DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 3

Topic :- Electromagnetic Waves

1 **(a)**
Use method of dimensions. Equating the dimensions of two sides we note the relation
(a)Is dimensionally correct

2 **(d)**
On the basis of dual nature of light, Lious de-Broglie suggested that the dual nature is not only of light, but each moving material particle has the dual nature. He assumed a wave to be associated with each moving material particle which is called the matter wave. The wavelength of this wave is determined by the momentum of the particle. If p is the momentum of the particle, the wavelength of the wave associated with it is

$$\lambda = \frac{h}{p}$$

Where h is Plank's constant.
Since, it is given that, alpha, beta and gamma rays carry same momentum, so they will have same wavelength.

3 **(b)**
Velocity of photon in vacuum is constant for all frequencies

4 **(c)**
A changing electric field produces a changing magnetic field and $vice - versa$ which gives rise to a transverse wave known as Electromagnetic Wave. The time varying electric and magnetic fields are mutually perpendicular to each other and also perpendicular to the direction of propagation of this wave.

5 **(d)**
Energy of a photon $E = \frac{hc}{\lambda}$
$\therefore$ Wavelength $\lambda = \frac{hc}{E}$

$$= \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{13.2 \times 10^{3} \times 1.6 \times 10^{-19}}$$
$$= 0.9375 \times 10^{-10} \text{ m}$$
$$= 1 \text{ Å}$$

Wavelength range of X-rays is from 10^{-11} m to 10^{-8} m (0.1 Å to 100 Å).
Therefore, the given electromagnetic radiation belongs to the X-ray region of electromagnetic spectrum.

6 **(c)**
Equation second shows that the electromagnetic wave travels along the positive x-axis

7 **(b)**

$$B=\frac{\mu_0}{4\pi}\frac{2i_D}{r}=\frac{\mu_0}{4\pi}\times\varepsilon_0\frac{d\phi_E}{dt}$$
$$=\frac{\mu_0}{2\pi}\frac{2i_D}{r}=\frac{\mu_0}{4\pi}\frac{2}{r}\times\varepsilon_0\frac{d\phi_E}{dt}$$
$$=\frac{\mu_0\varepsilon_0\pi r^2 dE}{2\pi r dt}=\frac{\mu_0\varepsilon_0 r}{2}\frac{dE}{dt}$$

9 **(c)**

$E=\frac{hc}{\lambda}$; minimum the wavelength, the maximum the energy of a λ ray. Therefore rays have minimum wave length

10 **(d)**

$$V=\frac{hc}{e\lambda}=\frac{6.6\times10^{-34}\times3\times10^{8}}{1.6\times10^{-19}\times10^{-10}}=10{,}000\text{ V}$$

11 **(b)**

$\psi_{(x,t)}=10^3\sin\pi(3\times10^6\,x-9\times10^{14}\,t)$
$=10^3\sin 3\times10^6\,\pi(x-3\times10^8\,t)$
Comparing it with the relation
$\psi_{(x,t)}=a\sin\frac{2\pi}{\lambda}(x-ct)$; We note that
$c=3\times10^8\text{ ms}^{-1}$

13 **(a)**

Solar radiations are transverse Electromagnetic waves. The central core of the sun emits a continuous Electromagnetic Spectrum.

14 **(c)**

$$c=\frac{1}{\sqrt{\mu_0\varepsilon_0}}\quad\text{or}\quad\frac{1}{\mu_0\varepsilon_0}=c^2$$
$$=[\text{M}^0\text{LT}^{-1}]^2=[\text{M}^0\text{L}^2\text{T}^{-2}]$$

16 **(c)**

Speed of Electromagnetic Waves in vacuum
$=\frac{1}{\sqrt{\mu_0\varepsilon_0}}=$ costant

17 **(c)**

Number of oscillator in coherence length
$$=\frac{l}{\lambda}=\frac{0.024}{5900\times10^{-10}}$$
$$=4.068\times10^6$$

18 **(d)**

Electric energy density
$$u_e=\frac{1}{2}\varepsilon_0E_{\text{rms}}^2$$
$$E_{\text{rms}}=\frac{E_0}{\sqrt{2}}$$
$$u_e=\frac{1}{4}\varepsilon_0E_0^2$$

19 **(a)**

$d=\sqrt{2hR}$ or $d\propto h^{1/2}$

20 **(a)**

For an Electromagnetic Wave (in vacuum),

Velocity $c = \frac{1}{\sqrt{\mu_0 \varepsilon_0}} = 3 \times 10^8 \text{ ms}^{-1}$

Air acts almost as vacuum, hence

$a = 3(\text{approx})$

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