Light waves

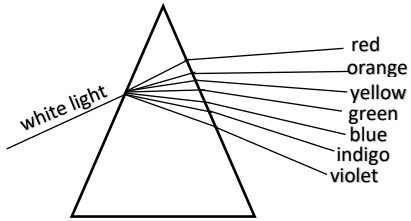
Diffraction of Light waves

Single split diffraction
-wide, central band
-both sides alternating with black and coloured strokes
-the larger the wavelength of light, the wider the coloured bands
Experiment: black glass slide, now cuts split. Where white, coloured strokes are observed = constructive

Double split diffraction
-parallel spaced strokes
-larger wavelength = wider strokes

Monochromatic Light
Light comprising only one wavelength (single frequency)
-Red light has a longer wavelength than blue light thus wider strokes
-constructive interference leads to light band/maximum
-destructive interference leads to dark band/ minimum
-central maximum = light band in middle, ranking = 0
-sinΘ = $\frac{m\lambda}{a}$ m=ranking of minimum (+-1; +-2; +-3)
a=width of split (meter)

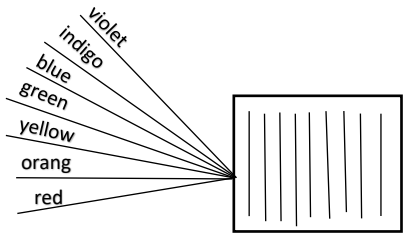
Light breaking through prism



Interference of light waves

The sources must be coherent, phase difference must be constant for a certain amount of time.
White, red, blue strokes of light= constructive interference
Black strokes of light= destructive interference
Strokes of red light= wider, longer wavelengths
Because only waves can experience interference, the interference of light is proof that light is a wave movement.

Diffraction Pattern



Speed of light= frequency x wavelength
$C(3x10^8) = f\lambda$
-Diffraction α ʎ (colour with largest wavelength breaks the most)
-Light breaking α f (colour with largest frequency breaks the most)

Colour

-7 colours are observed: red, orange, yellow, green, blue, indigo and violet (ROYGBIV)
-Each frequency move at the same speed in air or in a vacuum namely $3x10^8 m.s^{-1}$, as soon as it enters another medium, the speed decreases. The frequencies of the colours move at different velocities and then bend with different angles through the prism.
-Dispersion: procession of white light in its different frequencies of light waves.
-Refraction: effect where light changes direction in a prism, not through a 90°, thus changes direction.
-How a rainbow works: a rainbow forms when a ray of sun moves through a drop of rain. The ray is refracted when it enters the raindrop and is then internally reflected from the back of the drop. It is then refracted again when exiting the drop. Air is thus broken down in its 7 colours like dispersion through a prism. The red light is at the bottom and violet is at the top as it leaves the raindrop. You only see the light invading your eye directly. You see red light from the highest drop and violet from the lowest.

To obtain white light again:
-At the first level higher f light (violet) is more refracted than light with low f. Thus violet moves the slowest through glass and red the fastest.
-At the second level colours are more spread out because the speed of violet increases the most and red the least. Light then returns to its original speed. The 2^{nd} prims causes dispersion in the opposite direction so 7 colours give white.
-when the 2^{nd} prism is placed base-to-base with the 1^{st}, a new, wider spectrum is obtained, but no light is observed.
-can also use a Newton slide