DPP

DAILY PRACTICE PROBLEMS

Class : XIIth | **Solutions** | **Subject : PHYSICS**

Date : | **DPP No. : 4**

Topic :- Electromagnetic Waves

1 **(b)**

Refractive index $= \frac{c_0}{c} = \frac{1/\sqrt{\mu_0\varepsilon_0}}{1/\sqrt{\mu\varepsilon}}$

$= \sqrt{\frac{\mu\varepsilon}{\mu_0\varepsilon_0}}$

2 **(c)**

Using Ampere circuit law,

$\oint \vec{\mathbf{B}} \cdot \vec{\mathbf{dl}} = \mu_0 i_D$

or $B2\pi r = \mu i_D$

or $B = \mu_0 i_D / 2\pi r$

3 **(b)**

For an EM wave, $\frac{E_0}{B_0} = c$ or $E_0 = cB_0$

$= 3 \times 10^8 \times 510 \times 10^{-9}\ \text{NC}^{-1}$

$= 153\ \text{NC}^{-1}$

4 **(c)**

The direction of propagation of Electromagnetic Wave is in the plane perpendicular to both **E** and **B** *ie*, along **E** × **B**.

6 **(a)**

$F_{\text{total}} + F_{\text{ref}} + F_{\text{abs}}$

$= \frac{1.2P}{c} + \frac{0.4P}{c} = \frac{1.6P}{c}$

$= \frac{1.6 \times 200}{3 \times 10^8} = 1.07 \times 10^{-6}\ \text{N}$

7 **(c)**

The electromagnetic wave being packets of energy moving with speed of light may pass through the region

8 **(b)**

$E_0 = cB_0 = 3 \times 10^8 \times 10^{-4} = 3 \times 10^4\ \text{Vm}^{-1}$

9 **(a)**

From Maxwell's Electromagnetic theory, the Electromagnetic Wave propagation contains electric and magnetic fields vibrating perpendicularly to each other . Hence, changing of electric field gives rise to magnetic field.

10 **(a)**

Total average energy $= \varepsilon_0 E_{\text{rms}}^2$

$= 8.85 \times 10^{-12} \times (720)^2$

$= 4.58 \times 10^{-6}\ \text{Jm}^{-3}$

11 **(c)**

Given, $B_y = 3 \times 10^{-7}\sin(10^3 x + 6.28 \times 10^{12} t)$.

Comparing with the general equation

$$B_y = B_0 \sin(kx + \omega t)$$

we get $k = 10^3$

or $\frac{2\pi}{\lambda} = 10^3$

$$\Rightarrow \quad \lambda = \frac{2\pi}{10^3}$$

$= 6.28 \times 10^{-3}\text{m}$

$= 0.63\ \text{cm}$

12 **(b)**

$eV = hc/\lambda$

Or $\lambda = hc/eV$ *ie*, $\lambda \propto 1/V$

14 **(d)**

The electric displacement field is a vector valued **D** that accounts for the effects of bound charges within materials. In general **D** is given by

$$\mathbf{D} = \varepsilon_0 \mathbf{E} + \mathbf{P}$$

When **E** is electric field,ε_0 the vacuum permittivity and **P** the polarization density of the material.

In most ordinary terms

$$\mathbf{D} = \varepsilon_0 \mathbf{E}$$

When dielectric is present $\varepsilon = K\varepsilon_0$

$$\therefore \quad \mathbf{D} = \text{K}\varepsilon_0 \mathbf{E}$$

15 **(b)**

According to Daun-Hunt law, the wavelength of X-rays lies between minimum to certain limit

16 **(b)**

Energy contained in a cylinder

$U =$ avearge energy density $\times$ volume

$= \frac{1}{2}\varepsilon_0 E_0^2 \times Al$

$= \frac{1}{2} \times (8.85 \times 10^{-12}) \times (50)^2 \times (10 \times 10^{-4}) \times 1$

$= 1.1 \times 10^{-11}\ \text{J}$

17 **(b)**

All the component of electromagnetic spectrum have same velocity, *ie*, 3×10^8 ms^{-1}.

18 **(d)**

In electromagnetic wave, the average value of electric filed or magnetic field is zero

19 **(c)**

$$C = \frac{\varepsilon_0 KA}{d} = \frac{(8.85 \times 10^{-12}) \times 10 \times 1}{10^{-3}}$$

$$= 8.85 \times 10^{-8} \text{ F}$$

$$i = \frac{d}{dt}(CV) = C\frac{dV}{dt} = 8.85 \times 10^{-8} \times 25$$

$$= 2.2 \times 10^{-6} \text{ A}$$

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