DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 8

Topic :- WAVE OPTICS

1 **(b)**

Fringe shift is given by $x = \frac{(\mu - 1)t\beta}{\lambda}$

For first plate, $x = \frac{(\mu_1 - 1)t\beta}{\lambda}$

For second plate $\frac{3}{2}x = \frac{(\mu_2 - 1)t\beta}{\lambda}$

$\Rightarrow\left(\frac{\mu_2 - 1}{\mu_1 - 1}\right) = \frac{3}{2} \Rightarrow \left(\frac{\mu_2 - 1}{1.5 - 1}\right) = \frac{3}{2}$

$\Rightarrow \mu_2 = 1.75$

2 **(d)**

$y_1 = a\sin\omega t\,,\ y_2 = a\cos\omega t\ = a\sin\left(\omega t + \frac{\pi}{2}\right)$

3 **(d)**

$\phi = \frac{\lambda}{6} = \frac{360°}{6} = 60°$

$$I = I_0\cos^2\theta$$
$$= I_0\cos^2 60°$$
$$= \frac{3}{4} \times I_0$$
$$\frac{I}{I_0} = \frac{3}{4}$$

5 **(d)**

Let nth minima of 400 nm coincides with mth minima of 560 nm, then

$(2n - 1)\left(\frac{400}{2}\right) = (2m - 1)\left(\frac{560}{2}\right)$

Or $\frac{2n - 1}{2m - 1} = \frac{7}{2} = \frac{14}{10} = \ldots$

ie. 4^{th}minima of 400 nm coincides with 3^{rd} minima of 560 nm.

Location of this minima is,

$$Y_1 = \frac{(2 \times 4 - 1)(1000)(400 \times 10^{-6})}{2 \times 0.4} = 14 \text{ mm}$$

Next 11th minima of 400 nm will coincide with 8th minima of 560 nm. Location of this minima is ,

$$Y_2 = \frac{(2 \times 11 - 1)\,(1000)\,(400 \times 10^{-6})}{2 \times 0.1} = 42 \text{ mm}$$

$\therefore$ Required distance $= Y_2 - Y_1 = 28$ mm

6 **(a)**

Amplitude A_1 and A_2 are added as vector. Angle between these vectors is the phase difference $(\beta_1 - \beta_2)$ between them

$$\therefore \quad R = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos(\beta_1 - \beta_2)}$$

7 **(c)**

The interference fringes for two slits are hyperbolic

8 **(d)**

Momentum transferred in one second

$$p = \frac{2U}{c} = \frac{2S_{av}A}{c} = \frac{2 \times 6 \times 40 \times 10^{-4}}{3 \times 10^8}$$

$$= 1.6 \times 10^{-10} kg - m/s^2$$

9 **(d)**

Diffraction shows the wave nature of light and photoelectric effect shows particle nature of light

10 **(d)**

Phase difference, $\phi = \frac{2\pi}{\lambda} \times$ path difference

$$\phi = \frac{2\pi}{\lambda} \times \frac{\lambda}{6} = \frac{\pi}{3} = 60°$$

Intensity, $\quad I = I_0 \cos^2\left(\frac{\phi}{2}\right)$

$$\frac{I}{I_0} = \cos^2(30°) = \left(\frac{\sqrt{3}}{2}\right)^2 = 0.75$$

11 **(a)**

At any point along the path 1, path difference between the waves is 0

Hence maxima is obtained all along the path 1

At any point along the path 2, path difference is 1.5 λ which is odd multiple of $\frac{\lambda}{2}$, so minima is obtained all along the path 2

13 **(c)**

Let a_1 and a_2 be amplitudes of the two waves.

For maximum intensity

$$I_{\max} = (a_1 + a_2)^2$$

For minimum intensity

$$I_{\min} = (a_1 - a_2)^2$$

Given, $\frac{I_{\max}}{I_{\min}} = \frac{25}{1} = \frac{(a_1 + a_2)^2}{(a_1 - a_2)^2}$

$$\Rightarrow \frac{a_1 + a_2}{a_1 - a_2} = \frac{5}{1}$$

$$\Rightarrow \frac{a_1}{a_2} = \frac{3}{2}$$

(law of componendo and dividendo)

Also, Intensity $\propto$ (amplitude)^2

$$\therefore \frac{I_1}{I_2} = \left(\frac{a_1}{a_2}\right)^2 = \frac{9}{4}$$

15 **(a)**

Total phase difference

= Initial phase difference + Phase difference due to path

$$= 66° + \frac{360°}{\lambda} \times \Delta x = 66° + \frac{360°}{\lambda} \times \frac{\lambda}{4} = 66° + 90 = 156°$$

16 **(a)**

Photoelectric effect verifies particle nature of light. Reflection and refraction verify both particle nature and wave nature of light

18 **(a)**

The speed of light $C = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = \frac{1}{\sqrt{2 \times 8}} = \frac{1}{4} = 0.25$

19 **(c)**

Path difference, $x = (SS_1 + S_1O) - (SS_2 + S_2O)$

If$x = n\lambda$, the central fringe at O will be bright. If$x = (2n - 1)\lambda/2$, the central fringe at O will be dark.

20 **(c)**

Critical angle, $C = \sin^{-1}(0.6)$

$$\sin(C) = 0.6$$

$$\mu = \frac{1}{\sin C} = \frac{1}{0.6}$$

Polarizing angle $i_p = \tan^{-1}(\mu) = \tan^{-1}\left(\frac{1}{0.6}\right)$

$$= \tan^{-1}(1.6667)$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	D	D	D	D	A	C	D	D	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	A	B	C	C	A	A	C	A	C	C