

Board -

Class - 12

Topic - EM

1. Write the SI unit of displacement current?

Ans: Ampere

2. If \mathbf{E} , \mathbf{B} represent electric and magnetic field vectors of the electromagnetic waves, then what is the direction of propagation of the electromagnetic wave?

Ans: $\mathbf{E} \times \mathbf{B}$

3. Can the velocity of light in vacuum be changed?

Ans: Not possible

4. Calculate the wavelength of EMW emitted by the oscillator antenna system, if $L=0.253 \mu\text{H}$ and $C= 25\text{pF}$?

5. The magnetic component of polarized wave of light is $B_x = (4 \times 10^{-6}\text{T}) \sin[(1.57 \times 10^7 \text{m}^{-1})y + (4.5 \times 10^{11}\text{t})]$

- Find the direction of propagation of light
- Find the frequency
- Find intensity of light

6. What physical quantity is same for X-rays of wavelength 10^{-10}m , red light of wavelength 6800\AA and radio wave of wavelength 500m ?

Ans: Velocity

7. The amplitude of \mathbf{B} of harmonic electromagnetic wave in vacuum is $B_0 = 510 \text{nT}$. What is the amplitude of the electric field part of the wave?

Ans: 153N/C

8. Suppose $B_0 = 120 \text{N/C}$ and its frequency $\nu = 50\text{Hz}$. Find B_0 , ω , k and λ and write expression for \mathbf{E} and \mathbf{B} ?

Ans: $B_0 = 400 \text{nT}$; $\omega = 108 \text{rad/s}$, $k = 1.05 \text{rad/m}$, $\lambda = 6\text{m}$

9. The charging current for a capacitor is 0.25A . what is the displacement current across its plates?

Ans: 0.25A

10. What is the effect of EMW on charged particles?

Ans: Accelerate charges & produce oscillating currents

11. A variable frequency a.c source is connected to a capacitor. Will the displacement current increase or decrease with increasing frequency?

Ans: Increases

12. EMW travel in a medium at a speed of $2 \times 10^8 \text{m/s}$. the relative permeability of the medium is 1.0 . Calculate the relative permittivity?

Ans: $\epsilon_r = 2.25$

13. How does a charge q oscillating at certain frequency produce electromagnetic wave?

Ans: Oscillating charge produces oscillating \mathbf{E} which produces oscillating \mathbf{B} and so on

14. How would you establish an instantaneous displacement current of 1A in the space between the parallel plates of 1 μ F capacitor?

Ans: By changing the voltage $\frac{dv}{dt} = 10^6$ V/s

15. Name the Maxwell's equation among the four which shows that the magnetic monopole does not exist?

Ans: Gauss's theorem of Magnetism

16. Write the unit of $\mu_0\epsilon_0$.

Ans: $\left(\frac{m}{s}\right)^{-2}$

17. Give reason for decrease or increase in velocity of light, when it moves from air to glass or glass to air respectively?

Ans: The velocity of light depends on ϵ & μ of the medium.

18. A parallel plate capacitor made of circular plates each of radius 10 cm has a capacitance 200pF. The capacitor is connected to a 200V a.c. supply with an angular frequency of 200 rad/s.

- What is the rms value of conduction current
- Is the conduction current equal to displacement current
- Peak value of displacement current
- Determine the amplitude of magnetic field at a point 2cm from the axis between the plates

Ans:

- $I_{rms} = 8\mu A$
- $I_c = I_d$
- $I_0 = \sqrt{2} I_{rms}$
- $B = 4.525 \times 10^{-12}$

19. Electromagnetic waves with wavelength

- λ_1 are used to treat muscular strain
- λ_2 are used by a FM radio station for broadcasting.
- λ_3 are produced by bombarding metal target by high speed electrons
- λ_4 are observed by the ozone layer of the atmosphere.

Identify and name the part of electromagnetic spectrum to which these radiation belong.

Arrange these wave lengths, in decreasing order of magnitude.

Ans:

- λ_1 : Infrared radiation
 - λ_2 : VHF / Radiowaves
 - λ_3 : X - rays
 - λ_4 : UV
- $\lambda_2 > \lambda_1 > \lambda_4 > \lambda_3$

20. a) Which of the following if any, can act as a source of electromagnetic waves

- A charge moving with constant velocity.
- A charge moving in circular orbit.
- A charge at rest. Give reason

b) Identify the part of electromagnetic spectrum to which the waves of frequency

- 1020 Hz
- 109 Hz belong.

Ans:

a) (i) Can't produce EM waves because no acceleration. (ii) It is accelerated motion - can produce EM waves. (iii) Can't produce EM waves because no acceleration.

b) (i) Gamma rays (ii) Micro waves