DPP
DAILY PRACTICE PROBLEMS

Class : XIIth | **Solutions** | **Subject : PHYSICS**
Date : | | **DPP No. : 1**

Topic :- Electromagnetic Waves

1 **(a)**
Here, amplitude of electric filed, $E_0 = 100\ \mathrm{Vm^{-1}}$; amplitude of magnetic field, $B_0 = 0.265$ A $\mathrm{m^{-1}}$. We know that the maximum rate of energy flow
$S = E_0 \times B_0 = 100 \times 0.265 = 26.5\ \mathrm{Wm^{-2}}$

2 **(a)**
X-rays being of high energy radiations, penetrate the target and hence are not reflected back

3 **(a)**
$\sqrt{\frac{\mu}{\varepsilon}} =$ has the dimensions of resistance, hence it is called the intrinsic impedance of the medium

4 **(c)**
Power $= I \times \text{area} = (1.4 \times 10^3) \times 5$
Force $F = \frac{\text{Power}}{c} = \frac{1.4 \times 10^3 \times 5}{3 \times 10^8}$
$= 2.33 \times 10^{-5}$ N

5 **(a)**
The amplitude of the electric and magnetic fields in free space are related by $\frac{E_0}{B_0} = c$
Here, $E_0 = 30\ \mathrm{Vm^{-1}}$, $c = 3 \times 10^8\ \mathrm{ms^{-1}}$

$$\therefore \quad B_0 = \frac{E_0}{c} = \frac{30}{3 \times 10^8} = 10^{-7}\ \mathrm{T}$$

6 **(a)**
Displacement current is given by

$$I_d = \frac{dq}{dt} = 1.8 \times 10^{-8}\ \mathrm{Cs^{-1}}$$

7 **(b)**
Velocity of light in vacuum

$$c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$$

velocity of light in medium

$$v = \frac{1}{\sqrt{\mu\ \varepsilon}}$$

$$\therefore \quad \mu = \frac{c}{v} = \left(\frac{\mu\varepsilon}{\mu_0 \varepsilon_0}\right)^{1/2}$$

8 **(c)**

According to Maxwell, a changing electric field is a source of magnetic field

9 **(b)**

The electric field induced by changing magnetic field depends upon the rate of change of magnetic flux, hence it is non-conservative

10 **(b)**

$\mathrm{U} = \frac{1}{2} \times \frac{1}{2}\varepsilon_0 E^2 = \frac{1}{2} \times \frac{1}{2} \times 8.85 \times 10^{-12} \times (2)^2$

$= 8.85 \times 10^{-12} \mathrm{Jm}^{-3}$

11 **(c)**

Total power=solar constant $\times$ area

$= 10^4 \times (10 \times 10) = 10^6$ W

12 **(b)**

Infrared radiations are detected by pyrometer

14 **(d)**

The equation of electric field occurring in Y-direction

$$E_y = 66 \cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

Therefore, for the magnetic field in Z-direction

$$B_z = \frac{E_y}{c}$$

$$= \left(\frac{66}{3 \times 10^8}\right)\cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

$$= 22 \times 10^{-8} \cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

$$= 22 \times 10^{-7} \cos 2\pi \times 10^{11}\left(t - \frac{x}{c}\right)$$

17 **(b)**

In an electromagnetic wave, the average energy density of magnetic field $\mu_B =$ average energy density of electric filed $v_E = \frac{1}{4}\varepsilon_0 E_0^2$

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

$$= 2.21 \times 10^{-12}\ \mathrm{Jm}^{-3}$$

18 **(c)**

In vacuum, ε_0=1

In medium, $\varepsilon = 4$

So, refractive index

$$\mu = \sqrt{\varepsilon/\varepsilon_0} = \sqrt{4/1} = 2$$

wavelength $\lambda' = \frac{\lambda}{\mu} = \frac{\lambda}{2}$

and wave velocity $v = \frac{c}{\mu} = \frac{c}{2}$

Hence, it is clear that wavelength and velocity will become half but frequency remains uncharged when the wave is passing through any medium.

19 **(d)**

$I = \frac{1}{2}\ \varepsilon_0 E_0^2 c$

or $E_2 = \sqrt{\frac{2I}{\varepsilon_0 c}}$

$$= \sqrt{\frac{2 \times 4}{(8.85 \times 10^{-12}) \times (3 \times 10^8)}} = 55.5\ \mathrm{NC}^{-1}$$

20 **(c)**

Intensity $I = \frac{\text{pressure}}{\text{area}} = \frac{p}{4\pi r^2}$

=average energy density $\times$ velocity

$= \frac{1}{2}\varepsilon_0 E_0^2 c$

$$\therefore E_0 = \sqrt{\frac{2P}{4\pi\varepsilon_0 r^2 c}} = \sqrt{\frac{P}{2\pi\varepsilon_0 r^2 c}}$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	A	A	C	A	A	B	C	B	B

Q.	11	12	13	14	15	16	17	18	19	20
A.	C	B	C	D	B	C	B	C	D	C