DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 6

Topic :- WAVE OPTICS

1 **(a)**

To form circularly polarized light

$E_x = A \sin \omega t$

$E_y = A \cos \omega t$

Resultant amplitude

$|\vec{E}|^2 = A^2 + A^2 + 2A.A \cos\frac{\pi}{2} \Rightarrow |\vec{E}| = A\sqrt{2}$

= constant

2 **(a)**

The position of 30^{th} bright fringe

$$y_{30} = \frac{30\lambda D}{d}$$

Now position shift of central fringe is

$$y_0 = \frac{30\lambda D}{d}$$

But we know, $y_0 = \frac{D}{d}(\mu - 1)t$

$$\frac{30\lambda D}{d} = \frac{D}{d}(\mu - 1)t$$

$$(\mu - 1) = \frac{30\lambda}{t} = \frac{30 \times (6000 \times 10^{-10})}{(3.6 \times 10^{-5})} = 0.5$$

$\therefore \ \mu = 1.5$

3 **(b)**

Wavelength of visible spectrum is $3900Å - 7800Å$

4 **(a)**

$$f_1 = \frac{r^2}{\lambda} = \frac{(2.3 \times 10^{-3})^2}{5893 \times 10^{-10}} = 9m$$

5 **(a)**

$\frac{\Delta\lambda}{\lambda} = \frac{v}{c} \Rightarrow 1 = \frac{v}{c} \Rightarrow v = c$

6 **(b)**

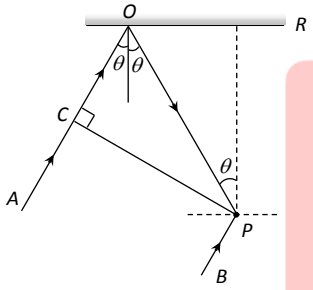
The polarization is the property of electromagnetic waves such as light which describes the direction of their transverse electric field. More generally, the polarization of transverse wave describes the direction of oscillation, in the plane perpendicular to the direction of travel. Longitudinal waves such as sound waves do not exhibit polarization, becomes for these waves the direction of oscillation is along the direction of travel.

7 **(a)**

If unpolarised light is incident at polarising angle, then reflected light is completely, ie, 100% polarized.

8 **(b)**

$\because PR = d \Rightarrow PO = d\sec\theta$ and $CO = PO\cos 2\theta = d\sec\theta\cos 2\theta$ is



Path difference between the two rays

$\Delta = CO + PO = (d\sec\theta + d\sec\theta\cos 2\theta)$

Phase difference between the two rays is

$\phi = \pi$ (One is reflected, while another is direct)

Therefore condition for constructive interference should be $\Delta = \frac{\lambda}{2}, \frac{3\lambda}{2}$....

Or $d\sec\theta(1 + \cos 2\theta) = \frac{\lambda}{2}$

Or $\frac{d}{\cos\theta}(2\cos^2\theta) = \frac{\lambda}{2} \Rightarrow \cos\theta = \frac{\lambda}{4d}$

10 **(a)**

Reflection phenomenon is shown by both particle and wave nature of light

11 **(c)**

$n_1\lambda_1 = n_2\lambda_2 \Rightarrow 3 \times 590 = 4 \times \lambda_2 \Rightarrow \lambda_2 = 442.5nm$

12 **(c)**

$x = \frac{(2n+1)\lambda D}{2a}$

For red light $x = \frac{(4+1)D}{2a} \times 6500$

For unknown wavelength of light,

$$x = \frac{(6+1)D}{2a} \times \lambda$$

Accordingly

$$\therefore 5 \times 6500 = 7 \times \lambda$$

$$\Rightarrow \lambda = \frac{5}{7} \times 6500 = 4642.8 \text{ Å}$$

13 **(b)**

Here, $a = 2mm = 2 \times 10^{-3}m$

$\lambda = 500nm = 500 \times 10^{-9}m = 5 \times 10^{-7}m$

$D = 1m$

The distance between the first minima on either side on a screen is

$$= \frac{2\lambda D}{a} = \frac{2 \times 5 \times 10^{-7} \times 1}{2 \times 10^{-3}}$$

$$= 5 \times 10^{-4}m = 0.5 \times 10^{-3}m = 0.5mm$$

14 **(d)**

Ultrasonic waves are longitudinal waves

15 **(d)**

$\beta = \frac{\lambda D}{d} \Rightarrow$ If D becomes twice and d becomes half so β becomes four times

16 **(b)**

$n\lambda_r = (n+1)\lambda_b$

$$\frac{n+1}{n} = \frac{\lambda_r}{\lambda_b} = \frac{600}{480} = \frac{4}{5}$$

$$\frac{1}{n} = \frac{4}{5} - 1 = \frac{1}{4} \; n = 4$$

17 **(d)**

$$x = \frac{mD\lambda_1}{d} = \frac{(m+1)D\lambda_2}{d}$$

$\Rightarrow 3 \times 6000 = 4\lambda_2$

Or $\lambda_2 = \frac{3 \times 6000}{4} = 4500$ Å

18 **(b)**

$$\beta = \frac{(a+b)\lambda}{2a(\mu-1)\alpha}$$

Where $a =$ distance between source and biprism $= 0.3\ m$

$b =$ distance between biprism and screen $= 0.7\ m$

$\alpha =$ Angle of prism $= 1°, \mu = 1.5, \lambda = 6000 \times 10^{-10} m$

Hence, $\beta = \frac{(0.3 + 0.7) \times 6 \times 10^{-7}}{2 \times 0.3(1.5 - 1) \times \left(1° \times \frac{\pi}{180}\right)}$

$= 1.14 \times 10^{-4} m = 0.0114\ cm$

20 **(d)**

$$\frac{I_{\max}}{I_{\min}} = \left(\frac{\frac{a_1}{a_2} + 1}{\frac{a_1}{a_2} - 1}\right)^2 \Rightarrow \frac{a_1 + a_2}{a_1 - a_2} = 6$$

$$\frac{7}{5} = \frac{a_1}{a_2}$$

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