Q.1 The magnetic field in a travelling electromagnetic wave has a peak value of **20 nT**. The peak value of electric field strength is

(A) 12 V/m **(B)** 3 V/m **(C)** 6 V/m **(D)** 9 V/m

Q.2 The speed of an electromagnetic wave in a medium whose dielectric constant is **2.25** and relative permeability is **4**, is equal to

(A) 0.5×10^8 m/s **(B)** 0.25×10^8 m/s **(C)** 0.75×10^8 m/s **(D)** 1×10^8 m/s

Q.3 The electric and the magnetic field, associated with an **EM** wave, propagating along the **+z**-axis, can be represented by

(A) $\vec{E} = E_0\hat{j},\ \vec{B} = B_0\hat{k}$ **(B)** $\vec{E} = E_0\hat{i},\ \vec{B} = B_0\hat{j}$ **(C)** $\vec{E} = E_0\hat{k},\ \vec{B} = B_0\hat{i}$ **(D)** $\vec{E} = E_0\hat{j},\ \vec{B} = B_0\hat{i}$

Q.4 If $\boldsymbol{\varepsilon_0}$ and $\boldsymbol{\mu_0}$ are the electric permittivity and magnetic permeability in a free space, $\boldsymbol{\varepsilon}$ and $\boldsymbol{\mu}$ are the corresponding quantities in a medium, the index of refraction of the medium is,

(A) $\sqrt{\frac{\varepsilon_0\,\mu_0}{\varepsilon\,\mu}}$ **(B)** $\sqrt{\frac{\varepsilon\,\mu}{\varepsilon_0\,\mu_0}}$ **(C)** $\sqrt{\frac{\varepsilon_0\,\mu}{\varepsilon\,\mu_0}}$ **(D)** $\sqrt{\frac{\varepsilon}{\varepsilon_0}}$

Q.5 A laser beam has intensity $\boldsymbol{2.5 \times 10^{14}\ Wm^{-2}}$. The amplitudes of electric and magnetic fields in the beam are:

(A) 1.44×10^8 N/C, 4.34 T **(B)** 4.34 N/C, 1.44 T
(C) 4.34×10^8 N/C, 1.44×10^{-2} T **(D)** 4.34×10^8 N/C, 1.44 T

Q.6 During the propagation of electromagnetic waves in a medium

(A) Both electric and magnetic energy densities are zero.
(B) Electric energy density is double of the magnetic energy density.
(C) Electric energy density is half of the magnetic energy density.
(D) Electric energy density is equal to the magnetic energy density.

Q.7 The **rms** value of the electric field of the light coming from the sun is **720 N/C**. The average total energy density of the electromagnetic wave is,

(A) 3.3×10^{-3} J/m^3 **(B)** 4.58×10^{-6} J/m^3
(C) 6.37×10^{-9} J/m^3 **(D)** 81.35×10^{-12} J/m^3

Q.8 A **27 mW** laser beam has a cross-sectional area of $\boldsymbol{10\ mm^2}$. The magnitude of the maximum electric field in this EM wave is given by [given permittivity of space $\boldsymbol{\varepsilon_0 = 9 \times 10^{-12}\ F/m}$, speed of light $\boldsymbol{c = 3 \times 10^8\ m/s}$]

(A) 2 kV/m **(B)** 0.7 kV/m **(C)** 1 kV/m **(D)** 1.4 kV/m

Q.9 Faraday's law of electromagnetic induction is given by,

$$\oint \vec{E}.\vec{dl} = -\frac{d\phi_B}{dt}$$

Then

(A) The electric field $\vec{E}$, in the given equation, is conservative.
(B) The electric field $\vec{E}$, in the given equation, is non-conservative.

(C) Work done by the force due to the electric field $\vec{E}$, in the given equation, in moving a charge over a closed path is zero.
(D) None of these

Q.10 At the threshold of detection, an FM receiver can pick up a signal for which $\mathbf{E_0 = 2\ \mu V/m}$. The intensity of the electromagnetic wave is -

(A) $5.31 \times 10^{-15}\ \text{W} - \text{m}^{-2}$ **(B)** $5.31 \times 10^{-12}\ \text{W} - \text{m}^{-2}$

(C) $5.31 \times 10^{-14}\ \text{W} - \text{m}^{-2}$ **(D)** $5.31 \times 10^{-17}\ \text{W} - \text{m}^{-2}$

ANSWER KEY

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(C)	(D)	(B)	(B)	(D)	(D)	(B)	(D)	(B)	(A)