DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 4

Topic :- WAVE OPTICS

1 **(c)**

Distance of n^{th}maxima, $x = n\lambda\frac{D}{d} \propto \lambda$

As $\lambda_b < \lambda_g$

$\therefore\ x_{blue} < x_{green}$

2 **(d)**

Wave is uv rays

3 **(b)**

The resultant intensity at any point P is

$I = 4I_0 \cos^2\left(\frac{\phi}{2}\right)$

$\therefore\ I_0 = 4I_0 \cos^2 \phi/2$

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

$\therefore\ \frac{\phi}{2} = \frac{\pi}{3}\ or\ \phi = \frac{2\pi}{3}$

If Δx is the corresponding value of path difference at P, then

$\phi = \frac{2\pi}{\lambda}(\Delta x)$

$\frac{2\pi}{3} = \frac{2\pi}{\lambda}\Delta x.$

As $\Delta x = \frac{xd}{D}$

$\therefore \ \frac{1}{3} = \frac{1}{\lambda}\frac{xd}{D}$

Or $x = \frac{\lambda}{3d/D} = \frac{6 \times 10^{-7}}{3 \times 10^{-4}} = 2 \times 10^{-3}\text{m}$

$x = 2\text{mm}$

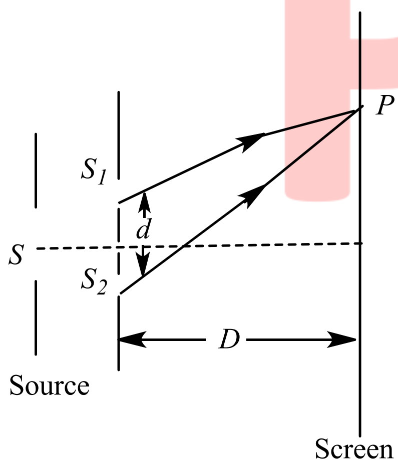
This is the difference of point P from central maximum.

4 **(c)**
Momentum of the electron will increase. So the wavelength ($\lambda = h/p$) of electrons will decrease and fringe width decreases as $\beta \propto \lambda$

5 **(a)**
As velocity of light is perpendicular to the wavefront, and light is travelling in vacuum along the y — axis, therefore, the wavefront is represented by $y =$ constant.

6 **(a)**
When distance between screen and source is D, and d the distance between coherent sources, then fringe width (W) is given by

$W = \frac{D\lambda}{d}$



Where λ is wavelength of monochromatic light.

$\lambda = \frac{Wd}{D}$

Given, $D = 1$ m, $d = 1$ mm $= 10^{-3}$ m,

$W = 0.06$ cm $= 0.06 \times 10^{-2}$m

$\therefore \ \lambda = \frac{0.06 \times 10^{-2} \times 10^{-3}}{1}$

$= 6 \times 10^{-7}\text{m} = 6000\ \text{Å}$

7 **(b)**

From $I_R = I_1 + I_2 + 2\sqrt{I_1 I_2} \cos\phi$

When $\phi = 0°$, $I_R = I + I + 2\sqrt{II} \cos 0° = 4I$

When $\phi = 90°$

$I'_R = I + I + 2\sqrt{II} \cos 90° = 2I$

$$\frac{I_R}{I'_R} = \frac{4I}{2I} = 2{:}1$$

8 **(c)**

When one slit is closed, amplitude becomes half and intensity becomes 1/4th

$ie, I_0 = \frac{1}{4} I$ or $\text{I} = 4I_0$

9 **(b)**

Here, wavelength, $\lambda = 625 nm = 625 \times 10^{-9} m$

Number of lines per meter, $N = 2 \times 10^5$

For principal maxima is grating spectra $\frac{\sin\theta}{N} = n\lambda$,

Where $n(= 1,2,3)$ is the order of principal maxima and θ is the angle of diffraction

The maximum value of $\sin\theta$ is 1

$$\therefore n = \frac{1}{N\lambda} = \frac{1}{2 \times 10^5 \times 625 \times 10^{-9}} = 8$$

$\therefore$ Number of maxima $= 2n + 1 = 2 \times 8 + 1 = 17$

10 **(b)**

Here, $n_1 = 12$, $\lambda_1 = 600$ nm

$n_2 = ?$, $\lambda_2 = 400$ nm

As $n_1 \lambda_1 = n_2 \lambda_2$

$$\therefore \quad n_2 = \frac{n_1 \lambda_1}{\lambda_2} = \frac{12 \times 600}{400} = 18$$

11 **(d)**

For 5th dark fringe, $x_1 = (2n - 1)\frac{\lambda D}{2d} = \frac{9\lambda D}{2d}$

For 7th bright fringe, $x_2 = n\lambda\frac{D}{d} = \frac{7\lambda D}{d}$

$$x_2 - x_1 = (\mu - 1)t\frac{D}{d}$$

$$\frac{\lambda D}{d}\left[7 - \frac{9}{2}\right] = (\mu - 1)t\frac{D}{d}$$

$$t = \frac{2.5\lambda}{(\mu - 1)}$$

12 **(d)**

Let it take $t\ sec$ for astronaut to acquire a velocity of 1 ms^{-1}. Then energy of photons $= 10\ t$

Momentum $= \frac{10t}{C} = 80 \times 1$

$$t = \frac{80 \times 1 \times 3 \times 10^8}{10} = 2.4 \times 10^9 sec$$

13 **(b)**

In Young's double slit experiment if white light is used instead of monochromatic light, then we shall get a white fringe at the centre surrounded on either side with some coloured fringes, with violet fringe in the beginning and red fringe in the last.

14 **(b)**

In simple slit diffraction experiment, width of central maxima

$$y = \frac{2\lambda D}{d}$$

$$\therefore \frac{y_1}{y_2} = \frac{\lambda_1}{\lambda_2} \times \frac{d_2}{d_1}$$

$$= \frac{400}{600} \times \frac{d/2}{d} = \frac{1}{3}$$

$$y_2 = 3y_1$$

15 **(a)**

The essential condition for sustained interference is constancy of phase difference

16 **(d)**

Fringe width $\beta = \frac{\lambda D}{d}$

Where D is the distance between slit and screen, d is the distance between two slits, λ is the wavelength of light

$$\therefore \Delta\beta = \frac{\lambda \Delta D}{d}$$

$$\Rightarrow \lambda = \frac{\Delta\beta d}{\Delta D} = \frac{10^{-3} \times 0.03 \times 10^{-3}}{5 \times 10^{-2}} = \frac{10^{-3} \times 3 \times 10^{-5}}{5 \times 10^{-2}}$$

$$= 6 \times 10^{-7} m = 6000\text{Å}$$

17 **(a)**

Polarization is shown by only transverse waves

18 **(b)**

Polarizer produces polarized light

19 **(b)**

The magnitude of electric field vector varies periodically with time because it is the form of electromagnetic wave

20 **(b)**

$I_{max} = I = I_1 + I_2 + 2\sqrt{I_1 I_2}$

When width of each slit is doubled, intensity from each slit becomes twice *ie,*

$I'_1 = 2I_1$ and $I'_2 = 2I_2$

$\therefore \; I'_{max} = I' = I'_1 + I'_2 + 2\sqrt{I'_1 \times I'_2}$

$= 2I_1 + 2I_2 + 2\sqrt{2I_1 \times 2I_2}$

$= 2\left(I_1 + I_2 + 2\sqrt{I_1 \times I_2}\right) = 2I$

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