YOUNGS DOUBLE SLIT INTERFERENCE PATTERN

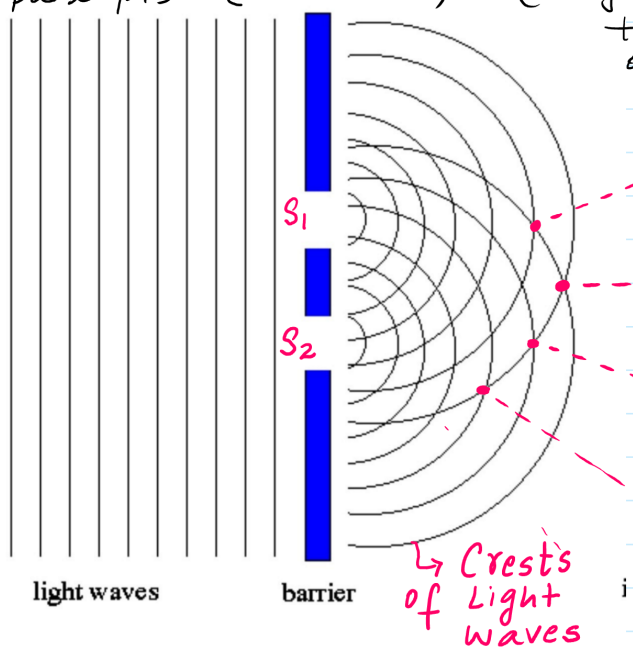
24 January 2021 19:04

Purpose :- To observe Interference from two Light Sources

Procedure :- Light waves were allowed to fall on two Slits Labelled as S_1 and S_2 on the diagram below. Diffraction occurs causing the light waves to spread out as they pass through the slits. This allows light waves to Interfere with each other hence an interference pattern is observed on the screen.

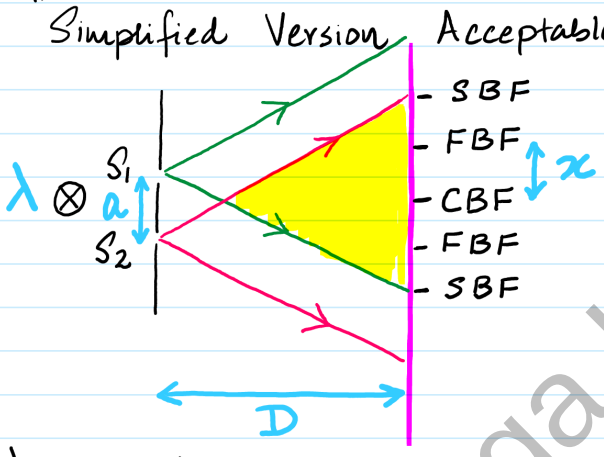
Observation :- Bright and dark spots (also called Bright fringes & Dark fringes are observed on the screen

Reason :- Bright fringes arises due to Constructive Interference b/w in phase pts (Crest + Crest) or (Trough + Trough) & dark fringes arrises due to Destructive Interference b/w out of phase pts i.e (Crest + Trough)



- First Bright fringe (path diff = 1λ).
- First Dark fringe (path diff = $\frac{1}{2}\lambda$)
- Central Bright Fringe (path diff = 0λ)
- First Dark Fringe (path diff = $\frac{1}{2}\lambda$)
- First Bright Fringe (path diff = 1λ).
- Second Dark Fringe (path diff = $\frac{3}{2}\lambda$)
- Second Bright Fringe (path diff = 2λ)

"Simplified Version Acceptable"



An interference pattern is observed in the Overlapping region

formula which relates x, a, λ, D

λ = wavelength
D = distance b/w double slit & screen
a = SLIT SEPERATION (distance b/w the two slits S_1 & S_2)
x = FRINGE SEPERATION (distance b/w two successive Bright fringe or b/w two successive Dark fringes).

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

Q:- Suggest Typical values for λ, D & a so that an Interference pattern can be easily observed on the screen?

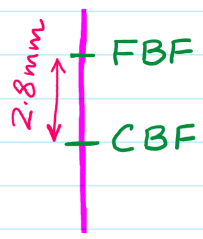
learn
- λ = 400nm (VIOLET) to 700nm (RED)
- D = 1m to 3m
- a = 0.5mm to 1.5mm

VIBGYOR
400nm ⟶ 700nm

Q:- $\lambda = 550nm$ $D = 2.8m$ $a = 0.55mm$

(i) Cal distance b/w two Successive Bright fringes

$$x = \frac{\lambda \cdot D}{a} = \frac{(550 \times 10^{-9})(2.8)}{0.55 \times 10^{-3}} \quad \therefore \quad x = 2.8mm \ (2.8 \times 10^{-3} m)$$



(ii) Cal distance b/w two Successive Dark fringes

x = same as (i) i.e $2.8 \times 10^{-3} m$ (2.8mm)

(iii) Cal distance b/w a Bright fringe & a dark fringe next to it ?

$\frac{1}{2}x$ ∴ 1.4mm

(iv) Cal distance b/w C.B.F and T.B.F (Central & Third)

$3x$ ∴ 5.6mm