DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 10

Topic :- WAVE OPTICS

1 **(a)**

In a single slit diffraction experiment, position of minima is given by $d\sin\theta = n\lambda$

So for first minima of red $\sin\theta = 1 \times \left(\frac{\lambda_R}{d}\right)$

and as first maxima is midway between first and second minima, for wavelength λ',

Its position will be

$$d\sin\theta' = \frac{\lambda' + 2\lambda'}{2} \Rightarrow \sin\theta' = \frac{3\lambda'}{2d}$$

According to given condition $\sin\theta = \sin\theta'$

$\Rightarrow \lambda' = \frac{2}{3}\lambda_R$ so $\lambda' = \frac{2}{3} \times 660 = 440nm = 4400\text{Å}$

2 **(c)**

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

$$= \frac{589 \times 10^{-9}}{0.589 \times 10^{-3}} = 10^{-3} = \frac{1}{1000} = 0.001$$

4 **(c)**

Huygen's wave theory fails to explain the particle nature of light (*i.e.*, photoelectric effect)

5 **(b)**

In diffraction pattern, fringe width is proportional to λ. We know that wavelength of violet light is less than that of red light, so on replacing red light with violet light, diffraction pattern would become narrower.

6 **(c)**

Width of the diffraction band is given by

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

Where D= distance between slit and the screen

λ = wavelength of light used and

d = width of slit.

Hence, width of the diffraction band varies directly as the distance between the slit and the screen.

8 **(c)**

The equation of nth principal maxima for wavelength λ is given by

$(a+b)\sin\theta = n\lambda$

Where a is the width of transparent portion and b is that of opaque portion. The width $(a+b)$ is called the grating element.

The spectral lines will overlap, *ie*, they will have the same angle of diffraction of

$\lambda_1 = \lambda_2$

When a line of wavelength λ_1 in order n_1 coincides with a line of unknown wavelength λ_2 in order n_2, then

$n_2\lambda_2 = n_1\lambda_1$

Or $\frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1}$

9 **(b)**

Ozone layer absorbs most of the UV rays emitted by sun

10 **(b)**

EM waves carry momentum and hence can exert pressure on surfaces. They also transfer energy to the surface so $p \neq 0$ and $E \neq 0$

11 **(c)**

$K = 0.5 \times 10^3$

$\frac{2\pi}{\lambda} = 0.5 \times 10^3 \Rightarrow \lambda = \frac{2\pi}{0.5} \times 10^{-3}$

$\lambda = 12.76mm$

λ lies in range of microwave

12 **(c)**

In 1903, the American scientists Nicols and Hull measured the radiation pressure of visible light. It was found to be of the order of $7 \times 10^{-6} N/m^2$

13 **(d)**

Interference is shown by electromagnetic as well as mechanical waves

14 **(c)**

As $x = n_1\beta_1 = n_2\beta_2 = n_2\lambda_1 = n_2\lambda_2$

$\therefore n_2 = \frac{n_1\lambda_1}{\lambda_2} = \frac{60 \times 4000}{6000} = 40$

15 **(c)**

When a beam of light is used to determine the position of an object, the maximum accuracy

is achieved if the light is shorter wavelength, because

$$\text{Accuracy} \propto \frac{1}{\text{Wavelength}}$$

17 **(b)**

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

So, $I_{max} = I + 4I + 2\sqrt{I.4I} = 9I$

18 **(b)**

Newton's of oscillations in coherence length

$$\frac{l}{\lambda} = \frac{0.024}{5900 \times 10^{-10}}$$

$= 40677.9 = 4.068 \times 10^4$

19 **(c)**

When white light is used in a biprism experiment, central spot will be white, while the surronding fringes will be colored.

20 **(d)**

Intensity $\propto \frac{1}{r^2}$

$$\frac{I_2}{I_1} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{r_1}{r_1(1+2\%)}\right)^2$$

$I_2 = I_1(1+2\%)^{-2}$

Expanding by binomial theorem $\Rightarrow I_2 = I_1(1-4\%)$

$\therefore$ Intensity decreases by 4%

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