

DPP

DAILY PRACTICE PROBLEMS

Class : XIIth

Date :

Solutions

Subject : PHYSICS

DPP No. : 1

Topic :- Electromagnetic Waves

- 1 (a)
Here, amplitude of electric field, $E_0 = 100 \text{ Vm}^{-1}$; amplitude of magnetic field, $B_0 = 0.265 \text{ Am}^{-1}$.
We know that the maximum rate of energy flow
 $S = E_0 \times B_0 = 100 \times 0.265 = 26.5 \text{ Wm}^{-2}$
- 2 (a)
X-rays being of high energy radiations, penetrate the target and hence are not reflected back
- 3 (a)
 $\sqrt{\frac{\mu}{\epsilon}}$ 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 $F = \frac{\text{Power}}{c} = \frac{1.4 \times 10^3 \times 5}{3 \times 10^8}$
 $= 2.33 \times 10^{-5} \text{ N}$
- 5 (a)
The amplitude of the electric and magnetic fields in free space are related by $\frac{E_0}{B_0} = c$
Here, $E_0 = 30 \text{ Vm}^{-1}$, $c = 3 \times 10^8 \text{ ms}^{-1}$
 $\therefore B_0 = \frac{E_0}{c} = \frac{30}{3 \times 10^8} = 10^{-7} \text{ T}$
- 6 (a)
Displacement current is given by
 $I_d = \frac{dq}{dt} = 1.8 \times 10^{-8} \text{ Cs}^{-1}$
- 7 (b)
Velocity of light in vacuum
 $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$
velocity of light in medium
 $v = \frac{1}{\sqrt{\mu \epsilon}}$
 $\therefore \mu = \frac{c}{v} = \left(\frac{\mu \epsilon}{\mu_0 \epsilon_0} \right)^{1/2}$
- 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)

$$U = \frac{1}{2} \times \frac{1}{2} \epsilon_0 E^2 = \frac{1}{2} \times \frac{1}{2} \times 8.85 \times 10^{-12} \times (2)^2$$

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

11 (c)
Total power = solar constant \times area
 $= 10^4 \times (10 \times 10) = 10^6 \text{ W}$

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 μ_B = average energy density of electric field $\nu_E = \frac{1}{4} \epsilon_0 E_0^2$
 $= \frac{1}{4} \times (8.85 \times 10^{-12}) \times 1^2$
 $= 2.21 \times 10^{-12} \text{ Jm}^{-3}$

18 (c)
In vacuum, $\epsilon_0 = 1$
In medium, $\epsilon = 4$
So, refractive index

$$\mu = \sqrt{\epsilon/\epsilon_0} = \sqrt{4/1} = 2$$

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 unchanged when the wave is passing through any medium.

19 (d)

$$I = \frac{1}{2} \epsilon_0 E_0^2 c$$
 or
$$E_2 = \sqrt{\frac{2I}{\epsilon_0 c}}$$



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

20

(c)

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

= average energy density \times velocity

$$= \frac{1}{2} \epsilon_0 E_0^2 c$$

$$\therefore E_0 = \sqrt{\frac{2P}{4\pi\epsilon_0 r^2 c}} = \sqrt{\frac{P}{2\pi\epsilon_0 r^2 c}}$$

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

SMARTLEARN
COACHING