

Factors

26 January 2021 10:38

Factors affecting the fringe separation (x) and the brightness of the fringes.

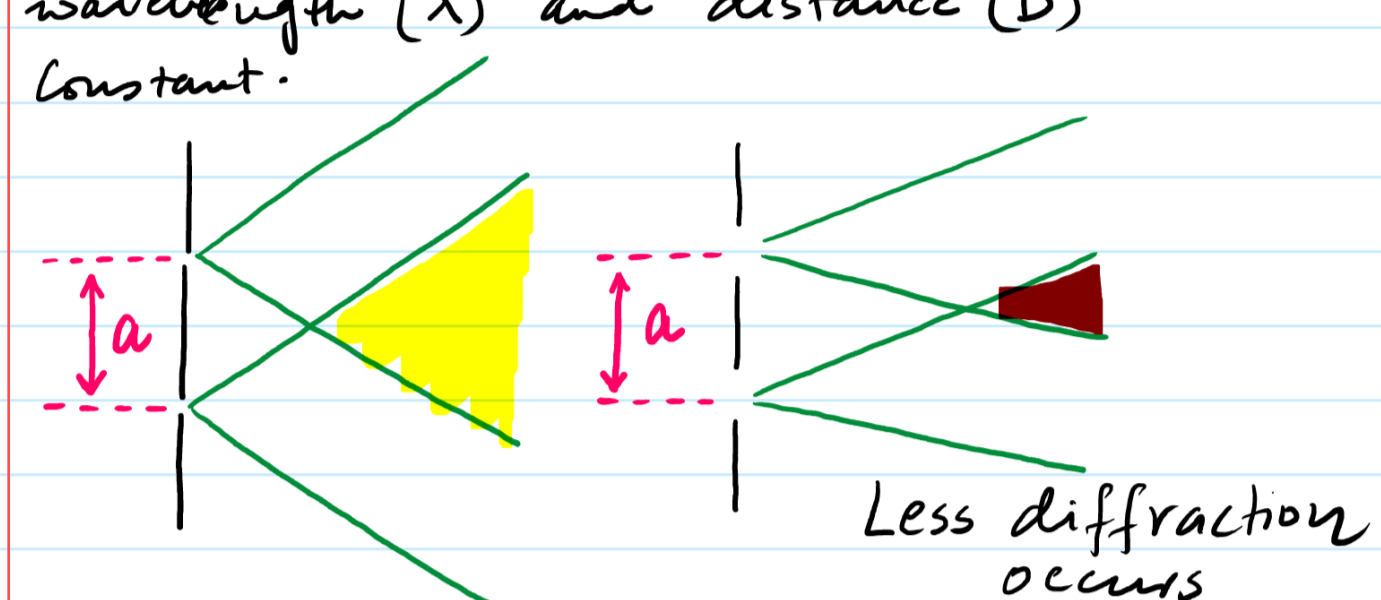
① The distance (D) b/w the double slit and the screen is **increased**, while all other factors stay unchanged.

- $\uparrow x = \frac{\lambda D}{a} \uparrow \therefore x$ increases i.e. fringe separation increases
- Since $I \propto \frac{1}{d^2}$ \therefore as distance increases, the Intensity of Light falling on the screen will decrease hence fringes will be less bright.

② Light Source is now replaced with a Sound Source

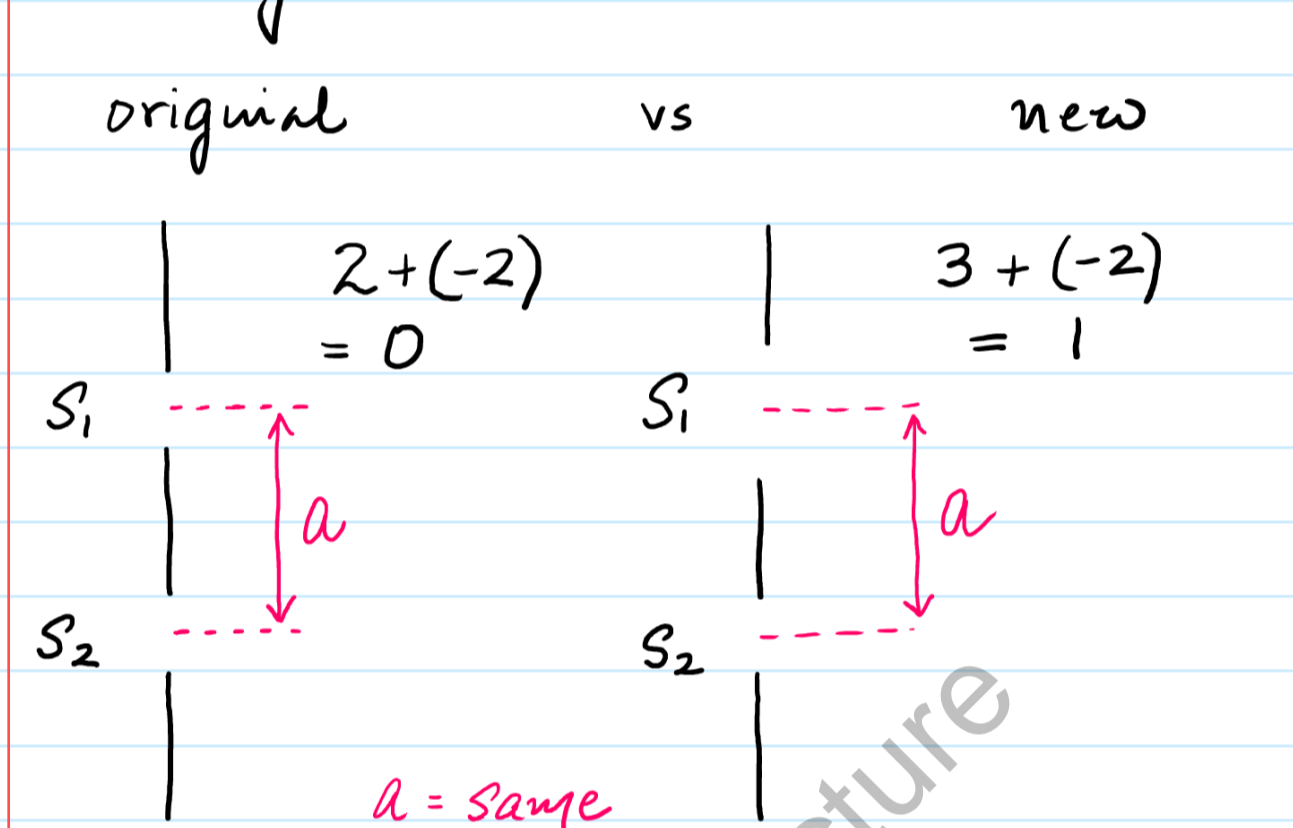
- since $\lambda_{\text{sound}} > \lambda_{\text{light}} \therefore \uparrow x = \frac{\lambda D}{a}$ hence x increases
- Interference pattern will disappear Bright & Dark fringes will now be replaced by the term Loud Sound & Soft Sound / Zero Sound.

③ The Size of each slit is increased while keeping the slit separation (a), wavelength (λ) and distance (D) constant.



- $x = \frac{\lambda D}{a}$, since λ, D & a are all unchanged \therefore fringe separation x also remains unchanged
- Since size of each slit is increased \therefore brightness of the fringes will also increase
- As slit size is increased, less diffraction occurs \therefore Interference pattern will now be observed over a limited area / less # of fringes detected.

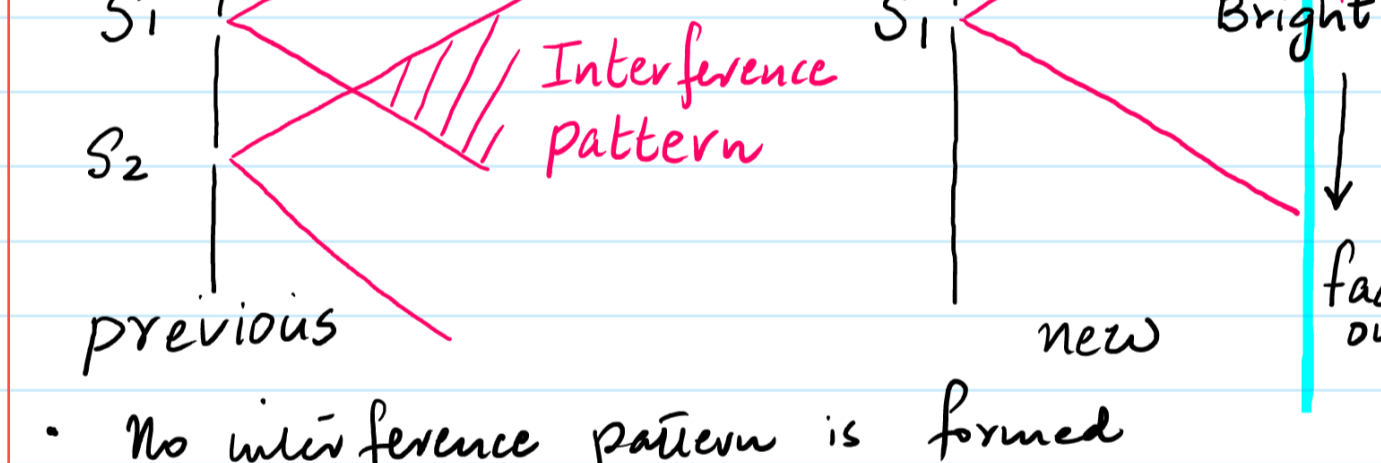
④ The Size of **only one slit S_1** is increased, the size of the other slit S_2 is kept unchanged. Other factors slit separation (a), wavelength (λ) and distance (D) also kept unchanged.



- $x = \frac{\lambda D}{a}$ x remains unchanged
- The terms bright & dark fringes will now be replaced by the terms more bright and less bright fringes "stopped"

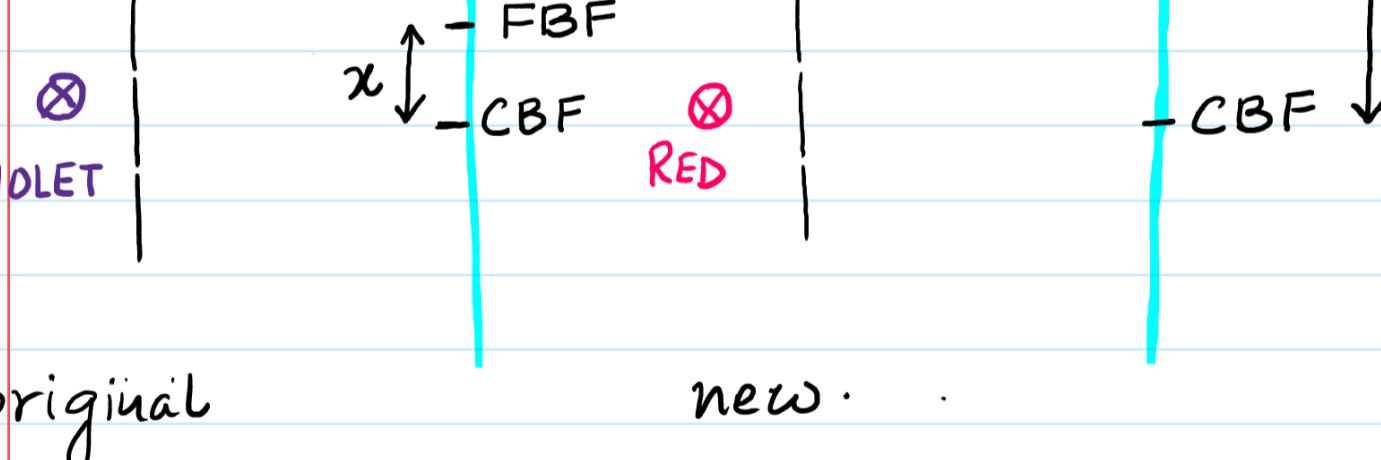
Factor 5

⑤ One of the slit is **completely closed** while the other slit is left unchanged.



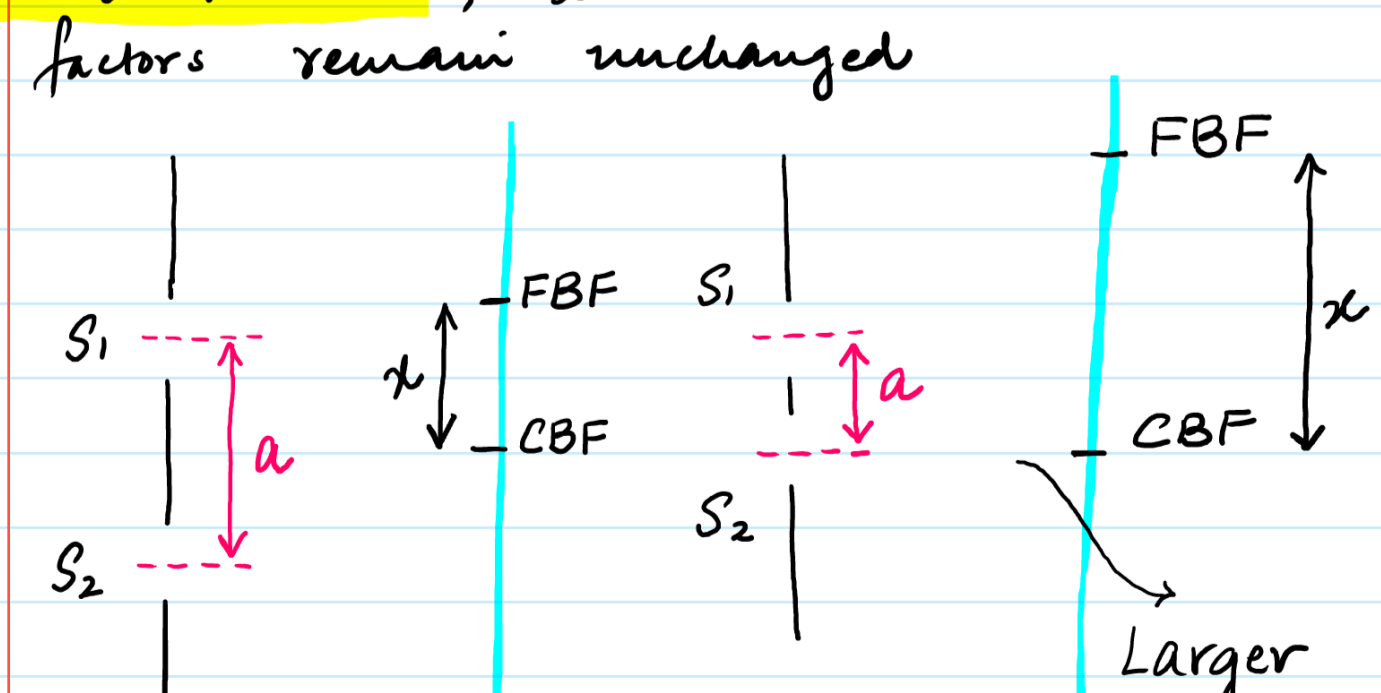
- No interference pattern is formed hence no appearance of bright & dark fringes.
- A large area on the screen will be lit up & the intensity continues to fade as we approach the end of the screen on either side. $I \propto \frac{1}{d^2}$

⑥ The violet light (400nm) is now replaced with a red light (700nm)



- $\uparrow x = \frac{\lambda D}{a}$ fringe sep (x) will increase
- CBF appearance unchanged
- FBF (Since FBF for longer wavelength (Red) is further away from CBF) \therefore its brightness will marginally reduce / almost unchanged.

⑦ The **slit separation (a)** is now reduced, while all other factors remain unchanged



- $\uparrow x = \frac{\lambda D}{a} \downarrow \therefore$ fringe separation x will increase
- C.B.F remains unchanged
- FBF (brightness marginally decreases or almost unchanged)
- Interference Pattern will be observed over a larger Area