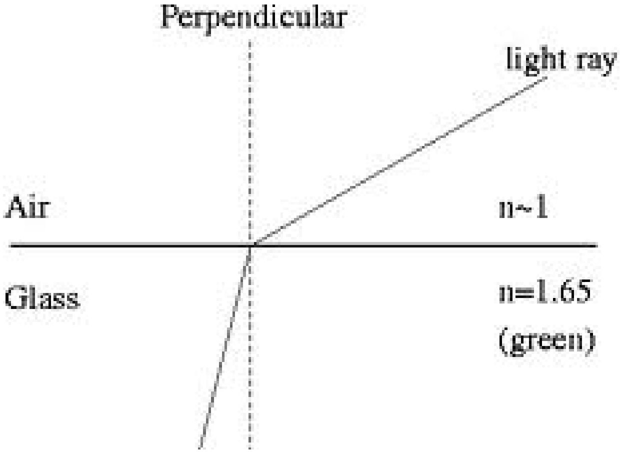
When light diffracts you get pattens of light and dark. Interference occurs when waves of equal frequency overlap. The patten makes a bright central fringe and alternating light and dark fringes on each side.

EM wave are transverse therefore can be polarised which transmits waves in one direction e.g. polarising sunglasses.



Refraction

- Waves slow down in shallow water- they don't change frequency or direction and therefore slow down.
- Light refracts, 'bends', towards the perspex blocks normal when travelling through. It is because the wave changes speed from going through air to through solid.
- Dispersion produces a rainbow e.g. through a glass pyramid again due to different speeds the light is travelling at.
- Total internal reflection and critical angles through a semi-circular glass block, this is worked out using Snell's law.



Refractive Index and Snell's Law

- Every transparent material has a refractive index.
- refractive index (n) = speed of light in a vacuum (c)

  Speed of light in a material (v)
- Snell's Law: n= sin i (normal)

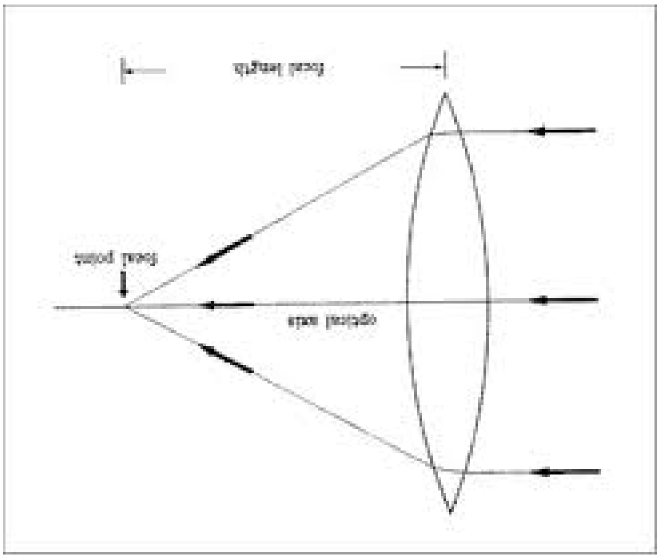
  sin r (normal)

$$\frac{\sin\phi}{\sin\phi'} = \frac{n'}{n}$$

Images and Converging Lenses

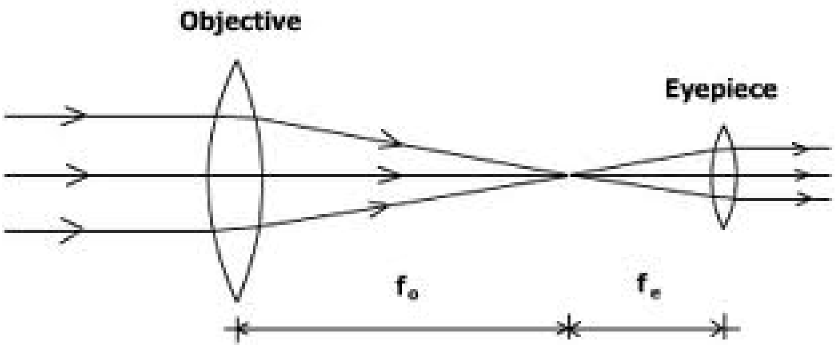
- A real image is actually seen e.g. a screen.
- A virtual image is not e.g. a mirror.

A converging lens is convex- it bulges outwards- the light enters a parallel but ends up at a focal point or the other way around. They make both real and virtual images depending on how close they're to the lens.



Ray Diagrams

- Draw them from converging lenses by:
- Choose point at top of lens.
- Draw a parallel line to the lens from it.
- Draw another line from the top to the middle of the lens.
- Incident ray is parallel to axis it's a refracted ray through the focal point.
- The line passing through the middle doesn't bond where the rays meet is at the top of the image.
- Repeat process for the bottom of the object.



Uses of Converging Lenses

- Magnifying glasses use convex lenses to produce a virtual image.
- Magnification= image height/ object height
- Taking a photo forms an image on a film- this is a real image because light rays actually meet there. The image is inverted (upside down).
- The same thing happens in our eyes- a real inverted image forms in the retina- our brains flip the image so we see it the right way up. The same thing happens in a projector.