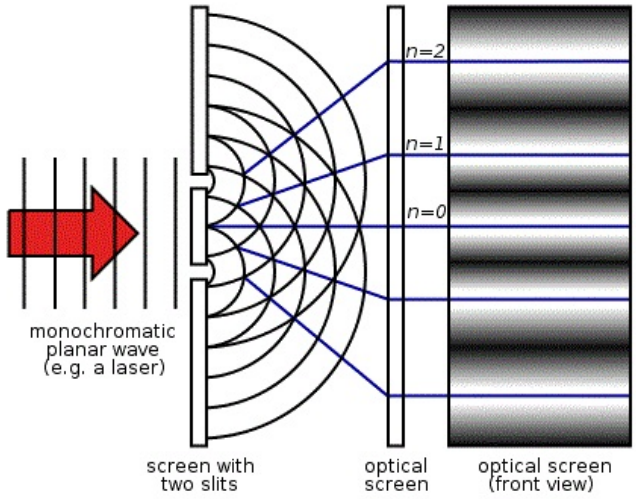
Refraction, Diffraction and interference

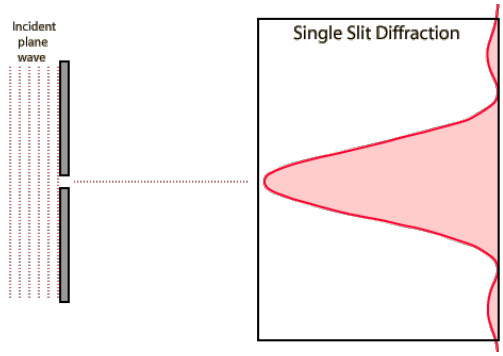
1 Interference

Coherence - Waves with the same frequency and a constant phase difference

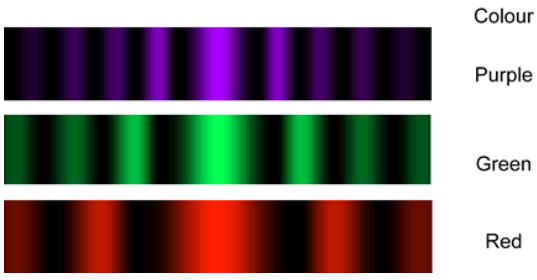


When two of the same type of point meet they cause **reinforcement/constructive interference**
When a point meets with its opposite they cause **cancellation/destructive interference**

2 Diffraction



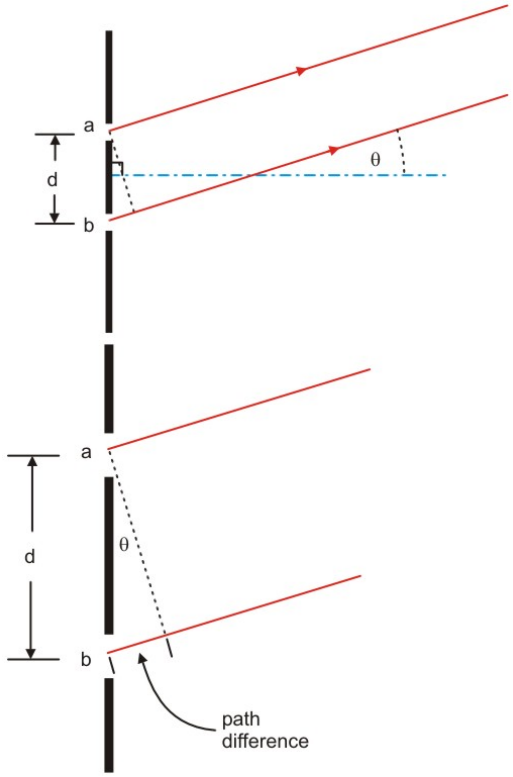
2.1 Diffraction of different colours



Increasing wavelength:

- Central maxima becomes wider
- Secondary maxima become wider apart

2.2 Deriving $n\lambda = d\sin\theta$



Path difference $= d\sin\theta$
$n\lambda = d\sin\theta$

3 Refraction

3.1 Refraction at a plane surface

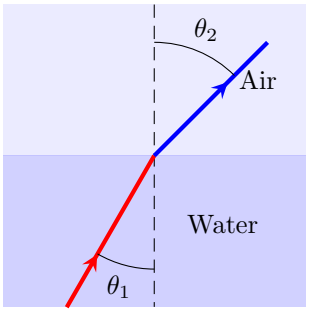


Figure 1: Normal Refraction

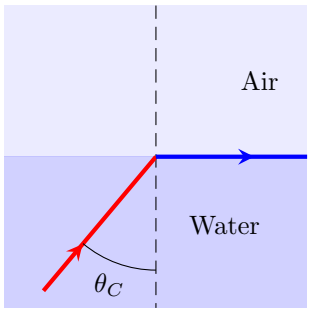


Figure 2: Critical angle

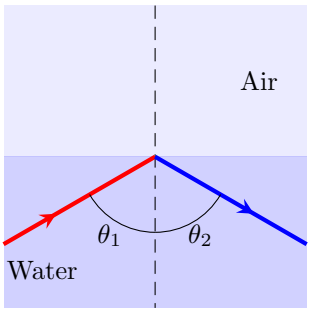
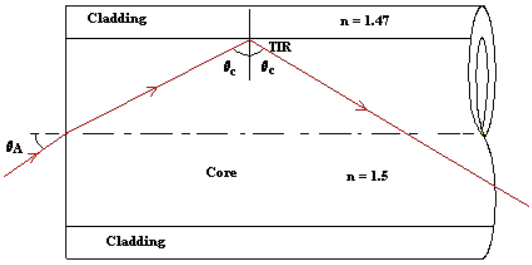
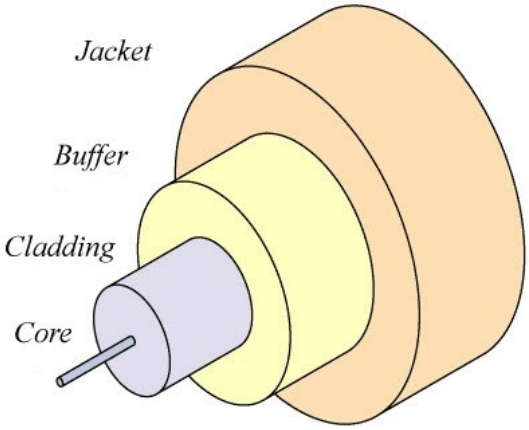


Figure 3: Total internal reflection

The angle is measured from the normal to the ray
After the angle reaches the critical angle the ray will undergo **total internal reflection**

3.2 Fibre Optics





3.2.1 Modal Dispersion

Waves entering the fibre at different angles will reflect differently and so will have different path lengths

3.2.2 Material Dispersion

Different wavelengths of light enter the same but refract differently, causing a difference in path length