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NEET ELECTROMAGNETIC WAVES — PROPERTIES OF EM WAVES (SPEED, TRANSVERSE NATURE, ENERGY, MOMENTUM, INTENSITY) — PYQS

Max. Marks: 84 **Questions:** 21

Section A (MCQ) — 21 questions

Q.1 An electromagnetic wave travelling in a lossless dielectric medium having a dielectric constant, $\varepsilon_r = 9$, has the electric field, $E_x = E_0\sin(kz - 2\pi \times 10^6 t)\ Vm^{-1}$ where E_0 is the amplitude and k is the wave vector. Among the following options, the incorrect choice is [RE-NEET (UG) 2026]

(1) The direction of propagation of the electromagnetic wave is along +z

(2) The speed of the electromagnetic wave inside the medium is $10^8\ ms^{-1}$

(3) The wavelength of the electromagnetic wave inside the medium is 300 m

(4) The magnetic field is given by the relation $B_y = \frac{E_0}{v}\sin(kz - 2\pi \times 10^6 t)$ where v is the speed of the electromagnetic wave inside the medium

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Q.2 The electric field in a plane electromagnetic wave is given by $E_z = 60\cos(5x + 1.5 \times 10^9 t)$ V/m

Then expression for the corresponding magnetic field is (here subscripts denote the direction of the field) : [NEET (UG) 2025]

(1) $B_z = 60\cos(5x + 1.5 \times 10^9 t)$ T

(2) $B_y = 60\sin(5x + 1.5 \times 10^9 t)$ T

(3) $B_y = 2 \times 10^{-7}\cos(5x + 1.5 \times 10^9 t)$ T

(4) $B_x = 2 \times 10^{-7}\cos(5x + 1.5 \times 10^9 t)$ T

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Q.3 If the ratio of relative permeability and relative permittivity of a uniform medium is 1:4. The ratio of the magnitudes of electric field intensity (E) to the magnetic field intensity (H) of an EM wave propagating in that medium is (Given that $\sqrt{\frac{\mu_0}{\varepsilon_0}} = 120\pi$): [RE-NEET (UG) 2024]

(1) 30π:1 (2) 1:120π (3) 60π:1 (4) 120π:1

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Q.4 In a plane electromagnetic wave travelling in free space, the electric field component oscillates sinusoidally at a frequency of 2.0×10^{10} Hz and amplitude 48 V m^{-1}. Then the amplitude of oscillating magnetic field is : (Speed of light in free space $= 3 \times 10^8\ m\ s^{-1}$) [NEET (UG) 2023]

(1) 1.6×10^{-8} T (2) 1.6×10^{-7} T

(3) 1.6×10^{-6} T (4) 1.6×10^{-9} T

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Q.5 The energy that will be ideally radiated by a 100 kW transmitter in 1 hour is [NEET (UG) 2022]

(1) 36×10^7 J (2) 36×10^4 J

(3) 36×10^5 J (4) 1×10^5 J

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Q.6 When light propagates through a material medium of relative permittivity ε_r and relative permeability μ_r, the velocity of light, v is given by (c-velocity of light in vacuum) [NEET (UG) 2022]

(1) v = c (2) $v = \sqrt{\frac{\mu_r}{\varepsilon_r}}$

(3) $v = \sqrt{\frac{\varepsilon_r}{\mu_r}}$ (4) $v = \frac{c}{\sqrt{\varepsilon_r \mu_r}}$

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Q.7 The magnetic field of a plane electromagnetic wave is given by $\vec{B} = 3 \times 10^{-8}\cos(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{j}$, then the associated electric field will be : [NEET (UG) 2022 (Phase 2)]

(1) $9\cos(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}$ V/m

(2) $3 \times 10^{-8}\cos(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{i}$ V/m

(3) $3 \times 10^{-8}\sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{i}$ V/m

(4) $9\sin(1.6 \times 10^3 x - 48 \times 10^{10} t)\hat{k}$ V/m

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Q.8 The ratio of the magnitude of the magnetic field and electric field intensity of a plane electromagnetic wave in free space of permeability μ_0 and permittivity ε_0 is (Given that c - velocity of light in free space) [NEET (UG) 2022 (Phase 2)]

(1) $\frac{\sqrt{\mu_0\varepsilon_0}}{c}$ (2) c

(3) $\frac{1}{c}$ (4) $\frac{c}{\sqrt{\mu_0\varepsilon_0}}$

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Q.9 For a plane electromagnetic wave propagating in x-direction, which one of the following combination gives the correct possible directions for electric field (E) and magnetic field (B) respectively? [NEET (UG) 2021]

(1) $-\hat{j}+\hat{k},\ -\hat{j}+\hat{k}$ (2) $\hat{j}+\hat{k},\ \hat{j}+\hat{k}$

(3) $-\hat{j}+\hat{k},\ -\hat{j}-\hat{k}$ (4) $\hat{j}+\hat{k},\ -\hat{j}-\hat{k}$

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Q.10 The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is : (c = speed of electromagnetic waves) [NEET (UG) 2020]

(1) 1 : 1 (2) 1 : c (3) 1 : c^2 (4) c : 1

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Q.11 Light with an average flux of 20 W/cm^2 falls on a non-reflecting surface at normal incidence having surface area 20 cm^2. The energy received by the surface during time span of 1 minute is : [NEET (UG) 2020]

(1) 12×10^3 J (2) 24×10^3 J

(3) 48×10^3 J (4) 10×10^3 J

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Q.12 An EM wave is propagating in a medium with a velocity $\vec{v} = v\hat{i}$. The instantaneous oscillating electric field of this em wave is along +y axis. Then the direction of oscillating magnetic field of the em wave will be along [NEET 2018]

(1) −z direction (2) +z direction

(3) −y direction (4) −x direction

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Q.13 In an electromagnetic wave in free space the root mean square value of the electric field is $E_{rms} = 6$ V m^{-1}. The peak value of the magnetic field is [NEET 2017]

(1) 2.83×10^{-8} T (2) 0.70×10^{-8} T

(3) 4.23×10^{-8} T (4) 1.41×10^{-8} T

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Q.14 A radiation of energy 'E' falls normally on a perfectly reflecting surface. The momentum transferred to the surface is (C = Velocity of light) [AIPMT 2015 (Cancelled)]

(1) $\frac{2E}{C^2}$ (2) $\frac{E}{C^2}$ (3) $\frac{E}{C}$ (4) $\frac{2E}{C}$

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Q.15 Light with an energy flux of 25×10^4 W m^{-2} falls on a perfectly reflecting surface at normal incidence. If the surface area is 15 cm^2, the average force exerted on the surface is [AIPMT 2014]

(1) 1.25×10^{-6} N (2) 2.50×10^{-6} N

(3) 1.20×10^{-6} N (4) 3.0×10^{-6} N

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Q.16 An electromagnetic wave of frequency $\nu = 3.0$ MHz passes from vacuum into a dielectric medium with relative permittivity $\varepsilon_r = 4.0$. Then [NEET 2013 (Karnataka)]

(1) Wavelength is doubled and frequency becomes half.

(2) Wavelength is halved and frequency remains unchanged.

(3) Wavelength and frequency both remain unchanged.

(4) Wavelength is doubled and frequency unchanged.

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Q.17 The ratio of amplitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacuum is equal to [AIPMT 2012 (Mains)]

(1) the speed of light in vacuum

(2) reciprocal of speed of light in vacuum

(3) the ratio of magnetic permeability to the electric susceptibility of vacuum

(4) unity

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Q.18 The electric field of an electromagnetic wave in free space is given by $\vec{E} = 10\cos(10^7 t + kx)\hat{j}$ V/m, where t and x are in seconds and metres respectively. It can be inferred that

Which one of the following pairs of statements is correct ?

A. the wavelength λ is 188.4 m.
B. the wave number k is 0.33 rad/m.
C. the wave amplitude is 10 V/m.
D. the wave is propagating along +x direction.

[AIPMT 2010 (Mains)]

(1) C and D only (2) A and B only
(3) B and C only (4) A and C only

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Q.19 Which of the following statements is false for the properties of electromagnetic waves?

[AIPMT 2010 (Prelims)]

(1) Both electric and magnetic field vectors attain the maxima and minima at the same place and same time.
(2) The energy in electromagnetic wave is divided equally between electric and magnetic vectors.
(3) Both electric and magnetic field vectors are parallel to each other and perpendicular to the direction of propagation of wave.
(4) These waves do not require any material medium for propagation.

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Q.20 The velocity of electromagnetic radiation in a medium of permittivity ε_0 and permeability μ_0 is given by [AIPMT 2008]

(1) $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$ (2) $\sqrt{\frac{\mu_0}{\varepsilon_0}}$
(3) $\sqrt{\frac{\varepsilon_0}{\mu_0}}$ (4) $\sqrt{\mu_0\varepsilon_0}$

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Q.21 The velocity of electromagnetic wave is parallel to

[AIPMT 2002]

(1) $\vec{B}\times\vec{E}$ (2) $\vec{E}\times\vec{B}$ (3) $\vec{E}$ (4) $\vec{B}$

Scan or tap for the full solution

ANSWER KEY

Ques.	1	2	3	4	5	6	7
Ans.	**3, 4**	**3**	**3**	**2**	**1**	**4**	**1**
Ques.	8	9	10	11	12	13	14
Ans.	**3**	**3**	**1**	**2**	**2**	**1**	**4**
Ques.	15	16	17	18	19	20	21
Ans.	**2**	**2**	**2**	**4**	**3**	**1**	**2**