DPP

DAILY PRACTICE PROBLEMS

Class : XIIth

Date :

Solutions

Subject : PHYSICS

DPP No. : 1

Topic :- WAVE OPTICS

1 **(d)**

$d \sin\theta = n\lambda$

$0.3 \times 10^{-3} \times \theta = 6000 \times 10^{-10}$

$\theta = 2 \times 10^{-3}$ rad

2 **(a)**

$I_0 = R^2 = \frac{R_2^2}{4}$

Number of HPZ covered by the disc at $b = 25cm$

$n_1 b_1 = n_2 b_2$

$n_2 = \frac{n_1 b_1}{b_2} = \frac{1 \times 1}{0.25} = 4$

Hence the intensity at this point is

$I = R'^2 = \left(\frac{R_5}{2}\right)^2 = \left(\frac{R_5}{R_4} \times \frac{R_4}{R_3} \times \frac{R_3}{R_2}\right)^2 \times \left(\frac{R_2}{2}\right)^2$

$I = (0.9)^6 I_0$

$I_1 = 0.531 I_0$

Hence the correct answer will be (a)

3 **(c)**

$I = I_{max} \cos^2\left(\frac{\phi}{2}\right)$

$\therefore \frac{I_{max}}{4} = I_{max} \cos^2 \frac{\phi}{2}$

$\cos\frac{\phi}{2} = \frac{1}{2}$

Or $\frac{\phi}{2} = \frac{\pi}{3}$

$$\therefore\ \phi = \frac{2\pi}{3} = \left(\frac{2\pi}{\lambda}\right).\Delta x \qquad ...(i)$$

Where $\Delta x = d\sin\theta$

Substituting in Eq. (i) we get,

$$\sin\theta = \frac{\lambda}{3d}$$

Or $\theta = \sin^{-1}\left(\frac{\lambda}{3d}\right)$

4 **(a)**

$\frac{E_0}{B_0} = c$. also $k = \frac{2\pi}{\lambda}$ and $\omega = 2\pi v$

These relation gives $E_0 k = B_0 \omega$

5 **(a)**

For diffraction to be observed, size of aperture must be of the same order as wavelength of light

6 **(b)**

Infrasonic waves are mechanical waves

7 **(a)**

$\beta = \frac{\lambda D}{d} \Rightarrow \beta \propto \lambda$

8 **(d)**

When two waves of same frenquency, same wavelength and same velocity moves in the same direction. Their superposition results in the interference. The two beams should be monochromatic.

9 **(d)**

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

$(2n-1)400 = (2m-1)560 \Rightarrow \frac{2n-1}{2m-1} = \frac{7}{5} = \frac{14}{10} = \frac{21}{15}$

i.e., 4th minima of 400 nm coincides with 3rd minima of 560 nm

The location of this minima is

$$= \frac{7(1000)(400\times10^{-6})}{2\times0.1} = 14\ mm$$

Next, 11th minima of 400nm will coincide with 8th minima of 560 nm

Location of this minima is

$$= \frac{21(1000)(400\times10^{-6})}{2\times0.1} = 42\ mm$$

$\therefore$ Required distance $= 28\ mm$

10 **(b)**

$$\frac{I_{\max}}{I_{\min}} = \frac{4}{1}\ \frac{(a_1 + a_2)^2}{(a_1 - a_2)^2}$$

Or $\frac{a_1 + a_2}{a_1 - a_2} = \frac{2}{1}$

Or $a_1 + a_2 = 2a_1 - 2a_2$

Or $a_1 = 3a_2$

$$\therefore \quad \frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} = \frac{(3a_2)^2}{a_2^2} = \frac{9}{1}$$

$$\therefore \quad \frac{a_1}{a_2} = \frac{3}{1}$$

11 **(c)**

Wave theory of light is given by Huygen

12 **(c)**

Interference fringes are bands on screen XY running parallel to the length of slits. Therefore, the locus of fringes is represented correctly byW_3W_4.

13 **(b)**

The angular distance (θ) is given by

$$\theta = \frac{\lambda}{d}$$

$$\theta = 2° = \frac{\pi}{180} \times 2, \lambda = 6980 \text{ Å}$$

$$= 6980 \times 10^{-10} \text{ m}$$

$$\Rightarrow d = \frac{\lambda}{\theta} = \frac{6980 \times 10^{-10} \times 180}{3.14 \times 2}$$

$$= 1.89 \times 10^{-5} \text{ mm}$$

$$\Rightarrow d = 2 \times 10^{-5} \text{ mm}$$

15 **(a)**

$$\beta = \frac{\lambda D}{d} \Rightarrow (0.06 \times 10^{-2}) = \frac{\lambda \times 1}{1 \times 10^{-3}} \Rightarrow \lambda = 6000\text{Å}$$

16 **(c)**

Given, $I_1 = I$ and $I_2 = 9I$

Maximum intensity $= (\sqrt{I_1} + \sqrt{I_2})^2$

$$= (\sqrt{I} + \sqrt{9I})^2 = 16I$$

Minimum intensity

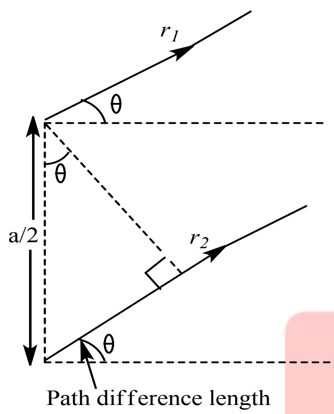
$= \left(\sqrt{I_1} - \sqrt{I_2}\right)^2 = \left(\sqrt{I} - \sqrt{9I}\right)^2 = 4I$

18 **(a)**

The diffraction pattern of light waves of wavelength (λ) diffracted by a single, long narrow slit of width is shown. For first minimum.

$e \sin \theta = \lambda$

$\sin \theta = \frac{\lambda}{e}$



When e is decreased for same wavelength, $\sin \theta$ increases, hence θ increases. Thus, width of central maxima will increase.

20 **(d)**

Intensity of EM wave is given by

$I = \frac{P}{4\pi R^2} = v_{av}.c = \frac{1}{2}\varepsilon_0 E_0^2 \times c$

$\Rightarrow E_0 = \sqrt{\frac{P}{2\pi R^2 \varepsilon_0 c}}$

$= \sqrt{\frac{800}{2 \times 3.14 \times (4)^2 \times 8.85 \times 10^{-12} \times 3 \times 10^8}}$

$= 54.77 \frac{V}{m}$

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