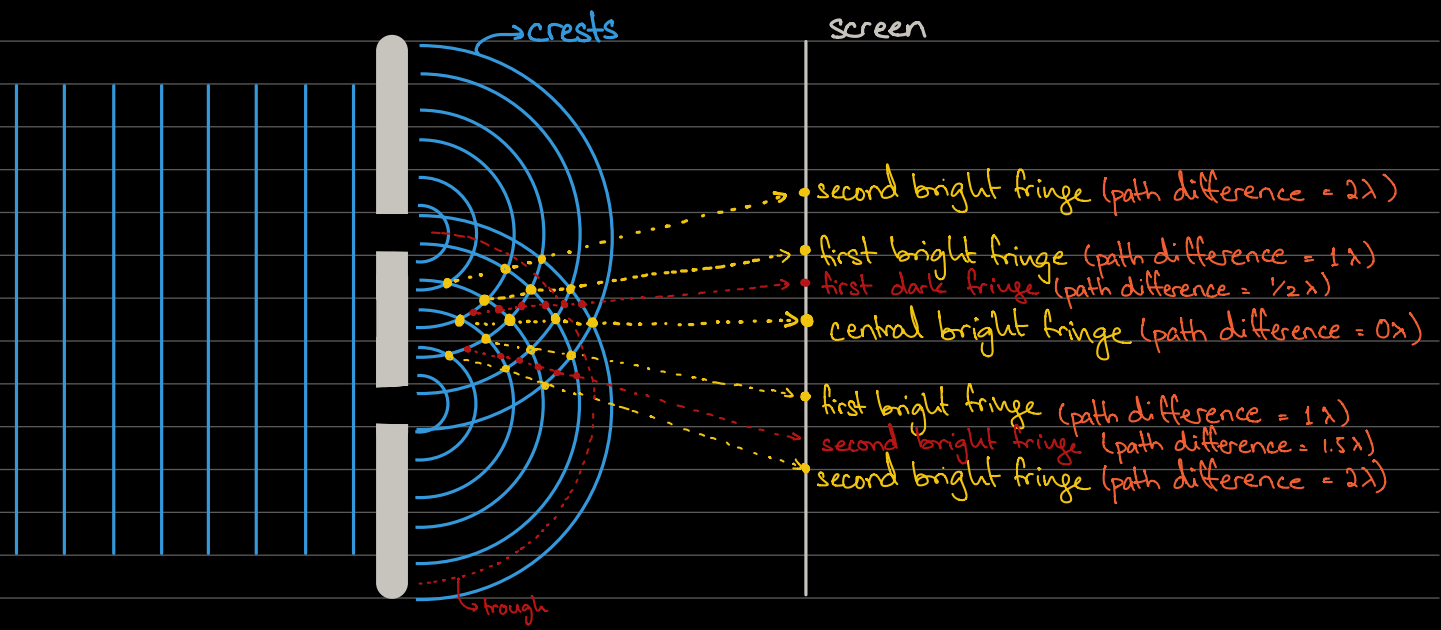
YOUNG'S DOUBLE SLIT INTERFERENCE PATTERN : WAVES

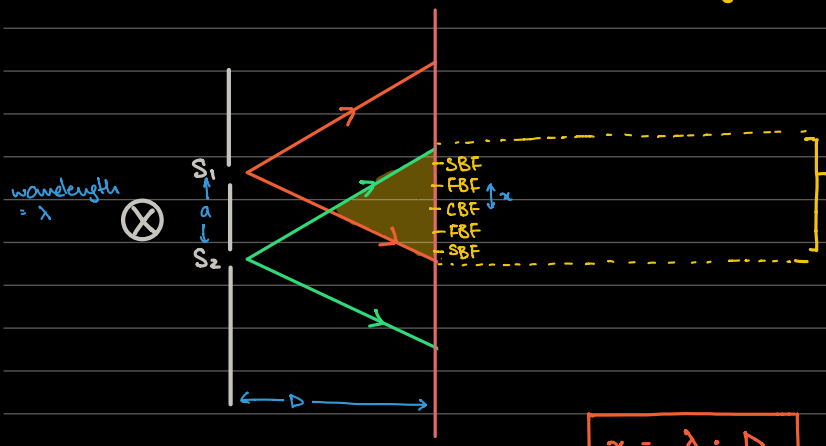
Purpose :
To observe the interference of light

Procedure :
- Light is allowed to pass through two slits S_1 and S_2.
- Diffraction occurs as shown below
- This causes light from one slit to interfere with the light from the other slit

Observation :
- Bright and dark spots, also called fringes, are seen on the screen
- Bright fringes will be observed due to constructive interference
- Dark fringes will be due to destructive interference



SIMPLIFIED VERSION of the diagram



An interference pattern is observed on the screen

$$x = \frac{\lambda \cdot D}{a}$$

- wavelength = λ
- slit seperation = a (distance b/w two slits S_1 & S_2)
- distance b/w double slit & screen = D
- fringe seperation = x (distance b/w two successive bright fringes / dark fringes)

Typical values for λ, D, and a so that an interference pattern can be observed on the screen?

Learn the following typical values:

λ = 400nm (violet) to 700nm (red) (4×10^{-7}m to 7×10^{-7}m)

D = 1m to 3m

a = 0.5mm to 1.5mm

Example Question:

Q. Calculate the distance between two successive bright fringes using the following values:

$\lambda = 5 \times 10^{-7}$m, D = 1.2m, a = 0.75mm

$$x = \frac{D \cdot \lambda}{a}$$

$$x = \frac{(5 \times 10^{-7})(1.2)}{(0.75 \times 10^{-3})}$$

$x = 0.0008$m or 8×10^{-4}m or 0.8mm

Q. Calculate the distance between two successive dark fringes

It is equal to x.

The distance between two bright fringes is equal to the distance between two successive dark fringes

Q. Calculate the distance between a bright fringe and the next dark fringe.

$\frac{1}{2}x$, because dark fringes occur exactly in the middle of two successive bright fringes, and vice versa