PHYSICS

Q.1 The S.I unit of displacement current is-

(A) Henry (B) Coulomb

(C) Ampere (D) Farad **[C]**

Q.2 Displacement current is same as-

(A) conduction current due to flow of free electrons

(B) conduction current due to flow of positive ions

(C) conduction current due to flow of both positive and negative free charge carriers

(D) is not a conduction current but is caused by time varying electric field **[D]**

Q.3 The maxwell's equation :

$\oint \vec{B}.\vec{dl} = \mu_0\left(i+\varepsilon_0.\frac{d\phi_E}{dt}\right)$ is a statement of-

(A) Faraday's law of induction

(B) Modified Ampere's law

(C) Gauss's law of electricity

(D) Gauss's law of magnetism **[B]**

Q.4 Maxwell's equation $\oint \vec{E}.\vec{dl} = -\frac{\delta \vec{B}}{dt}$ is a statement of-

(A) Ampere's law

(B) Faraday's law of induction

(C) Gauss's law of electricity

(D) Gauss's law of magnetism **[B]**

Q.5 The charge of a parallel plate capacitor is varying as $q = q_0 \sin \omega t$. Then find the magnitude of displacement current through the capacitor. (Plate Area = A, separation of plates = d) -

(A) $q_0 \cos(\omega t)$

(B) $q_0\omega \sin \omega t$

(C) $q_0\omega \cos \omega t$

(D) $\frac{q_0 A\omega}{d} \cos\omega t$ **[C]**

Q.6 The rate of change of voltage of a parallel plate capacitor if the instantaneous displacement current of 1A is established between the two plates of a 1μF parallel plate capacitor-

(A) 10^6 v/s (B) 10 v/s

(C) 10^8 v/s (D) 10^{-6} v/s **[A]**

Q.7 The relation between electric field E and magnetic field H in an electromagnetic wave is-

(A) E = H (B) $E = \frac{\mu_0}{\varepsilon_0} H$

(C) $E = \sqrt{\frac{\mu_0}{\varepsilon_0}}\ H$ (D) $E = \sqrt{\frac{\varepsilon_0}{\mu_0}}\ H$

[C]

Q.8 The relation between electric field E and magnetic field induction B in an electromagnetic waves-

(A) $E = \sqrt{\frac{\mu_0}{\varepsilon_0}}\ B$ (B) E = cB

(C) $E = \frac{B}{c}$ (D) $E = \frac{B}{c^2}$ **[B]**

Q.9 An electromagnetic wave is propagating along Y-axis. Then-

(A) Oscillating electric field is along X-axis and oscillating magnetic field is along Y-axis

(B) Oscillating electric field is along Z-axis and oscillating magnetic field is along X-axis

(C) Both oscillating electric and magnetic fields are along Y-axis, but phase difference between them is 90º

(D) Both oscillating electric and magnetic fields are mutually perpendicular in arbitrary directions **[B]**

Q.10 In electromagnetic wave the phase difference between electric and magnetic field vectors $\vec{E}$ and $\vec{B}$ is-

(A) 0 (B) $\pi/2$

(C) π (D) $\pi/4$ **[A]**

Q.11 An electromagnetic wave going through vaccum is described by $E = E_0\sin(kx - \omega t)$

Which is the following is/are independent of the wavelength ?

(A) k (B) k/ω

(C) $k\omega$ (D) ω **[B]**

Q.12 In a plane E.M. wave, the electric field oscillates sinusoidally at a frequency of 2.5×10^{10} Hz and amplitude 480 V/m. The amplitude of oscillating magnetic field will be-

(A) 1.52×10^{-8} Wb/m^2

(B) 1.52×10^{-7} Wb/m^2

(C) 1.6×10^{-6} Wb/m^2

(D) 1.6×10^{-7} Wb/m^2 **[C]**

Q.13 If $\in_0$ and μ_0 represent the permittivity and permeability of vaccum and $\in$ and μ represent the permittivity and permeability of medium, then refractive index of the medium is given by-

(A) $\sqrt{\dfrac{\in_0 \mu_0}{\in \mu}}$ (B) $\sqrt{\dfrac{\in \mu}{\in_0 \mu_0}}$

(C) $\sqrt{\dfrac{\in}{\mu_0 \in_0}}$ (D) $\sqrt{\dfrac{\mu_0 \in_0}{\in}}$ **[B]**

Q.14 An electromagnetic wave going through vacuum is described by-

$E = E_0 \sin(kx - \omega t)$

$B = B_0 \sin(kx - \omega t)$

(A) $E_0B_0 = \omega k$ (B) $E_0\omega = B_0k$

(C) $E_0k = B_0\omega$ (D) none of these **[C]**

Q.15 The ratio of $\dfrac{E_0}{H_0}$ for a plane electromagnetic wave has the dimension of -

(A) Impedance (B) Resistance

(C) Both (D) None **[C]**

Q.16 A electromagnetic wave wave going through a medium is given by $E = E_0\sin(kx - wt)$ and $B = B_0\sin(kx - wt)$ then -

(A) $E_0k = B_0\omega$

(B) If Electric is in Z direction them magnetic field should be in –y direction.

(C) Both 'A' and 'B' are correct

(D) Only A is correct **[C]**

Q.17 A plane E M wave of frequency 25 MHz travels in free space in x direction. At a particular point in space and time $E = 6.3\ \hat{j}$ v/m then B at that point is -

(A) $2.1 \times 10^{-8} - \hat{k}$ (B) $2.1 \times 10^{-8}\ \hat{k}$

(C) $2.1\ \hat{k}$ (D) $2.1 \times 10^{-8}\ \hat{i}$ **[B]**

Q.18 The energy density of electromagnetic wave in vacuum is given by the relation-

(A) $\dfrac{1}{2}.\dfrac{E^2}{\varepsilon_0} + \dfrac{B^2}{2\mu_0}$ (B) $\dfrac{1}{2}\varepsilon_0E^2 + \dfrac{1}{2}\mu_0B^2$

(C) $\dfrac{E^2+B^2}{C}$ (D) $\dfrac{1}{2}\varepsilon_0E^2 + \dfrac{B^2}{2\mu_0}$ **[D]**

Q.19 The average value of electric energy density in an electromagnetic wave is (E_0 is peak value) -

(A) $\dfrac{1}{2}\varepsilon_0E_0{}^2$ (B) $\dfrac{E_0^2}{2\varepsilon_0}$

(C) $\varepsilon_0E_0{}^2$ (D) $\dfrac{1}{4}\varepsilon_0E_0{}^2$ **[D]**

Q.20 A lamp radiates power P_0 uniformly in all directions, the amplitude of electric field strength E_0 at a distance r from it is-

(A) $E_0 = \dfrac{P_0}{2\pi\varepsilon_0 cr^2}$

(B) $E_0 = \sqrt{\left\{\frac{P_0}{2\pi\varepsilon_0 cr^2}\right\}}$

(C) $E_0 = \sqrt{\left\{\frac{P_0}{4\pi\varepsilon_0 cr^2}\right\}}$

(D) $E_0 = \sqrt{\left\{\frac{P_0}{8\pi\varepsilon_0 cr}\right\}}$ **[B]**

Q.21 In an electromagnetic wave, the amplitude of electric field is 1 V/m. The frequency of wave is 5×10^{14} Hz. The wave is propagating along Z-axis. The average energy density of electric field in joule/m^3, will be-

(A) 2.2×10^{-12} (B) 4.4×10^{-12}

(C) 6.6×10^{-12} (D) 8.8×10^{-12} **[A]**

Q.22 The sun delivers 10^3w/m^2 of electromagnetic flux to the earth's surface. The total power that is incident on a roof of dimensions 8m × 20 m will be-

(A) 2.56×10^4 W (B) 6.4×10^5 W

(C) 4.0×10^5 W (D) 1.6×10^5 W **[D]**

Q.23 The intensity of visible radiation at a distance of 1 m from a bulb of 100w which converts only 5% its power into light is-

(A) 0.4 w/m^2 (B) 0.5 w/m^2

(C) 0.1 w/m^2 (D) 0.01 w/m^2 **[A]**

Q.24 On an E M wave, the amplitude of electric and magnetic fields are 100 v/m and 0.265 A/m. the maximum energy flow is-

(A) 26.5 w/m^2 (B) 46.7 w/m^2

(C) 66.5 w/m^2 (D) 86.5 w/m^2 **[A]**

Q.25 The area to be covered for T.V. telecast is doubled, then the height of transmitting antenna (T.V. tower) will have to be-

(A) halved (B) doubled

(C) quardupled (D) kept unchanged **[B]**

Q.26 The waves which can travel directly along surface of the earth are known as-

(A) ground waves (B) X-ray

(C) α-rays (D) sky waves **[A]]**

Q.27 The distance upto which T.V. signals can be received depend upon-

(A) radius of the earth

(B) height of the antenna

(C) radius of the earth and also height of the antenna

(D) none of above **[C]**

Q.28 The infra-red spectrum lies between-

(A) radio wave and micro-wave region

(B) the micro-wave and visible region

(C) the visible and ultra violet region

(D) the ultra violet and the X-ray region **[B]**

Q.29 Consider an electric charge oscillating with a frequency of 10 MHz. The radiation emitted will have a wavelength equal to-

(A) 20 m (B) 30 m

(C) 40 m (D)10 m **[C]**

Q.30 The most penetrating radiation out of the following is-

(A) X-rays (B) β-rays

(C) α-rays (D) γ-rays **[D]**

Q.31 Which of the following electromagnetic waves has minimum frequency ?

(A) radio wave (B) ultrasonic wave

(C) microwave (D) audible wave **[A]**

Q.32 Which of the following statements about electromagnetic waves is/are correct-

(1) X-rays in vacuum travel faster than light waves in vacuum.

(2) The energy of X-ray photon is greater than that of a light photon

(3) Light can be polarised but X-ray cannot.

(A) 1 and 2 (B) 2 and 3

(C) 1, 2 and 3 (D) 2 only **[D]**

Q.33 A parallel plate capacitor consists of two circular plates each of radius 12 cm and separated by 5.0 mm. The capacitor is being charged by an external source. The charging current is constant and is equal to 0.15 A. The rate of change of potential difference between the plates will be-

(A) 1.873×10^7 V/s (B) 1.873×10^8 V/s

(C) 1.873×10^9 V/s (D) 1.873×10^{10} V/s **[C]**

Q.34 A lamp emits monochromatic green light uniformly in all directions. The lamp is 3% efficient in converting electrical power to electromagnetic waves and consumes 100 W of power. The amplitude of electric field associated with the electromagnetic radiation at a distance of 5 m from the lamp will be-

(A) 1.34 V/m (B) 2.68 V/m

(C) 4.02 V/m (D) 5.36 V/m**[B]**

Q.35 Transmission of T.V. signals from the surface of the moon can be received on earth. But transmitted T.V. signals from Delhi can not be received beyond 110 km distance. The reason is-

(A) there is no atomsphere on the moon

(B) strong gravitational effect on T.V. signals

(C) T.V. signals travel along a straight line, they do not follow the curvature of earth

(D) there is atmosphere around the earth **[C]**

Q.36 A parallel plate capacitor consists of two circular plates each of radius 2 cm, separated by a distance of 0.1 mm. If voltage across the plates is varying at the rate of 5×10^{13} V/s, then the value of displacement current is-

(A) 5.50 A (B) 5.56×10^2 A

(C) 5.56×10^3 A (D) 2.28×10^4 A **[C]**

Q.37 The transmitting antenna of a radio-station is mounted vertically. At a point 10 km due north of the transmitter the peak electric field is 10^{-3} volt/metre. The magnitude of the radiated magnetic field is-

(A) 3.33×10^{-10} Tesla

(B) 3.33×10^{-12} Tesla

(C) 10^{-3} Tesla

(D) 3×10^5 Tesla **[B]**

Q.38 To double the covering range of a T.V. transmitter tower, its height should be made-

(A) two times (B) four times

(C) $\sqrt{2}$ times (D) 8 times **[B]**

Q.39 In an electromagnetic wave, the direction of the magnetic field induction $\vec{B}$ is-

(A) parallel to electric field $\vec{E}$

(B) perpendicular to electric field $\vec{E}$

(C) antiparallel to Poynting vector $\vec{S}$

(D) random **[B]**

Q.40 In an electromagnetic wave-

(A) Power is transmitted along the magnetic field

(B) power is transmitted along the electric field

(C) power is equally transferred along the electric and magnetic fields

(D) power is transmitted in a direction perpendicular to both the fields **[D]**

Q.41 The ionosphere bends the electromagnetic waves having the frequencies-

(A) less than 40 MHz

(B) beyond 40 MHz

(C) nothing is certain

(D) depends on the moisture present **[B]**

Q.42 The magnetic field in a plane EM wave is given by-

$B = (100\ \mu T) \sin [(2 \times 10^{15}\ s^{-1})(t - x/c)]\ \hat{j}$

The equation for electric field is-

(A) $E = 100\ \mu N/C \sin [(2\times10^{15} s^{-1})(t-x/c)](-\hat{k})$

(B) $E=3\times10^{10} \mu N/C \sin[(2\times10^{15} s^{-1})(t-x/c)](-\hat{k})$

(C) $E=3\times10^{10} \mu N/C \sin[(2\times10^{15}\ s^{-1})(t-x/c)]\ \hat{k}$

(D) $E = 100\ \mu N/C \sin[(2 \times 10^{15}\ s^{-1})(t - x/c)]\ \hat{k}$ **[B]**

Q.43 For any E.M. wave if E = 100 V/m and $B = 3.33 \times 10^{-7}$ T. Then the rate of energy flow per unit area is-

(A) $3.33 \times 10^{-5}\ J/m^2$

(B) $26.5\ VA/m^2$

(C) $3 \times 10^{8}\ J/m^2$

(D) None of these **[B]**

Q.44 A variable frequency AC source is connected to a capacitor. Then on increasing the frequency-

(A) Both conduction current and displacement current will increase

(B) Both conduction current and displacement current will decrease

(C) conduction current will increase and displacement current will decrease

(D) conduction current will decrease and displacement current will increase. **[A]**

Q.45 The energy stored in a 90 cm length of laser beam operating at 10 mw-

(A) 3×10^{8} J (B) 3×10^{9} J

(C) 3×10^{11} J (D) 3×10^{-11} J **[D]**

Q.46 Microwaves are used in RADAR because of its-

(A) Small wave length

(B) Large wavelength

(C) High speed

(D) large penetration power **[A]**

Q.47 source of an electromagnetic wave is-

(A) A charge moving with constant velocity

(B) A charge at rest

(C) A charge moving in a circular orbit

(D) Charges cannot produce an EM wave **[C]**

Q.48 The dimension of E/H is that of-

(A) Impedance

(B) Inductance

(C) capacitance

(D) Inductance × Capacitance **[A]**

Q.49 Poynting vector $\vec{P}$ for an EM wave is-

(A) $\vec{P} = \vec{E} \times \vec{B}$ (B) $\vec{P} = \vec{E} \times \vec{H}$

(C) $\vec{P} = \frac{\vec{E}}{\vec{B}}$ (D) $\vec{P} = \frac{\vec{E}}{\vec{H}}$ **[B]**

Q.50 Which one statement is incorrect about electromagnetic wave -

(A) $\vec{E} \times \vec{B}$ gives always direction of propagation

(B) $\vec{E}$ is always perpendicular to $\vec{B}$

(C) Transverse in nature

(D) $\vec{E}$ is always parallel to $\vec{B}$ **[D]**