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PHYSICS · JEE MAIN

Electromagnetic Waves

Previous Year Questions with answers

189 questions · **171** papers · **2002–2026** · newest paper first

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What is in this PDF: every Electromagnetic Waves question we hold from past JEE Main and AIEEE papers, with its options and answer. Where an answer comes from a source other than the official final key, it says so next to the answer.

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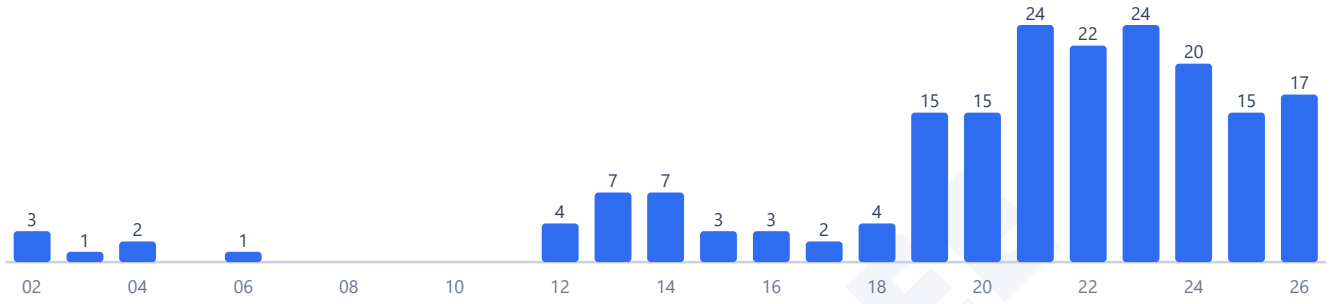
Chapter at a glance

3.3%	189	142 of 162	167 / 22
of Physics questions, 2019–2026	questions, 2002–2026	papers asked it, 2019–2026	MCQ / numerical, 2002–2026

Trend. Steady: 0.9 questions per paper in 2024–2026 against 1 in 2019–2023.

Questions per year



Counts are the questions we hold: 189 in 171 papers. No question in this chapter was found repeated across papers.

Most-asked topics in this chapter (2002–2026)

EM Waves	162
Electromagnetic Spectrum	27

How often it comes up

Electromagnetic waves unifies electricity, magnetism, and optics under Unit 15: Electromagnetic Waves in the Class 12 syllabus, holding rank 13 among the 29 physics chapters. Throughout the 2019 to 2026 computerized period, 152 questions were drawn from electromagnetic waves across 162 papers, an average of 0.9 questions per exam session. The topic appeared in 142 of those 162 papers, and questions have been included in every single testing year. Looking at the three years from 2024 to 2026, candidates answered 52 questions across 58 papers, maintaining an average of 0.9 questions per test and a 3.4 percent subject share. The chapter's share is up compared to the 2002 to 2018 window, which recorded 37 questions across 38 papers for a 2.7 percent share. Relative to the complete 2019 to 2026 baseline, the recent share has stayed about the same. In 2026 alone, 17 questions were set across 19 papers, showing up in 16 individual sessions. Across 2019 to 2026, 22 questions appeared in numerical answer format, while the rest were multiple choice items testing field orientations, phase equations, and spectrum properties.

Most-asked topics

The exam splits questions between wave propagation fundamentals and qualitative spectrum classifications:

- **EM Waves**: 162 questions historically, with 137 asked between 2019 and 2026, tested up to 2026. This dominant topic covers sinusoidal wave equations, the cross product relation linking electric field, magnetic field, and propagation direction, wave speed in vacuum and matter, energy density, intensity, radiation pressure, Poynting vector, and displacement current.
- **Electromagnetic Spectrum**: 27 total questions, with 15 appearing from 2019 to 2026, continuing in 2026. Problems assess frequency and wavelength ordering, generation mechanisms, and practical applications of radio waves, microwaves, infrared radiation, visible light, ultraviolet rays, X-rays, and gamma rays.

What the questions look like

Electromagnetic waves questions in JEE Main follow clear mathematical and classification templates:

- **Matching field vectors and directions**: Given a mathematical expression for an electric field oscillating along one Cartesian axis and propagating along another, students determine the amplitude, frequency, and directional unit vector of the corresponding magnetic field.
- **Phase speed and medium characteristics**: Wave phase functions containing spatial frequency k and angular frequency omega allow extracting wave speed, which students relate to dielectric constant, magnetic permeability, or refractive index.
- **Intensity and field amplitudes**: Evaluating the peak electric or magnetic field amplitude from the average intensity of a directional laser beam.
- **Matching spectrum bands to production sources**: Associating specific electromagnetic bands such as X-rays or microwaves with physical processes like decelerating electrons or magnetron oscillations.

How to practise it

Master the orthogonal vector geometry of transverse electromagnetic waves. The propagation direction always aligns with the vector cross product of the electric field vector with the magnetic field vector. Remembering this cross product rule prevents sign errors when writing out vector equations.

Keep the amplitude ratio E zero divided by B zero equal to the wave speed c at your fingertips. In any non-magnetic dielectric medium, wave speed equals c divided by the refractive index, where the refractive index equals the square root of the relative dielectric constant.

Review the NCERT table for the electromagnetic spectrum thoroughly. Memorize the wavelength ranges, detection methods, and production mechanisms for each band from radio waves to gamma rays, as direct matching questions appear routinely.

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Q1 JEE Main 2026 · 6 Apr · Shift 1 MCQ

A point light source emits E.M. waves in free space. A detector, placed at a distance of L m, measures the intensity as I_o. The detector is now shifted to another location on the same spherical surface ensuring the angle between original location and new location as 45°. The measured intensity at new location will be _____.

(A) $\frac{I_o}{4}$
(B) I_o
(C) $\frac{I_o}{\sqrt{2}}$
(D) $\frac{I_o}{2}$

Answer: (B) I_o · Official NTA final key

Q2 JEE Main 2026 · 6 Apr · Shift 2 MCQ

For an electromagnetic wave propagating through vacuum, $\vec{k}$, $\vec{E}$ and ω represent propagation vector, electric field and angular frequency, respectively. The magnetic field associated with this wave is represented by :

(A) $\frac{\vec{E} \times \vec{k}}{\omega}$
(B) $\frac{\vec{k} \times \vec{E}}{\omega}$
(C) $\omega\left(\vec{E} \times \vec{k}\right)$
(D) $\omega\left(\vec{k} \times \vec{E}\right)$

Answer: (B) $\frac{\vec{k} \times \vec{E}}{\omega}$ · Official NTA final key

Q3 JEE Main 2026 · 5 Apr · Shift 1 MCQ

A displacement current of 4.0 A can be set up in the space between two parallel plates of 6 μF capacitor. The rate of change of potential difference across the plates of the capacitor is nearly $\alpha \times 10^6$ V/s. The value of α is _____.

(A) 0.58
(B) 0.67
(C) 0.82
(D) 0.75

Answer: (B) 0.67 · Official NTA final key

Q4 JEE Main 2026 · 5 Apr · Shift 2 MCQ

Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The electromagnetic wave exerts pressure on the surface on which they are allowed to fall.

Reason (R) : There is no mass associated with the electromagnetic waves.

In the light of the above statements, choose the **correct answer** from the options given below :

(A) Both (A) and (R) are true and (R) is the correct explanation of (A)

(B) Both (A) and (R) are true but (R) is **not** the correct explanation of (A)

(C) (A) is true but (R) is false

(D) (A) is false but (R) is true

Answer: (B) Both (A) and (R) are true but (R) is **not** the correct explanation of (A) · Official NTA final key

Q5 JEE Main 2026 · 4 Apr · Shift 2 MCQ

A magnetic field vector in an electromagnetic wave is represented by $\vec{B} = B_0 \sin\left(2\pi\nu t - \frac{2\pi x}{\lambda}\right)\hat{j}$. Its associated electric field vector is _____.

(A) $\vec{E} = -\nu\lambda B_0 \sin\left(2\pi\nu t - \frac{2\pi x}{\lambda}\right)\hat{k}$

(B) $\vec{E} = -\nu\lambda B_0 \sin\left(2\pi\nu t - \frac{2\pi x}{\lambda}\right)\hat{i}$

(C) $\vec{E} = \nu\lambda B_0 \sin\left(2\pi\nu t - \frac{2\pi x}{\lambda}\right)\hat{k}$

(D) $\vec{E} = \nu\lambda B_0 \sin\left(2\pi\nu t - \frac{2\pi x}{\lambda}\right)\hat{i}$

Answer: (A) $\vec{E} = -\nu\lambda B_0 \sin\left(2\pi\nu t - \frac{2\pi x}{\lambda}\right)\hat{k}$ · Official NTA final key

Q6 JEE Main 2026 · 2 Apr · Shift 1 MCQ

An electromagnetic wave travelling in x-direction is described by field equation $\mathrm{E}_y = 300\ \sin\omega\left(t - \frac{x}{c}\right)$. If the electron is restricted to move in y-direction only with speed of 1.5×10^6 m/s then ratio of maximum electric and magnetic forces acting on the electron is _____.

(A) 200

(B) 150

(C) 400

(D) 300

Answer: (A) 200 · Official NTA final key

Q7 JEE Main 2026 · 2 Apr · Shift 2 MCQ

An electromagnetic wave travels in free space along the x-direction. At a particular point in space and time, $\vec{B} = 2 \times 10^{-7}\,\hat{j}$ T is associated with this wave. The value of corresponding electric field $\vec{E}$ at this point is _____ V/m.

(A) $60\,\hat{k}$
(B) $-60\,\hat{k}$
(C) $30\,\hat{k}$
(D) $-600\,\hat{k}$

Answer: (B) $-60\,\hat{k}$ · Official NTA final key

Q8 JEE Main 2026 · 28 Jan · Shift 1 MCQ

The electric field of an electromagnetic wave travelling through a medium is given by $\vec{E}(x,t) = 25\sin(2.0\times10^{15}t - 10^{7}x)\hat{n}$

then the refractive index of the medium is _____.

(All given measurement are in SI units)

(A) 1.7
(B) 1.5
(C) 1.2
(D) 2

Answer: (B) 1.5 · Official NTA final key

Q9 JEE Main 2026 · 28 Jan · Shift 2 MCQ

A plane electromagnetic wave is moving in free space with velocity $c = 3\times10^{8}$ m/s and its electric field is given as $\vec{E} = 54\sin(kz-\omega t)\hat{j}$ V/m, where $\hat{j}$ is the unit vector along y-axis. The magnetic field vector $\vec{B}$ of the wave is :

(A) $-1.8\times10^{-7}\sin(kz-\omega t)\hat{i}$ T
(B) $1.4\times10^{-7}\sin(kz-\omega t)\hat{k}$ T
(C) $1.4\times10^{-7}\sin(kz-\omega t)\hat{i}$ T
(D) $+1.8\times10^{-7}\sin(kz-\omega t)\hat{i}$ T

Answer: (A) $-1.8\times10^{-7}\sin(kz-\omega t)\hat{i}$ T · Official NTA final key

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Q10 JEE Main 2026 · 24 Jan · Shift 1 MCQ

Match the **LIST-I** with **LIST-II**

List-I	List-II
A. Radio-wave	I. is produced by Magnetron valve
B. Micro-wave	II. due to change in the vibrational modes of atoms
C. Infrared-wave	III. due to inner shell electrons moving from higher energy level to lower energy level
D. X-ray	IV. due to rapid acceleration of electrons

Choose the *__correct__* answer from the options given below:

(A) A-IV, B-II, C-I, D-III
(B) A-IV, B-III, C-I, D-II
(C) A-IV, B-I, C-II, D-III
(D) A-II, B-IV, C-III, D-I

Answer: (C) A-IV, B-I, C-II, D-III · Official NTA final key

Q11 JEE Main 2026 · 23 Jan · Shift 1 MCQ

Match List - I with List - II.

List - I Relation	List - II Law
A. $\oint \vec{E} \cdot \vec{dl} = -\frac{d}{dt} \oint \vec{B} \cdot \vec{da}$	I. Ampere's circuital law
B. $\oint \vec{B} \cdot \vec{dl} = \mu_0 \left(I + \epsilon_0 \frac{d\phi_E}{dt} \right)$	II. Faraday's laws of electromagnetic induction
C. $\oint \vec{E} \cdot \vec{da} = \frac{1}{\epsilon_0} \int_V \rho \, dv$	III. Ampere - Maxwell law
D. $\oint \vec{B} \cdot \vec{dl} = \mu_0 I$	IV. Gauss's law of electrostatics

Choose the **correct** answer from the options given below :

(A) A-II, B-III, C-I, D-IV
(B) A-I, B-IV, C-III, D-II
(C) A-IV, B-I, C-II, D-III
(D) A-II, B-III, C-IV, D-I

Answer: (D) A-II, B-III, C-IV, D-I · Official NTA final key

Q12 JEE Main 2026 · 23 Jan · Shift 1 Numerical

The equation of the electric field of an electromagnetic wave propagating through free space is given by : $E = \sqrt{377}\,\sin(6.27 \times 10^3\, t - 2.09 \times 10^{-5}\, x)$ N/C

The average power of the electromagnetic wave is $\left(\frac{1}{\alpha}\right)$ W/m^2. The value of α is _____

$\left(\text{Take } \sqrt{\frac{\mu_0}{\epsilon_0}} = 377 \text{ in SI units}\right)$

Numerical value type: the answer is a number.

Answer: 2. · Official NTA final key

Q13 JEE Main 2026 · 23 Jan · Shift 2 MCQ

The ratio of speeds of electromagnetic waves in vacuum and a medium, having dielectric constant $k = 3$ and permeability of $\mu = 2\mu_0$, is

(μ_0 = permeability of vacuum)

(A) $\sqrt{6} : 1$
(B) $6 : 1$
(C) $36 : 1$
(D) $3 : 2$

Answer: (A) $\sqrt{6} : 1$ · Official NTA final key

Q14 JEE Main 2026 · 22 Jan · Shift 1 Numerical

The electric field of a plane electromagnetic wave, travelling in an unknown non-magnetic medium is given by,

$E_y = 20 \sin(3 \times 10^6 x - 4.5 \times 10^{14} t)$ V/m

(where x, t and other values have S.I. units). The dielectric constant of the medium is _____

(speed of light in free space is 3×10^8 m/s)

Numerical value type: the answer is a number.

Answer: 4. · Official NTA final key

Q15 JEE Main 2026 · 22 Jan · Shift 2 MCQ

A laser beam has intensity of 4.0×10^{14} W/m^2. The amplitude of magnetic field associated with beam is _____ T. (Take $\epsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2 and c $= 3 \times 10^8$ m/s)

(A) 18.3
(B) 1.83
(C) 5.5
(D) 2.0

Answer: (B) 1.83 · Official NTA final key

Q16 JEE Main 2026 · 21 Jan · Shift 1 MCQ

The electric field in a plane electromagnetic wave is given by :
$E_y = 69 \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$ V/m.
The expression for magnetic field associated with this electromagnetic wave is _____ T.

(A) $B_z = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$
(B) $B_y = 69 \sin[0.6 \times 10^3 x + 1.8 \times 10^{11} t]$
(C) $B_z = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x + 1.8 \times 10^{11} t]$
(D) $B_y = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$

Answer: (A) $B_z = 2.3 \times 10^{-7} \sin[0.6 \times 10^3 x - 1.8 \times 10^{11} t]$ · Official NTA final key

Q17 JEE Main 2026 · 21 Jan · Shift 2 Numerical

An electromagnetic wave of frequency 100 MHz propagates through a medium of conductivity, $\sigma = 10$ mho/m. The ratio of maximum conduction current density to maximum displacement current density is _____.

[Take $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ Nm^2/C^2]

Numerical value type: the answer is a number.

Answer: 1800. · Official NTA final key

Q18 JEE Main 2025 · 7 Apr · Shift 1 MCQ

If ϵ_0 denotes the permittivity of free space and Φ_E is the flux of the electric field through the area bounded by the closed surface, then dimensions of $\left(\epsilon_0 \frac{d\phi_E}{dt}\right)$ are that of :

(A) electric charge
(B) electric current
(C) electric potential
(D) electric field

Answer: (B) electric current · Key from source paper

Q19 JEE Main 2025 · 7 Apr · Shift 2 MCQ

The unit of $\sqrt{\frac{2I}{\epsilon_0 C}}$ is : (I = intensity of an electromagnetic wave, c : speed of light)

(A) Nm
(B) Vm
(C) NC
(D) NC^{-1}

Answer: (D) NC^{-1} · Key from source paper

Q20 JEE Main 2025 · 4 Apr · Shift 1 MCQ

A small mirror of mass m is suspended by a massless thread of length l. Then the small angle through which the thread will be deflected when a short pulse of laser of energy E falls normal on the mirror (c = speed of light in vacuum and g = acceleration due to gravity)

(A) $\theta = \frac{E}{mc\sqrt{gl}}$
(B) $\theta = \frac{2E}{mc\sqrt{gl}}$
(C) $\theta = \frac{E}{2mc\sqrt{gl}}$
(D) $\theta = \frac{3E}{4mc\sqrt{gl}}$

Answer: (B) $\theta = \frac{2E}{mc\sqrt{gl}}$ · Key from source paper

Q21 JEE Main 2025 · 4 Apr · Shift 2 Numerical

If an optical medium possesses a relative permeability of $\frac{10}{\pi}$ and relative permittivity of $\frac{1}{0.0885}$, then the velocity of light is greater in vacuum than that in this medium by _____ times.
$\left(\mu_0 = 4\pi \times 10^{-7} H/m, \epsilon_0 = 8.85 \times 10^{-12} F/m, c = 3 \times 10^8 m/s\right)$

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q22 JEE Main 2025 · 3 Apr · Shift 1 MCQ

The radiation pressure exerted by a 450 W light source on a perfectly reflecting surface placed at 2 m away from it, is

(A) 3×10^{-8} Pascals
(B) 1.5×10^{-8} Pascals
(C) 0
(D) 6×10^{-8} Pascals

Answer: (D) 6×10^{-8} **Pascals** · Key from source paper

Q23 JEE Main 2025 · 29 Jan · Shift 1 MCQ

Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R). Assertion (A) : Electromagnetic waves carry energy but not momentum. Reason (**R**): Mass of a photon is zero. In the light of the above statements, choose the most appropriate answer from the options given below :

(A) Both (A) and (R) are true and (R) is the correct explanation of (**A**)
(B) Both (**A**) and (**R**) are true but (**R**) is not the correct explanation of (**A**)
(C) (A) is false but (R) is true
(D) (A) is true but (**R**) is false

Answer: (C) (A) is false but (R) is true · Key from source paper

Q24 JEE Main 2025 · 29 Jan · Shift 2 MCQ

A plane electromagnetic wave propagates along the $+x$ direction in free space. The components of the electric field, $\vec{E}$ and magnetic field, $\vec{B}$ vectors associated with the wave in Cartesian frame are

(A) $\mathrm{E_x}$, $\mathrm{B_y}$
(B) $\mathrm{E_y}$, $\mathrm{B_z}$
(C) $\mathrm{E_z}$, $\mathrm{B_y}$
(D) $\mathrm{E_y}$, $\mathrm{B_x}$

Answer: (B) $\mathrm{E_y}$, $\mathrm{B_z}$ · Key from source paper

Q25 JEE Main 2025 · 29 Jan · Shift 2 Numerical

A parallel plate capacitor consisting of two circular plates of radius 10 cm is being charged by a constant current of 0.15 A . If the rate of change of potential difference between the plates is 7×10^8 V/s then the integer value of the distance between the parallel plates is (Take, $\epsilon_0 = 9 \times 10^{-12}\ \frac{\mathrm{F}}{\mathrm{m}}$, $\pi = \frac{22}{7}$) _____ μm.

Numerical value type: the answer is a number.

Answer: 1320. · Key from source paper

Q26 JEE Main 2025 · 28 Jan · Shift 1 MCQ

Due to presence of an em-wave whose electric component is given by E = 100 sin(ωt − kx)NC^{-1}, a cylinder of length 200 cm holds certain amount of em-energy inside it. If another cylinder of same length but half diameter than previous one holds same amount of em-energy, the magnitude of the electric field of the corresponding em-wave should be modified as

(A) 400 sin(ωt − kx)NC^{-1}
(B) 200 sin(ωt − kx)NC^{-1}
(C) 50 sin(ωt − kx)NC^{-1}
(D) 25 sin(ωt − kx)NC^{-1}

Answer: (B) 200 sin(ωt − kx)NC^{-1} · Key from source paper

Q27 JEE Main 2025 · 28 Jan · Shift 2 MCQ

The magnetic field of an E.M. wave is given by $\vec{\mathrm{B}} = \left(\frac{\sqrt{3}}{2}\hat{i} + \frac{1}{2}\hat{j}\right) 30 \sin\left[\omega\left(\mathrm{t} - \frac{z}{c}\right)\right]$ (S.I. Units). The corresponding electric field in S.I. units is :

(A) $\vec{\mathrm{E}} = \left(\frac{1}{2}\hat{i} - \frac{\sqrt{3}}{2}\hat{j}\right) 30\mathrm{c} \sin\left[\omega\left(\mathrm{t} - \frac{z}{c}\right)\right]$
(B) $\vec{\mathrm{E}} = \left(\frac{3}{4}\hat{i} + \frac{1}{4}\hat{j}\right) 30\mathrm{c} \cos\left[\omega\left(\mathrm{t} - \frac{z}{c}\right)\right]$
(C) $\vec{\mathrm{E}} = \left(\frac{1}{2}\hat{i} + \frac{\sqrt{3}}{2}\hat{j}\right) 30\mathrm{c} \sin\left[\omega\left(\mathrm{t} + \frac{z}{c}\right)\right]$
(D) $\vec{\mathrm{E}} = \left(\frac{\sqrt{3}}{2}\hat{i} - \frac{1}{2}\hat{j}\right) 30\mathrm{c} \sin\left[\omega\left(\mathrm{t} + \frac{z}{c}\right)\right]$

Answer: (A) $\vec{\mathrm{E}} = \left(\frac{1}{2}\hat{i} - \frac{\sqrt{3}}{2}\hat{j}\right) 30\mathrm{c} \sin\left[\omega\left(\mathrm{t} - \frac{z}{c}\right)\right]$ · Key from source paper

Q28 JEE Main 2025 · 24 Jan · Shift 2 MCQ

Arrange the following in the ascending order of wavelength (λ) : (A) Microwaves (λ_1) (B) Ultraviolet rays (λ_2) (C) Infrared rays (λ_3) (D) X-rays (λ_4) Choose the most appropriate answer from the options given below :

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(A) $\lambda_4 < \lambda_3 < \lambda_2 < \lambda_1$
(B) $\lambda_3 < \lambda_4 < \lambda_2 < \lambda_1$
(C) $\lambda_4 < \lambda_3 < \lambda_1 < \lambda_2$
(D) $\lambda_4 < \lambda_2 < \lambda_3 < \lambda_1$

Answer: (D) $\lambda_4 < \lambda_2 < \lambda_3 < \lambda_1$ · Key from source paper

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Q29 JEE Main 2025 · 23 Jan · Shift 1 MCQ

The electric field of an electromagnetic wave in free space is $\vec{\mathrm{E}} = 57\cos\left[7.5\times10^{6}\mathrm{t} - 5\times10^{-3}(3x+4y)\right](4\hat{i}-3\hat{j})N/C$. The associated magnetic field in Tesla is

(A) $\vec{\mathrm{B}} = \frac{57}{3\times10^{8}}\cos\left[7.5\times10^{6}\mathrm{t} - 5\times10^{-3}(3x+4y)\right](\hat{k})$
(B) $\vec{\mathrm{B}} = -\frac{57}{3\times10^{8}}\cos\left[7.5\times10^{6}\mathrm{t} - 5\times10^{-3}(3x+4y)\right](\hat{k})$
(C) $\vec{\mathrm{B}} = -\frac{57}{3\times10^{8}}\cos\left[7.5\times10^{6}\mathrm{t} - 5\times10^{-3}(3x+4y)\right](5\hat{k})$
(D) $\vec{\mathrm{B}} = \frac{57}{3\times10^{8}}\cos\left[7.5\times10^{6}\mathrm{t} - 5\times10^{-3}(3x+4y)\right](5\hat{k})$

Answer: (C) $\vec{\mathrm{B}} = -\frac{57}{3\times10^{8}}\cos\left[7.5\times10^{6}\mathrm{t} - 5\times10^{-3}(3x+4y)\right](5\hat{k})$ · Key from source paper

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Q30 JEE Main 2025 · 23 Jan · Shift 2 MCQ

A plane electromagnetic wave of frequency 20 MHz travels in free space along the $+x$ direction. At a particular point in space and time, the electric field vector of the wave is $\mathrm{E}_y = 9.3\mathrm{Vm}^{-1}$. Then, the magnetic field vector of the wave at that point is

(A) $\mathrm{B}_z = 6.2\times10^{-8}$ T
(B) $\mathrm{B}_z = 3.1\times10^{-8}$ T
(C) $\mathrm{B}_z = 1.55\times10^{-8}$ T
(D) $\mathrm{B}_z = 9.3\times10^{-8}$ T

Answer: (B) $\mathrm{B}_z = 3.1\times10^{-8}$ T · Key from source paper

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Q31 JEE Main 2025 · 23 Jan · Shift 2 Numerical

A time varying potential difference is applied between the plates of a parallel plate capacitor of capacitance 2.5μ F. The dielectric constant of the medium between the capacitor plates is 1 . It produces an instantaneous displacement current of 0.25 mA in the intervening space between the capacitor plates, the magnitude of the rate of change of the potential difference will be _____ Vs^{-1}.

Numerical value type: the answer is a number.

Answer: 100. · Key from source paper

Q32 JEE Main 2025 · 22 Jan · Shift 2 Numerical

A parallel plate capacitor of area $A = 16\ \mathrm{cm}^2$ and separation between the plates 10 cm , is charged by a DC current. Consider a hypothetical plane surface of area $\mathrm{A}_0 = 3.2\ \mathrm{cm}^2$ inside the capacitor and

parallel to the plates. At an instant, the current through the circuit is 6A. At the same instant the displacement current through A_0 is _____ mA .

Numerical value type: the answer is a number.

Answer: 1200. · Key from source paper

Q33 JEE Main 2024 · 9 Apr · Shift 1 MCQ

A plane EM wave is propagating along x direction. It has a wavelength of 4 mm. If electric field is in y direction with the maximum magnitude of 60Vm^{-1}, the equation for magnetic field is :

(A) $B_z = 2 \times 10^{-7} \sin\left[\frac{\pi}{2} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{k}\,T$

(B) $B_z = 60 \sin\left[\frac{\pi}{2} \left(x - 3 \times 10^8 t\right)\right] \hat{k}\,T$

(C) $B_x = 60 \sin\left[\frac{\pi}{2} \left(x - 3 \times 10^8 t\right)\right] i\,\hat{T}$

(D) $B_z = 2 \times 10^{-7} \sin\left[\frac{\pi}{2} \left(x - 3 \times 10^8 t\right)\right] \hat{k}\,T$

Answer: (A) $B_z = 2 \times 10^{-7} \sin\left[\frac{\pi}{2} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{k}\,T$ · Key from source paper

Q34 JEE Main 2024 · 9 Apr · Shift 2 MCQ

The magnetic field in a plane electromagnetic wave is $B_y = (3.5 \times 10^{-7}) \sin(1.5 \times 10^3 x + 0.5 \times 10^{11} t)$ T. The corresponding electric field will be :

(A) $E_y = 10.5 \sin(1.5 \times 10^3 x + 0.5 \times 10^{11} t)\ \mathrm{Vm}^{-1}$

(B) $E_z = 1.17 \sin(1.5 \times 10^3 x + 0.5 \times 10^{11} t)\ \mathrm{Vm}^{-1}$

(C) $E_y = 1.17 \sin(1.5 \times 10^3 x + 0.5 \times 10^{11} t)\ \mathrm{Vm}^{-1}$

(D) $E_z = 105 \sin(1.5 \times 10^3 x + 0.5 \times 10^{11} t)\ \mathrm{Vm}^{-1}$

Answer: (D) $E_z = 105 \sin(1.5 \times 10^3 x + 0.5 \times 10^{11} t)\ \mathrm{Vm}^{-1}$ · Key from source paper

Q35 JEE Main 2024 · 8 Apr · Shift 1 MCQ

Average force exerted on a non-reflecting surface at normal incidence is 2.4×10^{-4} N. If 360 W/cm^2 is the light energy flux during span of 1 hour 30 minutes, Then the area of the surface is:

(A) $0.2\ \mathrm{m}^2$

(B) $20\ \mathrm{m}^2$

(C) $0.1\ \mathrm{m}^2$

(D) $0.02\ \mathrm{m}^2$

Answer: (D) $0.02\ \mathrm{m}^2$ · Key from source paper

Q36 JEE Main 2024 · 6 Apr · Shift 1 MCQ

Electromagnetic waves travel in a medium with speed of 1.5×10^8 m s^{-1}. The relative permeability of the medium is 2.0 . The relative permittivity will be:

(A) 2
(B) 4
(C) 5
(D) 1

Answer: (A) 2 · Key from source paper

Q37 JEE Main 2024 · 6 Apr · Shift 2 MCQ

In the given electromagnetic wave $E_y = 600\sin(\omega t - kx)\ Vm^{-1}$, intensity of the associated light beam is (in W/m^2 : (Given $\epsilon_0 = 9 \times 10^{-12}$ C^2 N^{-1} m^{-2})

(A) 243
(B) 729
(C) 972
(D) 486

Answer: (D) 486 · Key from source paper

Q38 JEE Main 2024 · 5 Apr · Shift 1 MCQ

An alternating voltage of amplitude 40 V and frequency 4kHz is applied directly across the capacitor of 12μF. The maximum displacement current between the plates of the capacitor is nearly :

(A) 10 A
(B) 12 A
(C) 8 A
(D) 13 A

Answer: (B) 12 A · Key from source paper

Q39 JEE Main 2024 · 5 Apr · Shift 2 MCQ

Match List-I with List-II :

List-I		List-II
EM-Wave		Wavelength Range
(A) Infra-red	(I)	$< 10^{-3}$ nm
(B) Ultraviolet	(II)	400 nm to 1 nm
(C) X-rays S	(III)	1 mm to 700 nm
(D) Gamma rays	(IV)	1 nm to 10^{-3} nm

(A) (A)-(III), (B)-(II), (C)-(IV), (D)-(I)
(B) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(C) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(D) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

Answer: (A) (A)-(III), (B)-(II), (C)-(IV), (D)-(I) · Key from source paper

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Q40 JEE Main 2024 · 4 Apr · Shift 1 MCQ

The electric field in an electromagnetic wave is given by $\vec{\mathrm{E}} = \hat{i}\, 40 \cos \omega(\mathrm{t} - z/c) \mathrm{NC}^{-1}$. The magnetic field induction of this wave is (in SI unit) :

(A) $\vec{\mathrm{B}} = \hat{k} \frac{40}{\mathrm{C}} \cos \omega(\mathrm{t} - z/c)$
(B) $\vec{B} = \hat{j}\, 40 \cos \omega(\mathrm{t} - z/c)$
(C) $\vec{\mathrm{B}} = \hat{i} \frac{40}{\mathrm{C}} \cos \omega(\mathrm{t} - z/c)$
(D) $\vec{\mathrm{B}} = \hat{j} \frac{40}{\mathrm{C}} \cos \omega(\mathrm{t} - z/c)$

Answer: (D) $\vec{\mathrm{B}} = \hat{j} \frac{40}{\mathrm{C}} \cos \omega(\mathrm{t} - z/c)$ · Key from source paper

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Q41 JEE Main 2024 · 4 Apr · Shift 2 MCQ

Arrange the following in the ascending order of wavelength: A. Gamma rays (λ_1) B. x - rays (λ_2) C. Infrared waves (λ_3) D. Microwaves (λ_4) Choose the most appropriate answer from the options given below

(A) $\lambda_4 < \lambda_3 < \lambda_1 < \lambda_2$
(B) $\lambda_2 < \lambda_1 < \lambda_4 < \lambda_3$
(C) $\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4$
(D) $\lambda_4 < \lambda_3 < \lambda_2 < \lambda_1$

Answer: (C) $\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4$ · Key from source paper

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Q42 JEE Main 2024 · 1 Feb · Shift 1 MCQ

A parallel plate capacitor has a capacitance $C = 200$ pF. It is connected to 230 V ac supply with an angular frequency 300 $\mathrm{rad\ s}^{-1}$. The rms value of conduction current in the circuit and displacement current in the capacitor respectively are :

(A) 1.38 μA and 1.38 μA
(B) 14.3 μA and 143 μA
(C) 13.8 μA and 138 μA
(D) 13.8 μA and 13.8 μA

Answer: (D) 13.8 μA and 13.8 μA · Key from source paper

EdLoop JEE

Q43 JEE Main 2024 · 1 Feb · Shift 2 MCQ

If frequency of electromagnetic wave is 60 MHz and it travels in air along z direction then the corresponding electric and magnetic field vectors will be mutually perpendicular to each other and the wavelength of the wave in m is :

(A) 2.5
(B) 10
(C) 5
(D) 2

Answer: (C) 5 · Key from source paper

Q44 JEE Main 2024 · 31 Jan · Shift 1 MCQ

In a plane EM wave, the electric field oscillates sinusoidally at a frequency of 5×10^{10} Hz and an amplitude of 50 V m^{-1}. The total average energy density of the electromagnetic field of the wave is : [Use $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2}]

(A) 1.106×10^{-8} J m^{-3}
(B) 4.425×10^{-8} J m^{-3}
(C) 2.212×10^{-8} J m^{-3}
(D) 2.212×10^{-10} J m^{-3}

Answer: (A) 1.106×10^{-8} J m^{-3} · Key from source paper

Q45 JEE Main 2024 · 31 Jan · Shift 2 MCQ

Given below are two statements:

Statement I: Electromagnetic waves carry energy as they travel through space and this energy is equally shared by the electric and magnetic fields.

Statement II: When electromagnetic waves strike a surface, a pressure is exerted on the surface.

In the light of the above statements, choose the most appropriate answer from the options given below:

(A) Statement I is incorrect but Statement II is correct
(B) Both Statement I and Statement II are correct
(C) Both Statement I and Statement II are incorrect
(D) Statement I is correct but Statement II is incorrect

Answer: (B) Both Statement I and Statement II are correct · Key from source paper

Q46 JEE Main 2024 · 30 Jan · Shift 1 MCQ

The electric field of an electromagnetic wave in free space is represented as $\vec{E} = E_0 \cos(\omega t - kz)\,\hat{i}$. The corresponding magnetic induction vector will be :

(A) $\vec{B} = E_0 C \cos(\omega t - kz)\,\hat{j}$
(B) $\vec{B} = \frac{E_0}{C} \cos(\omega t - kz)\,\hat{j}$
(C) $\vec{B} = E_0 C \cos(\omega t + kz)\,\hat{j}$
(D) $\vec{B} = \frac{E_0}{C} \cos(\omega t + kz)\,\hat{j}$

Answer: (B) $\vec{B} = \frac{E_0}{C} \cos(\omega t - kz)\,\hat{j}$ · Key from source paper

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Q47 JEE Main 2024 · 30 Jan · Shift 2 MCQ

Match List I with List II

List I	List II
A. Gauss's law of magnetostatics	i. $\oint \vec{E} \cdot d\vec{a} = \frac{1}{\varepsilon_0} \int \rho\, dV$
B. Faraday's law of electro magnetic induction	ii. $\oint \vec{B} \cdot d\vec{a} = 0$
C. Ampere's law	iii. $\oint \vec{E} \cdot d\vec{l} = \frac{-d}{dt} \int \vec{B} \cdot d\vec{a}$
D. Gauss's law of electrostatics	iv. $\oint \vec{B} \cdot d\vec{l} = \mu_0 I$

Choose the correct answer from the options given below:

(A) A-I, B-III, C-IV, D-II
(B) A-III, B-IV, C-I, D-II
(C) A-IV, B-II, C-III, D-I
(D) A-II, B-III, C-IV, D-I

Answer: (D) A-II, B-III, C-IV, D-I · Key from source paper

Q48 JEE Main 2024 · 30 Jan · Shift 2 MCQ

If the total energy transferred to a surface in time t is 6.48×10^5 J, then the magnitude of the total momentum delivered to this surface for complete absorption will be :

(A) 2.46×10^{-3} kg m s^{-1}
(B) 2.16×10^{-3} kg m s^{-1}
(C) 1.58×10^{-3} kg m s^{-1}
(D) 4.32×10^{-3} kg m s^{-1}

Answer: (B) 2.16×10^{-3} kg m s^{-1} · Key from source paper

Q49 JEE Main 2024 · 29 Jan · Shift 1 MCQ

Match List I with List II

List I	List II
A. $\oint \vec{B} \cdot \vec{dl} = \mu_0 i_c + \mu_0 \varepsilon_0 \frac{d\phi_E}{dt}$	I. Gauss' law for electricity
B. $\oint \vec{E} \cdot \vec{dl} = \frac{d\phi_B}{dt}$	II. Gauss' law for magnetism
C. $\oint \vec{E} \cdot \overrightarrow{dA} = \frac{Q}{\varepsilon_0}$	III. Faraday law
D. $\oint \vec{B} \cdot \overrightarrow{dA} = 0$	IV. Ampere − Maxwell law

Choose the correct answer from the options given below

(A) A – IV, B – I, C – III, D – II

(B) A – II, B – III, C – I, D – IV

(C) A – IV, B – III, C – I, D – II

(D) A – I, B – II, C – III, D – IV

Answer: (C) A – IV, B – III, C – I, D – II · Key from source paper

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Q50 JEE Main 2024 · 29 Jan · Shift 2 MCQ

A plane electromagnetic wave of frequency 35 MHz travels in free space along the X-direction. At a particular point (in space and time) $\vec{E} = 9.6\hat{j}$ V m^{-1}. The value of magnetic field at this point is:

(A) $3.2 \times 10^{-8}\hat{k}$ T

(B) $3.2 \times 10^{-8}\hat{i}$ T

(C) $9.6\hat{j}$ T

(D) $9.6 \times 10^{-8}\hat{k}$ T

Answer: (A) $3.2 \times 10^{-8}\hat{k}$ T · Key from source paper

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Q51 JEE Main 2024 · 27 Jan · Shift 1 MCQ

A plane electromagnetic wave propagating in x-direction is described by

$E_y = (200\ \text{V m}^{-1}) \sin\left[1.5 \times 10^7 t - 0.05x\right]$; The intensity of the wave is :

(Use $\epsilon_0 = 8.85 \times 10^{-12}$ C^2 N^{-1} m^{-2})

(A) 35.4 W m^{-2}

(B) 53.1 W m^{-2}

(C) 26.6 W m^{-2}

(D) 106.2 W m^{-2}

Answer: (B) 53.1 W m^{-2} · Key from source paper

Q52 JEE Main 2024 · 27 Jan · Shift 2 MCQ

An object is placed in a medium of refractive index 3. An electromagnetic wave of intensity 6×10^8 W m^{-2} falls normally on the object and it is absorbed completely. The radiation pressure on the object would be (speed of light in free space $= 3 \times 10^8$ m s^{-1}):

(A) 36 N m^{-2}

(B) 18 N m^{-2}

(C) 6 N m^{-2}

(D) 2 N m^{-2}

Answer: (C) 6 N m^{-2} · Key from source paper

Q53 JEE Main 2023 · 15 Apr · Shift 1 MCQ

Match List-I with List II of Electromagnetic waves with corresponding wavelength range:
List I | List II
(A) Microwave | (I) 400 nm to 1 nm
(B) Ultraviolet | (II) 1 nm to 10^{-3} nm
(C) X-Ray | (III) 1 mm to 700 nm
(D) Infra-red | (IV) 0.1 m to 1 mm
Choose the correct answer from the options given below:

(A) (A) – (IV), (B) – (I), (C) – (II), (D) – (III)
(B) (A) – (IV), (B) – (I), (C) – (III), (D) – (II)
(C) (A) – (IV), (B) – (II), (C) – (I), (D) – (III)
(D) (A) – (I), (B) – (IV), (C) – (II), (D) – (III)

Answer: (A) (A) – (IV), (B) – (I), (C) – (II), (D) – (III) · Key from source paper

Q54 JEE Main 2023 · 13 Apr · Shift 1 MCQ

The source of time varying magnetic field may be
(A) a permanent magnet
(B) an electric field changing linearly with time
(C) direct current
(D) a decelerating charge particle
(E) an antenna fed with a digital signal
Choose the correct answer from the options given below.

(A) (C) and (E) only
(B) (D) only
(C) (A) only
(D) (B) and (D) only

Answer: (B) (D) only · Key from source paper

Q55 JEE Main 2023 · 13 Apr · Shift 1 MCQ

Which of the following Maxwell's equation is valid for time varying conditions but not valid for static conditions:

(A) $\oint \vec{B} \cdot \vec{dl} = \mu_0 I$
(B) $\oint \vec{E} \cdot \vec{dl} = 0$
(C) $\oint \vec{D} \cdot \vec{dA} = Q$
(D) $\oint \vec{E} \cdot \vec{dl} = -\frac{\partial \phi_B}{\partial t}$

Answer: (D) $\oint \vec{E} \cdot \vec{dl} = -\frac{\partial \phi_B}{\partial t}$ · Key from source paper

Q56 JEE Main 2023 · 13 Apr · Shift 2 MCQ

In an electromagnetic wave, at an instant and at a particular position, the electric field is along the negative z-axis and magnetic field is along the positive x-axis. Then the direction of propagation of electromagnetic wave is:

(A) positive z-axis
(B) positive y-axis
(C) at 45° angle from positive y -axis
(D) negative y-axis

Answer: (D) negative y-axis · Key from source paper

Q57 JEE Main 2023 · 12 Apr · Shift 1 MCQ

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion A : EM waves used for optical communication have longer wavelengths than that of microwave, employed in Radar technology.
Reason R : Infrared EM waves are more energetic than microwaves, (used in Radar)
In the light of given statements, choose the correct answer from the options given below.

(A) Both A and R are true but R is NOT the correct explanation of A
(B) A is false but R is true
(C) A is true but R is false
(D) Both A and R are true and R is the correct explanation of A

Answer: (B) A is false but R is true · Key from source paper

Q58 JEE Main 2023 · 11 Apr · Shift 1 MCQ

The electric field in an electromagnetic wave is given by $\vec{E} = 20 \sin \omega t - \frac{x}{c}\hat{j}\ \mathrm{N\ C^{-1}}$, where ω and c are angular frequency and velocity of electromagnetic wave respectively. The energy contained in a volume of $5 \times 10^{-4}\ \mathrm{m^3}$ will be (Given $\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C^2\ N^{-1}\ m^{-2}}$)

(A) 88.5×10^{-13} J
(B) 17.7×10^{-13} J
(C) 28.5×10^{-13} J
(D) 8.85×10^{-13} J

Answer: (D) 8.85×10^{-13} **J** · Key from source paper

Q59 JEE Main 2023 · 11 Apr · Shift 2 MCQ

A plane electromagnetic wave of frequency 20 MHz propagates in free space along x-direction. At a particular space and time $\vec{E} = 6.6\hat{j}\ \mathrm{V\ m^{-1}}$. What is $\vec{B}$ at this point?

(A) $2.2 \times 10^{-8}\hat{k}\,\mathrm{T}$
(B) $-2.2 \times 10^{-8}\hat{i}\,\mathrm{T}$
(C) $-2.2 \times 10^{-8}\hat{k}\,\mathrm{T}$
(D) $2.2 \times 10^{-8}\hat{i}\,\mathrm{T}$

Answer: (A) $2.2 \times 10^{-8}\hat{k}\,\mathrm{T}$ · Key from source paper

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Q60 JEE Main 2023 · 10 Apr · Shift 1 MCQ

The energy of an electromagnetic wave contained in a small volume oscillates with

(A) Double the frequency of the wave
(B) The frequency of the wave
(C) Half the frequency of the wave
(D) Zero frequency

Answer: (A) Double the frequency of the wave · Key from source paper

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Q61 JEE Main 2023 · 10 Apr · Shift 2 MCQ

The amplitude of magnetic field in an electromagnetic wave propagating along y-axis is 6.0×10^{-7} T. The maximum value of electric field in the electromagnetic wave is

(A) $2 \times 10^{15}\ \mathrm{V\,m^{-1}}$
(B) $180\ \mathrm{V\,m^{-1}}$
(C) $6.0 \times 10^{-7}\ \mathrm{V\,m^{-1}}$
(D) $5 \times 10^{14}\ \mathrm{V\,m^{-1}}$

Answer: (B) $180\ \mathrm{V\,m^{-1}}$ · Key from source paper

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Q62 JEE Main 2023 · 6 Apr · Shift 1 MCQ

For the plane electromagnetic wave given by $E = E_0 \sin(\omega t - kx)$ and $B = B_0 \sin(\omega t - kx)$, the ratio of average electric energy density to average magnetic energy density is

(A) $\frac{1}{2}$
(B) 2
(C) 4
(D) 1

Answer: (D) 1 · Key from source paper

Q63 JEE Main 2023 · 6 Apr · Shift 2 MCQ

The energy density associated with electric field $\vec{E}$ and magnetic field $\vec{B}$ of an electromagnetic wave in free space is given by (ε_0 — permittivity of free space, μ_0 — permeability of free space)

(A) $U_E = \frac{E^2}{2\varepsilon_0}, U_B = \frac{B^2}{2\mu_0}$
(B) $U_E = \frac{\varepsilon_0 E^2}{2}, U_B = \frac{B^2}{2\mu_0}$
(C) $U_E = \frac{\varepsilon_0 E^2}{2}, U_B = \frac{\mu_0 B^2}{2}$
(D) $U_E = \frac{E^2}{2\varepsilon_0}, U_B = \frac{\mu_0 B^2}{2}$

Answer: (B) $U_E = \frac{\varepsilon_0 E^2}{2}, U_B = \frac{B^2}{2\mu_0}$ · Key from source paper

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Q64 JEE Main 2023 · 1 Feb · Shift 1 MCQ

Match the List-I with List-II:

	List I		List II
A	Microwaves	I	Radioactive decay of the nucleus
B	Gamma rays	II	Rapid acceleration and deceleration of electron in aerials
C	Radio waves	III	Inner shell electrons
D	X-rays	IV	Klystron valve

Choose the correct answer from the options given below:

(A) A-I, B-II, C-III, D-IV
(B) A-IV, B-I, C-II, D-III
(C) A-I, B-III, C-IV, D-II
(D) A-IV, B-III, C-II, D-I

Answer: (B) A-IV, B-I, C-II, D-III · Key from source paper

Q65 JEE Main 2023 · 1 Feb · Shift 2 MCQ

The ratio of average electric energy density and total average energy density of electromagnetic wave is:

(A) 2
(B) 1
(C) 3
(D) $\frac{1}{2}$

Answer: (D) $\frac{1}{2}$ · Key from source paper

Q66 JEE Main 2023 · 31 Jan · Shift 1 Numerical

In a medium the speed of light wave decreases to 0.2 times to its speed in free space. The ratio of relative permittivity to the refractive index of the medium is x: 1. The value of x is _____.
(Given speed of light in free space = $3 \times 10^8\ \mathrm{m\ s^{-1}}$ and for the given medium μ_r = 1)

Numerical value type: the answer is a number.

Answer: 5. · Key from source paper

Q67 JEE Main 2023 · 31 Jan · Shift 2 MCQ

Match List I and List II

List I
A Microwaves
B UV rays
C Infra-red rays
D X-rays

List II
I Physiotherapy
II Treatment of cancer
III Lasik eye surgery
IV Aircraft navigation

Choose the correct answer from the option given below:

(A) A-II, B-IV, C-III, D-I
(B) A-IV, B-I, C-II, D-III
(C) A-IV, B-III, C-I, D-II
(D) A-III, B-II, C-I, D-IV

Answer: (C) A-IV, B-III, C-I, D-II · Key from source paper

Q68 JEE Main 2023 · 30 Jan · Shift 1 MCQ

A small object at rest, absorbs a light pulse of power 20 mW and duration 300 ns. Assuming speed of light as 3×10^8 m s^{-1}. The momentum of the object becomes equal to :

(A) 0.5×10^{-17} kg m s^{-1}
(B) 2×10^{-17} kg m s^{-1}
(C) 3×10^{-17} kg m s^{-1}
(D) 1×10^{-17} kg m s^{-1}

Answer: (B) 2×10^{-17} kg m s^{-1} · Key from source paper

Q69 JEE Main 2023 · 30 Jan · Shift 1 Numerical

A point source of light is placed at the centre of curvature of a hemispherical surface. The source emits a power of 24 W. The radius of curvature of hemisphere is 10 cm and the inner surface is completely reflecting. The force on the hemisphere due to the light falling on it is _____ $\times 10^{-8}$ N.

Numerical value type: the answer is a number.

Answer: 4. · Key from source paper

Q70 JEE Main 2023 · 30 Jan · Shift 2 MCQ

A point source of 100 W emits light with 5% efficiency. At a distance of 5 m from the source, the intensity produced by the electric field component is:

(A) $\frac{1}{2\pi}\ \frac{\mathrm{W}}{\mathrm{m}^2}$
(B) $\frac{1}{40\pi}\ \frac{\mathrm{W}}{\mathrm{m}^2}$
(C) $\frac{1}{10\pi}\ \frac{\mathrm{W}}{\mathrm{m}^2}$
(D) $\frac{1}{20}\ \frac{\mathrm{W}}{\mathrm{m}^2}$

Answer: (B) $\frac{1}{40\pi}\ \frac{\mathrm{W}}{\mathrm{m}^2}$ · Key from source paper

Q71 JEE Main 2023 · 29 Jan · Shift 1 MCQ

Which of the following are true?

A. Speed of light in vacuum is dependent on the direction of propagation.
B. Speed of light in a medium is independent of the wavelength of light.
C. The speed of light is independent of the motion of the source.
D. The speed of light in a medium is independent of intensity.

Choose the correct answer from the question given below :

(A) A and C only
(B) B and D only
(C) B and C only
(D) C and D only

Answer: (D) C and D only · Key from source paper

Q72 JEE Main 2023 · 29 Jan · Shift 2 MCQ

Given below are two statements :
Statement I : Electromagnetic waves are not deflected by electric and magnetic field.
Statement II : The amplitude of electric field and the magnetic field in electromagnetic waves are related to each other as $E_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}}\, B_0$.

In the light of the above statements, choose the correct answer from the options given below:

(A) Statement I is true but statement II is false
(B) Both Statement I and Statement II are true
(C) Statement I is false but statement II is true
(D) Both Statement I and Statement II are false

Answer: (A) Statement I is true but statement II is false · Key from source paper

Q73 JEE Main 2023 · 25 Jan · Shift 1 MCQ

All electromagnetic wave is transporting energy in the negative z direction. At a certain point and certain time the direction of electric field of the wave is along positive y direction. What will be the direction of the magnetic field of the wave at that point and instant?

(A) Positive direction of x
(B) Positive direction of z
(C) Negative direction of x
(D) Negative direction of y

Answer: (A) Positive direction of x · Key from source paper

Q74 JEE Main 2023 · 25 Jan · Shift 2 MCQ

Match List I and List II

List I	List II
A. Gauss's Law in Electrostatics	I. $\oint \vec{E} \cdot d\vec{l} = -\frac{d\phi_B}{dt}$
B. Faraday's Law	II. $\oint \vec{B} \cdot d\vec{A} = 0$
C. Gauss's Law in Magnetism	III. $\oint \vec{B} \cdot d\vec{l} = \mu_0 i_c + \mu_0 \epsilon_0 \frac{d\phi_E}{dt}$
D. Ampere-Maxwell Law	IV. $\oint \vec{E} \cdot d\vec{s} = \frac{q}{\epsilon_0}$

Choose the correct answer from the options given below :

(A) A-IV, B-I, C-II, D-III
(B) A-I, B-II, C-III, D-IV
(C) A-III, B-IV, C-I, D-II
(D) A-II, B-III, C-IV, D-I

Answer: (A) A-IV, B-I, C-II, D-III · Key from source paper

Q75 JEE Main 2023 · 24 Jan · Shift 1 MCQ

If $\vec{E}$ and $\vec{K}$ represent electric field and propagation vectors of the EM waves in vacuum, then magnetic field vector is given by:

(ω - angular frequency)

(A) $\frac{1}{\omega}\vec{K} \times \vec{E}$
(B) $\omega\vec{E} \times \vec{K}$
(C) $\omega\vec{K} \times \vec{E}$
(D) $\vec{K} \times \vec{E}$

Answer: (A) $\frac{1}{\omega}\vec{K} \times \vec{E}$ · Key from source paper

Q76 JEE Main 2023 · 24 Jan · Shift 2 MCQ

The electric field and magnetic field components of an electromagnetic wave going through vacuum is described by

$E_x = E_0 \sin(kz - \omega t)$

$B_y = B_0 \sin(kz - \omega t)$

Then the correct relation between E_0 and B_0 is given by

(A) $E_0 B_0 = \omega k$

(B) $E_0 = kB_0$

(C) $kE_0 = \omega B_0$

(D) $\omega E_0 = kB_0$

Answer: (C) $kE_0 = \omega B_0$ · Key from source paper

Q77 JEE Main 2022 · 29 Jul · Shift 1 MCQ

Match List - I with List - II

List-I: (a) UV rays, (b) X-rays, (c) Microwave, (d) Infrared wave

List-II: (i) Diagnostic tool in medicine, (ii) Water purification, (iii) Communication, Radar, (iv) Improving visibility in foggy days

Choose the correct answer from the options given below :

(A) (a) – (iii), (b) – (ii), (c) – (i), (d) – (iv)

(B) (a) – (ii), (b) – (i), (c) – (iii), (d) – (iv)

(C) (a) – (ii), (b) – (iv), (c) – (iii), (d) – (i)

(D) (a) – (iii), (b) – (i), (c) – (ii), (d) – (iv)

Answer: (B) (a) – (ii), (b) – (i), (c) – (iii), (d) – (iv) · Key from source paper

Q78 JEE Main 2022 · 29 Jul · Shift 2 Numerical

Nearly 10% of the power of a 110 W light bulb is converted to visible radiation. The change in average intensities of visible radiation, at a distance of 1 m from the bulb to a distance of 5 m is $a \times 10^{-2}$ W m^{-2}. The value of 'a' will be

Numerical value type: the answer is a number.

Answer: 84. · Key from source paper

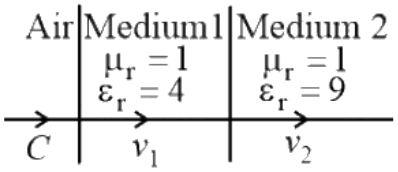
Q79 JEE Main 2022 · 28 Jul · Shift 1 MCQ

As shown in the figure, after passing through the medium 1. The speed of light v_2 in medium 2 will be :

(Given $c = 3 \times 10^8$ m s^{-1})

(see the figure above)

Q15. As shown in the figure, after passing through the medium 1. The speed of light v_2 in medium 2 will be :
(Given $c = 3 \times 10^8$ m s^{-1})



(1) 1.0×10^8 m s^{-1}
(2) 0.5×10^8 m s^{-1}
(3) 1.5×10^8 m s^{-1}
(4) 3.0×10^8 m s^{-1}

(A) $1.0 \times 10^8\ \mathrm{m\ s^{-1}}$
(B) $0.5 \times 10^8\ \mathrm{m\ s^{-1}}$
(C) $1.5 \times 10^8\ \mathrm{m\ s^{-1}}$
(D) $3.0 \times 10^8\ \mathrm{m\ s^{-1}}$

Answer: (A) $1.0 \times 10^8\ \mathrm{m\ s^{-1}}$ · Key from source paper

Q80 JEE Main 2022 · 28 Jul · Shift 2 MCQ

Sun light falls normally on a surface of area $36\ \mathrm{cm}^2$ and exerts an average force of 7.2×10^{-9} N within a time period of 20 minutes. Considering a case of complete absorption, the energy flux of incident light is

(A) $25.92 \times 10^2\ \mathrm{W\ cm^{-2}}$
(B) $8.64 \times 10^{-6}\ \mathrm{W\ cm^{-2}}$
(C) $6.0\ \mathrm{W\ cm^{-2}}$
(D) $0.06\ \mathrm{W\ cm^{-2}}$

Answer: (D) $0.06\ \mathrm{W\ cm^{-2}}$ · Key from source paper

Q81 JEE Main 2022 · 27 Jul · Shift 1 MCQ

A beam of light travelling along X-axis is described by the electric field E_y = 900 $\sin\omega\left(t - \frac{x}{c}\right)$. The ratio of electric force to magnetic force on a charge q moving along Y-axis with a speed of 3×10^7 m s^{-1} will be : [Given speed of light = 3×10^8 m s^{-1}]

(A) 1 : 1
(B) 1 : 10
(C) 10 : 1
(D) 1 : 2

Answer: (C) 10 : 1 · Key from source paper

Q82 JEE Main 2022 · 27 Jul · Shift 2 MCQ

Identify the correct statements from the following descriptions of various properties of electromagnetic waves.

A. In a plane electromagnetic wave electric field and magnetic field must be perpendicular to each other and direction of propagation of wave should be along electric field or magnetic field.
B. The energy in electromagnetic wave is divided equally between electric and magnetic fields.
C. Both electric field and magnetic field are parallel to each other and perpendicular to the direction of propagation of wave.
D. The electric field, magnetic field and direction of propagation of wave must be perpendicular to each other.
E. The ratio of amplitude of magnetic field to the amplitude of electric field is equal to speed of light.
Choose the most appropriate answer from the options given below:

(A) D only
(B) B and D only
(C) B, C and E only
(D) A, B and E only

Answer: (B) B and D only · Key from source paper

Q83 JEE Main 2022 · 26 Jul · Shift 1 MCQ

The magnetic field of a plane electromagnetic wave is given by $\vec{B} = 2 \times 10^{-8} \sin(0.5 \times 10^3 x + 1.5 \times 10^{11} t)\hat{j}$ T. The amplitude of the electric field would be

(A) $6\ \mathrm{Vm}^{-1}$ along x-axis
(B) $3\ \mathrm{Vm}^{-1}$ along z-axis
(C) $6\ \mathrm{Vm}^{-1}$ along z-axis
(D) $2 \times 10^{-8}\ \mathrm{Vm}^{-1}$ along z-axis

Answer: (C) $6\ \mathrm{Vm}^{-1}$ along z-axis · Key from source paper

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Q84 JEE Main 2022 · 26 Jul · Shift 1 MCQ

A radio can tune to any station in 6 MHz to 10 MHz band. The value of corresponding wavelength bandwidth will be

(A) 4 m
(B) 20 m
(C) 30 m
(D) 50 m

Answer: (B) 20 m · Key from source paper

Q85 JEE Main 2022 · 26 Jul · Shift 2 MCQ

The oscillating magnetic field in a plane electromagnetic wave is given by $B_y = 5 \times 10^{-6} \sin 1000\pi 5x - 4 \times 10^8 t$ T. The amplitude of electric field will be

(A) $15 \times 10^{2}\ \mathrm{Vm}^{-1}$
(B) $5 \times 10^{-6}\ \mathrm{Vm}^{-1}$
(C) $16 \times 10^{12}\ \mathrm{Vm}^{-1}$
(D) $4 \times 10^{2}\ \mathrm{Vm}^{-1}$

Answer: (D) $4 \times 10^{2}\ \mathrm{Vm}^{-1}$ · Key from source paper

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Q86 JEE Main 2022 · 25 Jul · Shift 2 MCQ

Light wave travelling in air along x-direction is given by $E_y = 540 \sin \pi \times 10^{4}(x - ct)\ \mathrm{V\,m^{-1}}$. Then, the peak value of magnetic field of wave will be (Given $c = 3 \times 10^{8}\ \mathrm{m\,s^{-1}}$)

(A) $18 \times 10^{-7}\ \mathrm{T}$
(B) $54 \times 10^{-7}\ \mathrm{T}$
(C) $54 \times 10^{-8}\ \mathrm{T}$
(D) $18 \times 10^{-8}\ \mathrm{T}$

Answer: (A) $18 \times 10^{-7}\ \mathrm{T}$ · Key from source paper

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Q87 JEE Main 2022 · 29 Jun · Shift 1 Numerical

The intensity of the light from a bulb incident on a surface is $0.22\ \mathrm{W\,m^{-2}}$. The amplitude of the magnetic field in this light-wave is _____ $\times 10^{-9}\ \mathrm{T}$
(Given : Permittivity of vacuum $\epsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C^2\,N^{-1}\,m^{-2}}$, speed of light in vacuum $c = 3 \times 10^{8}\ \mathrm{m\,s^{-1}}$
)

Numerical value type: the answer is a number.

Answer: 43. · Key from source paper

Q88 JEE Main 2022 · 29 Jun · Shift 2 Numerical

The displacement current of $4.425\ \mu\mathrm{A}$ is developed in the space between the plates of parallel plate capacitor when voltage is changing at a rate of $10^{6}\ \mathrm{V\,s^{-1}}$. The area of each plate of the capacitor is $40\ \mathrm{cm^2}$. The distance between each plate of the capacitor is $x \times 10^{-3}\ \mathrm{m}$. The value of x is ,
(Permittivity of free space, $\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C^2\,N^{-1}\,m^{-2}}$) _____

Numerical value type: the answer is a number.

Answer: 8. · Key from source paper

Q89 JEE Main 2022 · 28 Jun · Shift 1 MCQ

A radar sends an electromagnetic signal of electric field $(E_0) = 2.25\ \mathrm{V\,m^{-1}}$ and magnetic field $(B_0) = 1.5 \times 10^{-8}\ \mathrm{T}$ which strikes a target on line of sight at a distance of $3\ \mathrm{km}$ in a medium. After that, a part of signal (echo) reflects back towards the radar with same velocity and by same path. If the signal was transmitted at time $t = 0$ from radar, then after how much time echo will reach to the radar?

(A) 2.0×10^{-5} s
(B) 4.0×10^{-5} s
(C) 1.0×10^{-5} s
(D) 8.0×10^{-5} s

Answer: (B) 4.0×10^{-5} s · Key from source paper

Q90 JEE Main 2022 · 28 Jun · Shift 2 MCQ

An EM wave propagating in x-direction has a wavelength of 8 mm. The electric field vibrating y-direction has maximum magnitude of $60\ \mathrm{Vm}^{-1}$. Choose the correct equations for electric and magnetic fields if the EM wave is propagating in vacuum :

(A) $E_y = 60 \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{j}\ \mathrm{V\ m^{-1}}$
$B_z = 2 \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{k}\ \mathrm{T}$
(B) $E_y = 60 \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{j}\ \mathrm{V\ m^{-1}}$
$B_z = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{k}\ \mathrm{T}$
(C) $E_y = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{j}\ \mathrm{V\ m^{-1}}$
$B_z = 60 \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{k}\ \mathrm{T}$
(D) $E_y = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^4 \left(x - 4 \times 10^8 t\right)\right] \hat{j}\ \mathrm{V\ m^{-1}}$
$B_z = 60 \sin\left[\frac{\pi}{4} \times 10^4 \left(x - 4 \times 10^8 t\right)\right] \hat{k}\ \mathrm{T}$

Answer: (B) $E_y = 60 \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{j}\ \mathrm{V\ m^{-1}}$
$B_z = 2 \times 10^{-7} \sin\left[\frac{\pi}{4} \times 10^3 \left(x - 3 \times 10^8 t\right)\right] \hat{k}\ \mathrm{T}$ · Key from source paper

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Q91 JEE Main 2022 · 27 Jun · Shift 1 MCQ

Match List - I with List - II
List-I
(a) Ultraviolet rays
(b) Microwaves
(c) Infrared waves
(d) X-rays
List-II
(i) Study crystal structure
(ii) Greenhouse effect
(iii) Sterilizing surgical instrument
(iv) Radar system

(A) (a) – (iii), (b)(iv), (c) – (ii), (d) – (i)
(B) (a) – (iii), (b)(i), (c) – (ii), (d) – (iv)
(C) (a) – (iv), (b)(iii), (c) – (ii), (d) – (i)
(D) (a) – (iii), (b)(iv), (c) – (i), (d) – (ii)

Answer: (A) (a) – (iii), (b)(iv), (c) – (ii), (d) – (i) · Key from source paper

Q92 JEE Main 2022 · 27 Jun · Shift 2 MCQ

Given below are two statements :
Statement I: A time varying electric field is a source of changing magnetic field and vice-versa. Thus a disturbance in electric or magnetic field creates EM waves.
Statement II: In a material medium, the EM wave travels with speed $v = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$.
In the light of the above statements, choose the correct answer from the options given below.

(A) Both statement I and statement II are true
(B) Both statement I and statement II are false
(C) Statement I is correct but statement II is false
(D) Statement I is incorrect but statement II is true

Answer: (C) Statement I is correct but statement II is false · Key from source paper

Q93 JEE Main 2022 · 26 Jun · Shift 1 MCQ

If Electric field intensity of a uniform plane electro magnetic wave is given as $E = -301.6\sin(kz - \omega t)\hat{a}_x + 452.4\sin(kz - \omega t)\hat{a}_y$ V m^{-1}. Then, magnetic intensity H of this wave in A m^{-1} will be [Given : Speed of light in vacuum $c = 3 \times 10^8$ m s^{-1}, Permeability of vacuum $\mu_0 = 4\pi \times 10^{-7}$ N A^{-2}]

(A) $+0.8\sin(kz - \omega t)\hat{a}_y + 0.8\sin(kz - \omega t)\hat{a}_x$
(B) $+1.0 \times 10^{-6}\sin(kz - \omega t)\hat{a}_y + 1.5 \times 10^{-6}(kz - \omega t)\hat{a}_x$
(C) $-0.8\sin(kz - \omega t)\hat{a}_y - 1.2\sin(kz - \omega t)\hat{a}_x$
(D) $-1.0 \times 10^{-6}\sin(kz - \omega t)\hat{a}_y - 1.5 \times 10^{-6}\sin(kz - \omega t)\hat{a}_x$

Answer: (C) $-0.8\sin(kz - \omega t)\hat{a}_y - 1.2\sin(kz - \omega t)\hat{a}_x$ · Key from source paper

Q94 JEE Main 2022 · 26 Jun · Shift 2 MCQ

Which is the correct ascending order of wavelengths?

(A) $\lambda_{\text{visible}} < \lambda_{\text{X-ray}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{microwave}}$
(B) $\lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}} < \lambda_{\text{visible}} < \lambda_{\text{microwave}}$
(C) $\lambda_{\text{X-ray}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{visible}} < \lambda_{\text{microwave}}$
(D) $\lambda_{\text{microwave}} < \lambda_{\text{visible}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}}$

Answer: (B) $\lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}} < \lambda_{\text{visible}} < \lambda_{\text{microwave}}$ · Key from source paper

Q95 JEE Main 2022 · 25 Jun · Shift 1 MCQ

The electric field in an electromagnetic wave is given by $E = 56.5\sin\omega\frac{t-x}{c}\text{NC}^{-1}$. Find the intensity of the wave if it is propagating along x-axis in the free space. (Given $\epsilon_0 = 8.85 \times 10^{-12}\text{C}^2\ \text{N}^{-1}\ \text{m}^{-2}$)

(A) $5.65 \mathrm{Wm}^{-2}$
(B) $1.9 \times 10^{-7} \mathrm{Wm}^{-2}$
(C) $4.24\ \mathrm{Wm}^{-2}$
(D) $56.5 \mathrm{Wm}^{-2}$

Answer: (C) $4.24\ \mathrm{Wm}^{-2}$ · Key from source paper

Q96 JEE Main 2022 · 25 Jun · Shift 2 MCQ

The electromagnetic waves travel in a medium at a speed of $2.0 \times 10^8\ \mathrm{m\ s}^{-1}$. The relative permeability of the medium is 1.0. The relative permittivity of the medium will be

(A) 2.25
(B) 4.25
(C) 6.25
(D) 8.25

Answer: (A) 2.25 · Key from source paper

Q97 JEE Main 2022 · 24 Jun · Shift 1 MCQ

A plane electromagnetic wave travels in a medium of relative permeability 1.61 and relative permittivity 6.44. If magnitude of magnetic intensity is $4.5 \times 10^{-2}\ \mathrm{A\ m}^{-1}$ at a point, what will be the approximate magnitude of electric field intensity at that point ?
(Given : Permeability of free space $\mu_0 = 4\pi \times 10^{-7}\ \mathrm{N\ A}^{-2}$, speed of light in vacuum $c = 3 \times 10^8\ \mathrm{m\ s}^{-1}$)

(A) $16.96\ \mathrm{V\ m}^{-1}$
(B) $2.25 \times 10^{-2}\ \mathrm{V\ m}^{-1}$
(C) $8.48\ \mathrm{V\ m}^{-1}$
(D) $6.75 \times 10^6\ \mathrm{V\ m}^{-1}$

Answer: (C) $8.48\ \mathrm{V\ m}^{-1}$ · Key from source paper

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Q98 JEE Main 2022 · 24 Jun · Shift 2 MCQ

An electric bulb is rated as $200\ \mathrm{W}$. What will be the peak magnetic field at $4\ \mathrm{m}$ distance produced by the radiations coming from this bulb? Consider this bulb as a point source with 3.5% efficiency.

(A) $1.19 \times 10^{-8}\ \mathrm{T}$
(B) $1.71 \times 10^{-8}\ \mathrm{T}$
(C) $0.84 \times 10^{-8}\ \mathrm{T}$
(D) $3.36 \times 10^{-8}\ \mathrm{T}$

Answer: (B) $1.71 \times 10^{-8}\ \mathrm{T}$ · Key from source paper

Q99 JEE Main 2021 · 1 Sep · Shift 2 MCQ

Electric field of a plane electromagnetic wave propagating through a non-magnetic medium is given by $E = 20\cos 2 \times 10^{10}t - 200x$ V m^{-1}. The dielectric constant of the medium is equal to:
(Take $\mu_r = 1$)

(A) 2
(B) $\frac{1}{3}$
(C) 9
(D) 3

Answer: (C) 9 · Key from source paper

Q100 JEE Main 2021 · 31 Aug · Shift 1 Numerical

The electric field in an electromagnetic wave is given by
$E = \left(50\ \text{N C}^{-1}\right)\sin\omega\left(t - \frac{x}{c}\right)$
The energy contained in a cylinder of volume V is 5.5×10^{-12} J. The value of V is _____ cm^3.
(given $\epsilon_0 = 8.8 \times 10^{-12}$C^2 N^{-1} m^{-2})

Numerical value type: the answer is a number.

Answer: 500. · Key from source paper

Q101 JEE Main 2021 · 31 Aug · Shift 2 MCQ

The magnetic field vector of an electromagnetic wave is given by $B = B_0\frac{i+j}{\sqrt{2}}\cos kz - \omega t$ where $\hat{i}$, $\hat{j}$ represents unit vector along x and y-axis respectively. At $t = 0$ s, two electric charges q_1 of 4π coulomb and q_2 of 2π coulomb located at $0, 0, \frac{\pi}{k}$ and $0, 0, \frac{3\pi}{k}$, respectively, have the same velocity of $0.5c\hat{i}$, (where c is the velocity of light). The ratio of the force acting on charge q_1 to q_2 is :

(A) $1 : \sqrt{2}$
(B) $2\sqrt{2} : 1$
(C) $\sqrt{2} : 1$
(D) $2 : 1$

Answer: (D) $2 : 1$ · Key from source paper

Q102 JEE Main 2021 · 27 Aug · Shift 1 MCQ

The electric field in a plane electromagnetic wave is given by, $E = 50\sin(500x - 10 \times 10^{10}t)$ V m^{-1}. The velocity of an electromagnetic wave in this medium is: (Given c = the speed of light in vacuum.)

EdLoop JEE

(A) $\frac{3}{2}c$
(B) c
(C) $\frac{c}{2}$
(D) $\frac{2}{3}c$

Answer: (D) $\frac{2}{3}c$ · Key from source paper

Q103 JEE Main 2021 · 27 Aug · Shift 2 Numerical

A plane electromagnetic wave with a frequency of $30\ \mathrm{MHz}$ travels in free space. At a particular point in space and time, the electric field is $6\ \mathrm{V\ m^{-1}}$. The magnetic field at this point will be $x \times 10^{-8}\ \mathrm{T}$. The value of x is,

Numerical value type: the answer is a number.

Answer: 2. · Key from source paper

Q104 JEE Main 2021 · 26 Aug · Shift 1 Numerical

The electric field in a plane electromagnetic wave is given by
$\vec{E} = 200\cos\left[\left(0.5 \times 10^{3}\ \mathrm{m^{-1}}\right)x - \left(1.5 \times 10^{11}\ \mathrm{rad\ s^{-1}}\right)t\right]\ \mathrm{V\ m^{-1}}\ \hat{j}$.
If this wave falls normally on a perfectly reflecting surface having an area of $100\ \mathrm{cm^2}$. If the radiation pressure exerted by the E.M. wave on the surface during a 10 min exposure is $\frac{k}{10^9}\ \mathrm{N\ m^{-2}}$. Find the value of k

Numerical value type: the answer is a number.

Answer: 354. · Key from source paper

Q105 JEE Main 2021 · 26 Aug · Shift 2 MCQ

A light beam is described by $E = 800\sin\omega\left(t - \frac{x}{c}\right)$. An electron is allowed to move normal to the propagation of light beam with a speed of $3 \times 10^{7}\ \mathrm{m\ s^{-1}}$. What is the maximum magnetic force exerted on the electron?

(A) $1.28 \times 10^{-21}\ \mathrm{N}$
(B) $12.8 \times 10^{-18}\ \mathrm{N}$
(C) $1.28 \times 10^{-18}\ \mathrm{N}$
(D) $12.8 \times 10^{-17}\ \mathrm{N}$

Answer: (B) $12.8 \times 10^{-18}\ \mathrm{N}$ · Key from source paper

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Q106 JEE Main 2021 · 27 Jul · Shift 1 MCQ

The relative permittivity of distilled water is 81. The velocity of light in it will be: (Given $\mu_r = 1$)

(A) $4.33 \times 10^{7}\ \mathrm{m\ s^{-1}}$
(B) $2.33 \times 10^{7}\ \mathrm{m\ s^{-1}}$
(C) $3.33 \times 10^{7}\ \mathrm{m\ s^{-1}}$
(D) $5.33 \times 10^{7}\ \mathrm{m\ s^{-1}}$

Answer: (C) $3.33 \times 10^{7}\ \mathrm{m\ s^{-1}}$ · Key from source paper

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Q107 JEE Main 2021 · 25 Jul · Shift 1 MCQ

A linearly polarised electromagnetic wave in vacuum is $E = 3.1\cos(1.8z - 5.4 \times 10^{6}t)\hat{i}\ \mathrm{N\ C^{-1}}$ is incident normally on a perfectly reflecting wall at $z = a$. Choose the correct option.

(A) The wavelength is $5.4\ \mathrm{m}$.
(B) The frequency of electromagnetic wave is $54 \times 10^{4}\ \mathrm{Hz}$.
(C) The transmitted wave will be $3.1\cos(1.8z - 5.4 \times 10^{6}t)\hat{i}\ \mathrm{N/C}$.
(D) The reflected wave will be $3.1\cos(1.8z + 5.4 \times 10^{6}t)\hat{i}\ \mathrm{N\ C^{-1}}$.

Answer: (D) The reflected wave will be $3.1\cos(1.8z + 5.4 \times 10^{6}t)\hat{i}\ \mathrm{N\ C^{-1}}$. · Key from source paper

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Q108 JEE Main 2021 · 22 Jul · Shift 1 MCQ

Intensity of sunlight is observed as $0.092\ \mathrm{Wm^{-2}}$ at a point in free space. What will be the peak value of magnetic field at that point ? ($\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C^2\ N^{-1}\ m^{-2}}$)

(A) $2.77 \times 10^{-8}\ \mathrm{T}$
(B) $1.96 \times 10^{-8}\ \mathrm{T}$
(C) $8.31\ \mathrm{T}$
(D) $5.88\ \mathrm{T}$

Answer: (A) $2.77 \times 10^{-8}\ \mathrm{T}$ · Key from source paper

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Q109 JEE Main 2021 · 20 Jul · Shift 1 MCQ

AC voltage $V(t) = 20\ \sin\omega t$ of frequency $50\ \mathrm{Hz}$ is applied to a parallel plate capacitor. The separation between the plates is $2\ \mathrm{mm}$ and the area is $1\ \mathrm{m^2}$. The amplitude of the oscillating displacement current for the applied AC voltage is $\left[\mathrm{Take}\ \varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{F\ m^{-1}}\right]$

(A) $21.14\ \mu\mathrm{A}$
(B) $83.37\ \mu\mathrm{A}$
(C) $27.79\ \mu\mathrm{A}$
(D) $55.58\ \mu\mathrm{A}$

Answer: (C) $27.79\ \mu\mathrm{A}$ · Key from source paper

Q110 JEE Main 2021 · 20 Jul · Shift 2 MCQ

In an electromagnetic wave, the electric field vector and magnetic field vector are given as $\overrightarrow{E} = E_0\hat{\mathrm{i}}$ and $\overrightarrow{B} = B_0\hat{\mathrm{k}}$, respectively. The direction of propagation of electromagnetic wave is along:

(A) $\left(\hat{\mathrm{k}}\right)$
(B) $\hat{\mathrm{J}}$
(C) $\left(-\hat{\mathrm{k}}\right)$
(D) $\left(-\hat{\mathrm{j}}\right)$

Answer: (D) $\left(-\hat{\mathrm{j}}\right)$ · Key from source paper

Q111 JEE Main 2021 · 18 Mar · Shift 1 MCQ

A plane electromagnetic wave of frequency $100\ \mathrm{MHz}$ is traveling in a vacuum along the $x-$direction. At a particular point in space and time, $\vec{B} = 2.0 \times 10^{-8}\ \hat{k}\mathrm{T}$. (where, $\hat{k}$ is unit vector along $z-$direction) What is $\vec{E}$ at this point?

(A) $0.6\hat{j}\ \mathrm{V\,m^{-1}}$
(B) $6.0\hat{k}\ \mathrm{V\,m^{-1}}$
(C) $6.0\hat{j}\ \mathrm{V\,m^{-1}}$
(D) $0.6\hat{k}\ \mathrm{V\,m^{-1}}$

Answer: (C) $6.0\hat{j}\ \mathrm{V\,m^{-1}}$ · Key from source paper

Q112 JEE Main 2021 · 18 Mar · Shift 2 MCQ

A plane electromagnetic wave propagating along y-direction can have the following pair of electric field $\left(\vec{E}\right)$ and magnetic field $\left(\vec{B}\right)$ components.

(A) E_y, B_y or E_z, B_z
(B) E_y, B_x or E_x, B_y
(C) E_x, B_z or E_z, B_x
(D) E_x, B_y or E_y, B_x

Answer: (C) E_x, B_z or E_z, B_x · Key from source paper

Q113 JEE Main 2021 · 17 Mar · Shift 1 Numerical

If $2.5 \times 10^{-6}\ \mathrm{N}$ average force is exerted by a light wave on a non-reflecting surface of $30\ \mathrm{cm^2}$ area during 40 min of time span, the energy flux of light just before it falls on the surface is _____ $\mathrm{Wcm^{-2}}$. (Round off to the Nearest Integer), (Assume complete absorption and normal incidence conditions are there)

Numerical value type: the answer is a number.

Answer: 25. · Key from source paper

EdLoop JEE

Q114 JEE Main 2021 · 17 Mar · Shift 2 Numerical

The electric field intensity is produced by the radiation coming from a 100 W bulb at a distance of 3 m is E. The electric field intensity produced by the radiation coming from 60 W at the same distance is $\sqrt{\frac{x}{5}}E$. Where the value of $x =$ _____.

Numerical value type: the answer is a number.

Answer: 3. · Key from source paper

Q115 JEE Main 2021 · 17 Mar · Shift 2 Numerical

Seawater at a frequency $f = 9 \times 10^2$ Hz, has permittivity $\varepsilon = 80\varepsilon_0$ and resistivity $\rho = 0.25\Omega\text{m}$. Imagine a parallel plate capacitor is immersed in seawater and is driven by an alternating voltage source $V(t) = V_0 \sin(2\pi f t)$. Then the conduction current density becomes 10^x times the displacement current density after time $t = \frac{1}{800}$ s. The value of x is _____

(Given : $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\ \text{N m}^2\text{C}^{-2}$)

Numerical value type: the answer is a number.

Answer: 6. · Key from source paper

Q116 JEE Main 2021 · 16 Mar · Shift 1 MCQ

A plane electromagnetic wave of frequency 500 MHz is traveling in a vacuum along the y-direction. At a particular point in space and time, $\vec{B} = 8.0 \times 10^{-8}\hat{z}\ \text{T}$. The value of the electric field at this point is:(speed of light $= 3 \times 10^8\ \text{ms}^{-1}$) $\hat{x}, \hat{y}, \hat{z}$ are unit vectors along x, y and z direction.

(A) $-24\hat{x}\ \text{V m}^{-1}$

(B) $2.6\hat{x}\ \text{V m}^{-1}$

(C) $24\hat{x}\ \text{V m}^{-1}$

(D) $-2.6\hat{x}\ \text{V m}^{-1}$

Answer: (A) $-24\hat{x}\ \text{V m}^{-1}$ · Key from source paper

Q117 JEE Main 2021 · 16 Mar · Shift 1 MCQ

For an electromagnetic wave travelling in free space, the relation between average energy densities due to electric (U_e) and magnetic (U_m) fields is :

(A) $U_e = U_m$

(B) $U_e > U_m$

(C) $U_e < U_m$

(D) $U_e \neq U_m$

Answer: (A) $U_e = U_m$ · Key from source paper

Q118 JEE Main 2021 · 16 Mar · Shift 2 MCQ

Red light differs from blue light as they have :

(A) Different frequencies and different wavelengths
(B) Different frequencies and same wavelengths
(C) Same frequencies and same wavelengths
(D) Same frequencies and different wavelengths

Answer: (A) Different frequencies and different wavelengths · Key from source paper

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Q119 JEE Main 2021 · 26 Feb · Shift 1 Numerical

A radiation is emitted by $1000\ \mathrm{W}$ bulb and it generates an electric field and magnetic field at P, placed at a distance of $2\ \mathrm{m}$. The efficiency of the bulb is 1.25%. The value of peak electric field at P is $x \times 10^{-1}\ \mathrm{V\,m^{-1}}$. Value of x is _____ (Rounded-off to the nearest integer) [Take $\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C^2\,N^{-1}\,m^{-2}}$, $c = 3 \times 10^8\ \mathrm{m\,s^{-1}}$]

Numerical value type: the answer is a number.

Answer: 137. · Key from source paper

Q120 JEE Main 2021 · 24 Feb · Shift 1 Numerical

An electromagnetic wave of frequency $5\mathrm{GHz}$, is travelling in a medium whose relative electric permittivity and relative magnetic permeability both are 2. Its velocity in this medium is _____ $\times 10^7\ \mathrm{m\,s^{-1}}$.

Numerical value type: the answer is a number.

Answer: 15. · Key from source paper

Q121 JEE Main 2021 · 24 Feb · Shift 2 MCQ

Match List - I with List - II.
List-I
(a) Source of microwave frequency
(b) Source of infrared frequency
(c) Source of Gamma Rays
(d) Source of X-rays
List-II
(i) Radioactive decay of nucleus
(ii) Magnetron
(iii) Inner shell electrons
(iv) Vibration of atoms and molecules
(v) LASER
(vi) RC circuit
Choose the correct answer from the options given below:

(A) (a)-(ii), (b)-(iv), (c)-(vi), (d)-(iii)

(B) (a)-(vi), (b)-(iv), (c)-(i), (d)-(v)

(C) (a)-(vi), (b)-(v), (c)-(i), (d)-(iv)

(D) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii)

Answer: (D) (a)-(ii), (b)-(iv), (c)-(i), (d)-(iii) · Key from source paper

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Q122 JEE Main 2021 · 24 Feb · Shift 2 Numerical

An electromagnetic wave of frequency $3\ \mathrm{GHz}$ enters a dielectric medium of relative electric permittivity 2.25 from vacuum. The wavelength of this wave in that medium will be _____ $\times 10^{-2}$ cm.

Numerical value type: the answer is a number.

Answer: 667. · Key from source paper

Q123 JEE Main 2020 · 6 Sep · Shift 1 Numerical

Suppose that intensity of a laser is $\left(\frac{315}{\pi}\right)\ \mathrm{W\ m^{-2}}$. The rms electric field, in units of $\mathrm{V\ m^{-1}}$ associated with this source is close to the nearest integer is $-$ ($\varepsilon_0 = 8.86 \times 10^{-12}\ \mathrm{C^2\ N\ m^{-2}}$; $\mathrm{c} = 3 \times 10^8\ \mathrm{m\ s^{-1}}$)

Numerical value type: the answer is a number.

Answer: 194. · Checked by our team

Q124 JEE Main 2020 · 6 Sep · Shift 2 MCQ

For a plane electromagnetic wave, the magnetic field at a point x and time t is :

$\vec{B}(x,t) = \left[1.2 \times 10^{-7} \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right) \hat{k}\right]$ T.

The instantaneous electric field $\vec{E}$ corresponding to $\vec{B}$ is :

(A) $\vec{E}(x,t) = \left[-36\ \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right) \hat{j}\right] \frac{\mathrm{V}}{\mathrm{m}}$

(B) $\vec{E}(x,t) = \left[36\ \sin\left(1 \times 10^3 x + 0.5 \times 10^{11} t\right) \hat{j}\right] \frac{\mathrm{V}}{\mathrm{m}}$

(C) $\vec{E}(x,t) = \left[36\ \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right) \hat{k}\right] \frac{\mathrm{V}}{\mathrm{m}}$

(D) $\vec{E}(x,t) = \left[36 \sin\left(1 \times 10^3 x + 15 \times 10^{11} t\right) \hat{i}\right] \frac{\mathrm{V}}{\mathrm{m}}$

Answer: (A) $\vec{E}(x,t) = \left[-36\ \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right) \hat{j}\right] \frac{\mathrm{V}}{\mathrm{m}}$ · Key from source paper

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Q125 JEE Main 2020 · 5 Sep · Shift 1 MCQ

An electron is constrained to move along the y-axis with a speed of 0. 1 c (c is the speed of light) in the presence of electromagnetic wave, whose electric field is $\vec{\mathrm{E}} = 30\hat{j} \sin\left(1.5 \times 10^7 \mathrm{t} - 5 \times 10^{-2} \mathrm{x}\right)$ V m^{-1}. where t in seconds and x is im (sic) meters.The maximum magnetic force experienced by the electron will be: (given c = 3 $\times 10^8$ m s^{-1} and electron charge = 1. 6 $\times 10^{-19}$ Coloumbs

(A) 2×10^{-18} N

(B) 4×10^{-18} N

(C) 8×10^{-19} N

(D) 6×10^{-19} N

Answer: (C)

1. 8×10^{-19} N

· Key from source paper

Q126 JEE Main 2020 · 5 Sep · Shift 2 MCQ

The correct match between the entries in column I and column II are :
Column I (Radiation): a Microwave, b Gamma rays, c A.M. radio, d X-rays
Column II (Wavelength): i $100\ m$, ii $10^{-15}\mathrm{m}$, iii $10^{-10}\mathrm{m}$, iv $10^{-3}\mathrm{m}$

(A) (a)–(ii), (b) – (i), (c) – (iv), (d) – (iii)

(B) (a)–(i), (b) – (iii), (c) – (iv), (d) – (ii)

(C) (a)–(iii), (b) – (ii), (c) – (i), (d) – (iv)

(D) (a)–(iv), (b) – (ii), (c) – (i), (d) – (iii)

Answer: (D) (a)–(iv), (b) – (ii), (c) – (i), (d) – (iii) · Key from source paper

Q127 JEE Main 2020 · 4 Sep · Shift 1 MCQ

Choose the correct option relating wavelengths of different parts of electromagnetic wave spectrum:

(A) $\lambda_{\text{visible}} < \lambda_{\text{micro waves}} < \lambda_{\text{radio waves}} < \lambda_{\text{x-rays}}$

(B) $\lambda_{\text{radio waves}} > \lambda_{\text{micro waves}} > \lambda_{\text{visible}} > \lambda_{\text{x-rays}}$

(C) $\lambda_{\text{x-rays}} < \lambda_{\text{micro waves}} < \lambda_{\text{radio waves}} < \lambda_{\text{visible}}$

(D) $\lambda_{\text{visible}} > \lambda_{\text{x-rays}} > \lambda_{\text{radio waves}} > \lambda_{\text{micro waves}}$

Answer: (B) $\lambda_{\text{radio waves}} > \lambda_{\text{micro waves}} > \lambda_{\text{visible}} > \lambda_{\text{x-rays}}$ · Key from source paper

Q128 JEE Main 2020 · 4 Sep · Shift 2 MCQ

The electric field of a plane electromagnetic wave is given by $\vec{E} = E_0\,(\hat{x} + \hat{y})\sin(kz - \omega t)$. Its magnetic field will be given by

(A) $\frac{E_0}{c}\,(-\hat{x} + \hat{y})\sin(kz - \omega t)$

(B) $\frac{E_0}{c}\,(\hat{x} + \hat{y})\sin(kz - \omega t)$

(C) $\frac{E_0}{c}\,(\hat{x} - \hat{y})\sin(kz - \omega t)$

(D) $\frac{E_0}{c}\,(\hat{x} - \hat{y})\cos(kz - \omega t)$

Answer: (A) $\frac{E_0}{c}\,(-\hat{x} + \hat{y})\sin(kz - \omega t)$ · Key from source paper

Q129 JEE Main 2020 · 3 Sep · Shift 1 MCQ

The magnetic field of a plane electromagnetic wave is $\vec{B} = 3 \times 10^{-8} \sin[200\pi(y + ct)]\hat{i}$ T . Where, $c = 3 \times 10^8$ m s^{-1} is the speed of light the corresponding electric filed is :

(A) $\vec{E} = 9 \sin[200\pi(y + ct)]\hat{k}$ V/m
(B) $\vec{E} = -10^{-6} \sin[200\pi(y + ct)]\hat{k}$ V/m
(C) $\vec{E} = 3 \times 10^{-8} \sin[200\pi(y + ct)]\hat{k}$ V/m
(D) $\vec{E} = -9 \sin[200\pi(y + ct)]\hat{k}$ V/m

Answer: (D) $\vec{E} = -9 \sin[200\pi(y + ct)]\hat{k}$ V/m · Checked by our team

Q130 JEE Main 2020 · 3 Sep · Shift 2 MCQ

The electric field of a plane electromagnetic wave propagating along the x direction in vacuum is $\vec{E} = E_0\hat{j}\cos(\omega t - kx)$. The magnetic field $\vec{B}$, at the moment $t = 0$ is:

(A) $\vec{B} = \frac{E_0}{\sqrt{\mu_0\varepsilon_0}}\cos(kx)\hat{k}$
(B) $\vec{B} = E_0\sqrt{\mu_0\varepsilon_0}\cos(kx)\hat{j}$
(C) $\vec{B} = E_0\sqrt{\mu_0\varepsilon_0}\cos(kx)\hat{k}$
(D) $\vec{B} = \frac{E_0}{\sqrt{\mu_0\varepsilon_0}}\cos(kx)\hat{j}$

Answer: (C) $\vec{B} = E_0\sqrt{\mu_0\varepsilon_0}\cos(kx)\hat{k}$ · Key from source paper

Q131 JEE Main 2020 · 2 Sep · Shift 1 MCQ

A plane electromagnetic wave, has frequency of 2.0×10^{10} Hz and its energy density is 1.02×10^{-8} J m^{-3} in vacuum. The amplitude of the magnetic field of the wave is close to $\left(\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \ \frac{\text{Nm}^2}{\text{C}^2}\right)$ and speed of light $= 3 \times 10^8$ m s^{-1}.

(A) 150 nT
(B) 160 nT
(C) 180 nT
(D) 190 nT

Answer: (B) 160 nT · Key from source paper

Q132 JEE Main 2020 · 2 Sep · Shift 2 MCQ

In a plane electromagnetic wave, the directions of electric field and magnetic field are represented by $\hat{k}$ and $2\hat{i} - 2\hat{j}$, respectively. What is the unit vector along direction of propagation of the wave.

(A) $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$
(B) $\frac{1}{\sqrt{2}}\left(\hat{j}+\mathrm{k}\right)$
(C) $\frac{1}{\sqrt{5}}\left(\hat{i}+2\hat{j}\right)$
(D) $\frac{1}{\sqrt{5}}\left(2\hat{i}+\hat{j}\right)$

Answer: (A) $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$ · Key from source paper

Q133 JEE Main 2020 · 9 Jan · Shift 1 MCQ

The electric fields of two plane electromagnetic plane waves in vacuum are given by $\overrightarrow{E_1}=E_0\hat{j}\cos(\omega t-kx)$ and $\overrightarrow{E_2}=E_0\hat{k}\cos(\omega t-ky)$ At $t=0$, a particle of charge q is at origin with a velocity $\overrightarrow{v}=08c\hat{j}$ (c is the speed of light in vaccum). The instantaneous force experienced by the particle is:

(A) $E_0q\left(0.8\hat{i}-\hat{j}+0.4\hat{k}\right)$
(B) $E_0q\left(0.4\hat{i}-3\hat{j}+0.8\hat{k}\right)$
(C) $E_0q\left(-0.8\hat{i}+\hat{j}+\hat{k}\right)$
(D) $E_0q\left(0.8\hat{i}+\hat{j}+0.2\hat{k}\right)$

Answer: (D) $E_0q\left(0.8\hat{i}+\hat{j}+0.2\hat{k}\right)$ · Key from source paper

Q134 JEE Main 2020 · 9 Jan · Shift 2 MCQ

A plane electromagnetic wave is propagating along the direction $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$, with its polarization along the direction $\hat{k}$. The correct form of the magnetic field of the wave would be (here B_0 is an appropriate constant):

(A) $B_0\frac{\hat{i}-\hat{j}}{\sqrt{2}}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$
(B) $B_0\frac{\hat{j}-\hat{i}}{\sqrt{2}}\cos\left(\omega t+k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$
(C) $B_0\hat{k}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$
(D) $B_0\frac{\hat{i}+\hat{j}}{\sqrt{2}}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$

Answer: (A) $B_0\frac{\hat{i}-\hat{j}}{\sqrt{2}}\cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$ · Key from source paper

Q135 JEE Main 2020 · 8 Jan · Shift 2 MCQ

A plane electromagnetic wave of frequency $25\mathrm{GHz}$ is propagating in vacuum along the z-direction. At a particular point in space and time, the magnetic filed is given by $\vec{B}=5\times10^{-8}\,\hat{j}\,T$. The corresponding electric field $\vec{E}$ is (speed of light $=3\times10^8\ \mathrm{m\ s^{-1}}$)

(A) $1.66 \times 10^{-16}\,\hat{i}\,\frac{\mathrm{V}}{\mathrm{m}}$
(B) $-1.66 \times 10^{-16}\,\hat{i}\,\frac{\mathrm{V}}{\mathrm{m}}$
(C) $-15\hat{i}\,\frac{\mathrm{V}}{\mathrm{m}}$
(D) $15\hat{i}\,\frac{\mathrm{V}}{\mathrm{m}}$

Answer: (D) $15\hat{i}\,\frac{\mathrm{V}}{\mathrm{m}}$ · Key from source paper

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Q136 JEE Main 2020 · 7 Jan · Shift 1 MCQ

If the magnetic field in a plane electromagnetic wave is given by $\vec{B} = 3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{j}T$, then what will be expression for electric field ?

(A) $\vec{E} = \left(60 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}\frac{\mathrm{V}}{\mathrm{m}}\right)$
(B) $\vec{E} = \left(9 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}\frac{\mathrm{V}}{\mathrm{m}}\right)$
(C) $\vec{E} = \left(3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{j}\frac{\mathrm{V}}{\mathrm{m}}\right)$
(D) $\vec{E} = \left(3 \times 10^{-8} \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{i}\frac{\mathrm{V}}{\mathrm{m}}\right)$

Answer: (B) $\vec{E} = \left(9 \sin(1.6 \times 10^3 x + 48 \times 10^{10} t)\hat{k}\frac{\mathrm{V}}{\mathrm{m}}\right)$ · Key from source paper

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Q137 JEE Main 2020 · 7 Jan · Shift 2 MCQ

The electric field of a plane electromagnetic wave is given by $\vec{E} = E_0 \frac{\hat{i}+\hat{j}}{\sqrt{2}} \cos(kz + \omega t)$. At $t = 0$, a positively charged particle is at the point $(x, y, z) = \left(0, 0, \frac{\pi}{k}\right)$. If its instantaneous velocity at $(t = 0)$ is $v_0\hat{k}$, the force acting on it due to the wave is:

(A) parallel to $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
(B) zero
(C) antiparallel to $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
(D) parallel to $\hat{k}$

Answer: (C) antiparallel to $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$ · Key from source paper

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Q138 JEE Main 2019 · 12 Apr · Shift 2 MCQ

A plane electromagnetic wave having a frequency $f = 23.9\ \mathrm{GHz}$ propagates along the positive $z-$ direction in free space. The peak value of the Electric Field is 60 V/m. Which among the following is the acceptable magnetic field component in the electromagnetic wave?

(A) $\vec{B} = 2 \times 10^{-7}\ \sin\left(0.5 \times 10^3 z - 1.5 \times 10^{11} t\right)\hat{i}$
(B) $\vec{B} = 2 \times 10^{-7}\ \sin\left(1.5 \times 10^3 x + 0.5 \times 10^{11} t\right)\hat{j}$
(C) $\vec{B} = 2 \times 10^{7}\ \sin\left(0.5 \times 10^3 z + 1.5 \times 10^{11} t\right)\hat{i}$
(D) $\vec{B} = 60\ \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right)\hat{i}$

Answer: (A) $\vec{B} = 2 \times 10^{-7}\ \sin\left(0.5 \times 10^3 z - 1.5 \times 10^{11} t\right)\hat{i}$ · Key from source paper

Q139 JEE Main 2019 · 10 Apr · Shift 1 MCQ

The electric field of a plane electromagnetic wave is given by
$\vec{E} = E_0\hat{i}\ \cos(kz)\cos(\omega t)$
The corresponding magnetic field $\vec{B}$ is then given by:

(A) $\vec{B} = \frac{E_0}{C}\hat{j}\cos(kz)\sin(\omega t)$
(B) $\vec{B} = \frac{E_0}{C}\hat{k}\sin(kz)\cos(\omega t)$
(C) $\vec{B} = \frac{E_0}{C}\hat{j}\sin(kz)\sin(\omega t)$
(D) $\vec{B} = \frac{E_0}{C}\hat{j}\sin(kz)\cos(\omega t)$

Answer: (C) $\vec{B} = \frac{E_0}{C}\hat{j}\sin(kz)\sin(\omega t)$ · Key from source paper

Q140 JEE Main 2019 · 10 Apr · Shift 2 MCQ

Light is incident normally on a completely absorbing surface with an energy flux of $25\ \mathrm{W\,cm^{-2}}$. If the surface has an area of $25\ \mathrm{cm^2}$, the momentum transferred to the surface in 40 min time duration will be:

(A) $6.3 \times 10^{-4}\ \mathrm{N\,s}$
(B) $5.0 \times 10^{-3}\ \mathrm{N\,s}$
(C) $3.5 \times 10^{-6}\ \mathrm{N\,s}$
(D) $1.4 \times 10^{-6}\ \mathrm{N\,s}$

Answer: (B) $5.0 \times 10^{-3}\ \mathrm{N\,s}$ · Key from source paper

Q141 JEE Main 2019 · 9 Apr · Shift 1 MCQ

The magnetic field of a plane electromagnetic wave is given by $\vec{B} = B_0\hat{i}[\cos(kz - \omega t)] + B_1\hat{j}\cos(kz + \omega t)$, where $B_0 = 3 \times 10^{-5}$ T and $B_1 = 2 \times 10^{-6}$ T. The RMS value of the force experienced by a stationary charge Q = 10^{-4} C at z = 0 is closest to

(A) 0.1 N
(B) 0.9 N
(C) 3×10^{-2} N
(D) 0.6 N

Answer: (D) 0.6 N · Key from source paper

Q142 JEE Main 2019 · 9 Apr · Shift 2 MCQ

Sunlight of intensity 50 $\mathrm{W\ m^{-2}}$ is incident normally on the surface of a solar panel. Some part of incident energy (25%) is reflected from the surface and the rest is absorbed. The force exerted on 1 $\mathrm{m^2}$ surface area will be close to ($c = 3 \times 10^8\ \mathrm{m\ s^{-1}}$)

(A) 15×10^{-8} N
(B) 20×10^{-8} N
(C) 10×10^{-8} N
(D) 35×10^{-8} N

Answer: (B) 20×10^{-8} N · Key from source paper

Q143 JEE Main 2019 · 8 Apr · Shift 1 MCQ

A plane electromagnetic wave travels in free space along the x-direction. The electric field component of the wave at a particular point of space and time is $E = 6\ \mathrm{V\,m^{-1}}$ along y-direction. Its corresponding magnetic field component, B would be:

(A) 2×10^{-8} T along z-direction
(B) 2×10^{-8} T along y-direction
(C) 6×10^{-8} T along z-direction
(D) 6×10^{-8} T along x-direction

Answer: (A) 2×10^{-8} T along z-direction · Key from source paper

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Q144 JEE Main 2019 · 8 Apr · Shift 2 MCQ

The magnetic field of an electromagnetic wave is given by:
$\vec{B} = 1.6 \times 10^{-6} \cos 2 \times 10^{7} z + 6 \times 10^{15} t\ 2\hat{i} + \hat{j}\ \frac{\mathrm{Wb}}{\mathrm{m}^2}$
The associated electric field will be:

(A) $\vec{E} = 4.8 \times 10^{2}\ \cos 2 \times 10^{7} z - 6 \times 10^{15} t\ \text{-}2\hat{j} + \hat{i}\ \frac{\mathrm{V}}{\mathrm{m}}$
(B) $\vec{E} = 4.8 \times 10^{2}\ \cos 2 \times 10^{7} z + 6 \times 10^{15} t\ \hat{i}\ \text{-}\ 2\hat{j}\ \frac{\mathrm{V}}{\mathrm{m}}$
(C) $\vec{E} = 4.8 \times 10^{2}\ \cos 2 \times 10^{7} z + 6 \times 10^{15} t\ \text{-}\hat{i} + 2\hat{j}\ \frac{\mathrm{V}}{\mathrm{m}}$
(D) $\vec{E} = 4.8 \times 10^{2}\ \cos 2 \times 10^{7} z - 6 \times 10^{15} t\ 2\hat{i} + \hat{j}\ \frac{\mathrm{V}}{\mathrm{m}}$

Answer: (C) $\vec{E} = 4.8 \times 10^{2}\ \cos 2 \times 10^{7} z + 6 \times 10^{15} t\ \text{-}\hat{i} + 2\hat{j}\ \frac{\mathrm{V}}{\mathrm{m}}$ · Key from source paper

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Q145 JEE Main 2019 · 12 Jan · Shift 1 MCQ

A light wave is incident normally on a glass slab of refractive index 1.5. If 4% of light gets reflected and the amplitude of the electric field of the incident light is $30\ \frac{V}{m}$, then the amplitude of the electric field for the wave propagating in the glass medium will be:

(A) $30\frac{V}{m}$
(B) $6\frac{V}{m}$
(C) $24\frac{V}{m}$
(D) $10\frac{V}{m}$

Answer: (C) $24\frac{V}{m}$ · Key from source paper

Q146 JEE Main 2019 · 12 Jan · Shift 2 MCQ

The mean intensity of radiation on the surface of the Sun is about $10^8 W/m^2$. The rms value of the corresponding magnetic field is closest to:

(A) $1T$
(B) $10^{-2}T$
(C) 10^2T
(D) $10^{-4}T$

Answer: (D) $10^{-4}T$ · Key from source paper

Q147 JEE Main 2019 · 11 Jan · Shift 1 MCQ

An electromagnetic wave of intensity 50Wm^{-2} enters in a medium of refractive index 'n' without any loss. The ratio of the magnitudes of electric fields, and the ratio of the magnitudes of magnetic fields of the wave before and after entering into the medium are respectively, given by :

(A) $\left(\frac{1}{\sqrt{n}}, \frac{1}{\sqrt{n}}\right)$
(B) $(\sqrt{n}, \sqrt{n})$
(C) $\left(\sqrt{n}, \frac{1}{\sqrt{n}}\right)$
(D) $\left(\frac{1}{\sqrt{n}}, \sqrt{n}\right)$

Answer: (C) $\left(\sqrt{n}, \frac{1}{\sqrt{n}}\right)$ · Key from source paper

Q148 JEE Main 2019 · 11 Jan · Shift 2 MCQ

A 27 mW laser beam has a cross-sectional area of 10 mm^2. The magnitude of the maximum electric field in this electromagnetic wave is given by: [Given permittivity of space $\epsilon_0 = 9 \times 10^{-12}$SI units, Speed of light c = 3×10^8 m/s]

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

Answer: (D) 1.4kV/m · Key from source paper

Q149 JEE Main 2019 · 10 Jan · Shift 1 MCQ

If the magnetic field of a plane electromagnetic wave is given by (The speed of light $= 3 \times 10^8\ m/s$) $B = 100 \times 10^{-6}\ \sin\left[2\pi \times 2 \times 10^{15}\left(t - \frac{x}{c}\right)\right]$ then the maximum electric field associated with it is:

(A) 3×10^4 N C^{-1}
(B) 4×10^4 N C^{-1}
(C) 4.5×10^4 N C^{-1}
(D) 6×10^4 N C^{-1}

Answer: (A) 3×10^4 N C^{-1} · Key from source paper

Q150 JEE Main 2019 · 10 Jan · Shift 2 MCQ

The electric field of a plane polarized electromagnetic wave in free space at time $t = 0$ is given by the expression $\overrightarrow{E}(x,\ y) = 10\hat{j}\cos(6x + 8z)$. The magnetic field $\overrightarrow{B}(x,\ z,\ t)$ is given by (c is the velocity of light.)

(A) $\frac{1}{c}\left(6\hat{k} - 8\hat{i}\right)\cos(6x + 8z + 10\,ct)$
(B) $\frac{1}{c}\left(6\hat{k} + 8\hat{i}\right)\cos(6x + 8z - 10\,ct)$
(C) $\frac{1}{c}\left(6\hat{k} + 8\hat{i}\right)\cos(6x - 8z + 10\,ct)$
(D) $\frac{1}{c}\left(6\hat{k} - 8\hat{i}\right)\cos(6x + 8z - 10\,ct)$

Answer: (D) $\frac{1}{c}\left(6\hat{k} - 8\hat{i}\right)\cos(6x + 8z - 10\,ct)$ · Key from source paper

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Q151 JEE Main 2019 · 9 Jan · Shift 1 MCQ

A plane electromagnetic wave of frequency $50\ MHz$ travels in free space along the positive x - direction. At a particular point in space and time, $\overrightarrow{E} = 6.3\ \hat{j}\ V\ /\ m$, The corresponding magnetic field $\overrightarrow{B}$, at that point will be:

(A) $2.1 \times 10^{-8}\hat{k}\ T$
(B) $18.9 \times 10^{8}\hat{k}\ T$
(C) $18.9 \times 10^{-8}\hat{k}\ T$
(D) $6.3 \times 10^{-8}\hat{k}\ T$

Answer: (A) $2.1 \times 10^{-8}\hat{k}\ T$ · Key from source paper

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Q152 JEE Main 2019 · 9 Jan · Shift 2 MCQ

The energy associated with electric field (U_E) and with magnetic field is (U_B) for an electromagnetic wave in free space. Then:

(A) $U_E > U_B$
(B) $U_E = U_B$
(C) $U_E = \frac{U_B}{2}$
(D) $U_E < U_B$

Answer: (B) $U_E = U_B$ · Key from source paper

Q153 JEE Main 2018 · 16 Apr · Online MCQ

A plane electromagnetic wave of wavelength λ has an intensity I. It is propagating along the positive $Y-$direction. The allowed expressions for the electric and magnetic fields are given by:

(A) $\vec{E}=\sqrt{\frac{2I}{\varepsilon_0 c}}\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\hat{k}, \vec{B}=+\frac{1}{c}E\hat{i}$

(B) $\vec{E}=\sqrt{\frac{I}{\varepsilon_0 c}}\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\hat{k}, \vec{B}=+\frac{1}{c}E\hat{i}$

(C) $\vec{E}=\sqrt{\frac{2I}{\varepsilon_0 c}}\cos\left[\frac{2\pi}{\lambda}(y+ct)\right]\hat{k}, \vec{B}=+\frac{1}{c}E\hat{i}$

(D) $\vec{E}=\sqrt{\frac{I}{\varepsilon_0 c}}\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\hat{i}, \vec{B}=+\frac{1}{c}E\hat{k}$

Answer: (A) $\vec{E}=\sqrt{\frac{2I}{\varepsilon_0 c}}\cos\left[\frac{2\pi}{\lambda}(y-ct)\right]\hat{k}, \vec{B}=+\frac{1}{c}E\hat{i}$ · Key from source paper

Q154 JEE Main 2018 · 15 Apr · Shift 1 MCQ

A monochromatic beam of light has a frequency $v=\frac{3}{2\pi}\times10^{12}\ \text{Hz}$ and is propagating along the direction $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$. It is polarized along the $\hat{k}$ direction. The acceptable form for the magnetic field is:

(A) $\frac{E_0}{C}\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)\cos\left[10^4\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}-(3\times10^{12})t\right]$

(B) $\frac{E_0}{C}\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}-(3\times10^{12})t\right]$

(C) $\frac{E_0}{C}\hat{k}\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\vec{r}+(3\times10^{12})t\right]$

(D) $\frac{E_0}{C}\frac{(\hat{i}+\hat{j}+\hat{k})}{\sqrt{3}}\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\vec{r}+(3\times10^{12})t\right]$

Answer: (B) $\frac{E_0}{C}\left(\frac{\hat{i}-\hat{j}}{\sqrt{2}}\right)\cos\left[10^4\left(\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)\cdot\vec{r}-(3\times10^{12})t\right]$ · Checked by our team

Q155 JEE Main 2018 · 15 Apr · Shift 2 MCQ

A plane polarized monochromatic EM wave is travelling a vacuum along z direction such that at $t = t_1$ it is found that the electric field is zero at a spatial point z_1. The next zero that occurs in its neighbourhood is at z_2. The frequency of the electromagnetic wave is:

(A) $\frac{3\times10^8}{|z_2-z_1|}$

(B) $\frac{6\times10^8}{|z_2-z_1|}$

(C) $\frac{1.5\times10^8}{|z_2-z_1|}$

(D) $\frac{1}{t_1+\frac{|z_2-z_1|}{3\times10^8}}$

Answer: (C) $\frac{1.5\times10^8}{|z_2-z_1|}$ · Checked by our team

Q156 JEE Main 2018 · 8 Apr · Offline MCQ

An EM wave from air enters a medium. The electric fields are $\vec{E_1}=E_{01}\hat{x}\cos\left[2\pi v\left(\frac{z}{c}-t\right)\right]$ in air and $\vec{E_2}=E_{02}\hat{x}\cos[k(2z-ct)]$in medium, where the wave number k and frequency v refer to their values

in the air. The medium is non-magnetic. If ϵ_{r_1} and ϵ_{r_2} refer to relative permittivities of air and medium respectively, which of the following options, is correct?

(A) $\frac{\epsilon_{r_1}}{\epsilon_{r_2}} = \frac{1}{2}$
(B) $\frac{\epsilon_{r_1}}{\epsilon_{r_2}} = 4$
(C) $\frac{\epsilon_{r_1}}{\epsilon_{r_2}} = 2$
(D) $\frac{\epsilon_{r_1}}{\epsilon_{r_2}} = \frac{1}{4}$

Answer: (D) $\frac{\epsilon_{r_1}}{\epsilon_{r_2}} = \frac{1}{4}$ · Key from source paper

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Q157 JEE Main 2017 · 9 Apr · Online MCQ

The electric field component of a monochromatic radiation is given by $\vec{E} = 2E_0 \cos kz \cos \omega t \, \hat{i}$, Its magnetic field $\vec{B}$ is then given by:

(A) $\frac{2E_0}{c} \sin kz \sin \omega t \, \hat{j}$
(B) $\frac{2E_0}{c} \cos kz \cos \omega t \, \hat{j}$
(C) $\frac{2E_0}{c} \sin kz \cos \omega t \, \hat{j}$
(D) $\frac{-2E_0}{c} \sin kz \sin \omega t \, \hat{j}$

Answer: (A) $\frac{2E_0}{c} \sin kz \sin \omega t \, \hat{j}$ · Key from source paper

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Q158 JEE Main 2017 · 8 Apr · Online MCQ

Magnetic field in a plane electromagnetic wave is given by, $\vec{B} = B_0 \sin(kx + \omega t)\hat{j}$ T. Expression for corresponding electric field will be: (Where c is speed of light)

(A) $\vec{E} = -B_0 c \sin(kx + \omega t)\hat{k}$ V m^{-1}
(B) $\vec{E} = B_0 c \sin(kx - \omega t)\hat{k}$ V m^{-1}
(C) $\vec{E} = B_0 c \sin(kx + \omega t)\hat{k}$ V m^{-1}
(D) $\vec{E} = \frac{B_0}{c} \sin(kx + \omega t)\hat{k}$ V m^{-1}

Answer: (C) $\vec{E} = B_0 c \sin(kx + \omega t)\hat{k}$ V m^{-1} · Key from source paper

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Q159 JEE Main 2016 · 10 Apr · Online MCQ

Consider an electromagnetic wave propagating in vacuum. Choose the correct statement:

(A) For an electromagnetic wave propagating in $+y$ direction the electric field is $\vec{E} = \frac{1}{\sqrt{2}}E_{yz}(x,t)\hat{z}$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}}B_z(x,t)\hat{y}$

(B) For an electromagnetic wave propagating in + y direction the electric field is $\vec{E} = \frac{1}{\sqrt{2}}E_{yz}(x,t)\hat{y}$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}}B_{\mathrm{yz}}(x,t)\hat{z}$

(C) For an electromagnetic wave propagating in + x direction the electric field is $\vec{E} = \frac{1}{\sqrt{2}}E_{yz}(y,\ z,\ t)\ (\hat{y}+\hat{z})$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}}E_{yz}(y,\ z,\ t)\ (\hat{y}+\hat{z})$

(D) For an electromagnetic wave propagating in + x direction the electric field is $\vec{E} = \frac{1}{\sqrt{2}}E_{yz}(x,t)\ (\hat{y}-\hat{z})$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}}\ B_{yz}(x,\ t)(\hat{y}+\hat{z})$

Answer: (D) For an electromagnetic wave propagating in + x direction the electric field is $\vec{E} = \frac{1}{\sqrt{2}}E_{yz}(x,t)\ (\hat{y}-\hat{z})$ and the magnetic field is $\vec{B} = \frac{1}{\sqrt{2}}\ B_{yz}(x,\ t)(\hat{y}+\hat{z})$ · Key from source paper

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Q160 JEE Main 2016 · 9 Apr · Online MCQ

Microwave oven acts on the principle of:

(A) giving rotational energy to water molecules

(B) giving translational energy to water molecules

(C) giving vibrational energy to water molecules

(D) transferring electrons from lower to higher energy levels in water molecule

Answer: (A) giving rotational energy to water molecules · Checked by our team

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Q161 JEE Main 2016 · 3 Apr · Offline MCQ

Arrange the following electromagnetic radiations per quantum in the order of increasing energy:

A : Blue light

B : Yellow light

C : X-ray

D : Radiowave

(A) C, A, B, D

(B) B, A, D, C

(C) D, B, A, C

(D) A, B, D, C

Answer: (C) D, B, A, C · Key from source paper

Q162 JEE Main 2015 · 11 Apr · Online MCQ

For plane electromagnetic waves propagating in the $+z$-direction, which one of the following combinations gives the correct possible direction for $\vec{E}$ and $\vec{B}$ field respectively?

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(A) $\left(\hat{i}+2\hat{j}\right)$ and $\left(2\hat{i}-\hat{j}\right)$
(B) $\left(-2\hat{i}-3\hat{j}\right)$ and $\left(3\hat{i}-2\hat{j}\right)$
(C) $\left(2\hat{i}+3\hat{j}\right)$ and $\left(\hat{i}+2\hat{j}\right)$
(D) $\left(3\hat{i}+4\hat{j}\right)$ and $\left(4\hat{i}-3\hat{j}\right)$

Answer: (B) $\left(-2\hat{i}-3\hat{j}\right)$ and $\left(3\hat{i}-2\hat{j}\right)$ · Key from source paper

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Q163 JEE Main 2015 · 10 Apr · Online MCQ

An electromagnetic wave travelling in the $x-$ direction has frequency of 2×10^{14} H z and electric field amplitude of $27\ \mathrm{V\,m^{-1}}$ oscillates in $Y-$direction. From the options given below, which one describes the magnetic field for this wave?

(A) $\vec{B}(x,\ t) = \left(9 \times 10^{-8}\ \mathrm{T}\right)\hat{\mathrm{j}}\ \sin\left[1.5 \times 10^{-6}\ x - 2 \times 10^{14}t\right]$
(B) \vec{B}(x,\ t) = \left(9 \times 10^{-8} T\right)\hat{\mathrm{i}}\sin\left[2\pi\left(1.5 \times 10^{-8}\ x - 2 \times 10^{14}
(C) $\vec{B}(x,t) = (3 \times 10^{-8}\mathrm{T})\hat{\mathrm{j}} \sin 2\pi\left[\left(\frac{x}{1.5\times10^{-8}}\right) - 2 \times 10^{14}t\right]$
(D) $\vec{B}(x,t) = (9 \times 10^{-8}\mathrm{T})\hat{\mathrm{k}} \sin 2\pi\left[\left(\frac{x}{1.5\times10^{-6}}\right) - 2 \times 10^{14}t\right]$

Answer: (D) $\vec{B}(x,t) = (9 \times 10^{-8}\mathrm{T})\hat{\mathrm{k}} \sin 2\pi\left[\left(\frac{x}{1.5\times10^{-6}}\right) - 2 \times 10^{14}t\right]$ · Key from source paper

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Q164 JEE Main 2015 · 4 Apr · Offline MCQ

A red LED emits light at 0.1 watt uniformly around it. The amplitude of the electric field of the light at a distance of $1\ \mathrm{m}$ from the diode is:

(A) $7.75\ \mathrm{V\,m^{-1}}$
(B) $1.73\ \mathrm{V\,m^{-1}}$
(C) $2.45\ \mathrm{V\,m^{-1}}$
(D) $5.48\ \mathrm{V\,m^{-1}}$

Answer: (C) $2.45\ \mathrm{V\,m^{-1}}$ · Key from source paper

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Q165 JEE Main 2014 · 19 Apr · Online MCQ

If microwaves, X-rays, infrared, gamma rays, ultraviolet, radio waves and visible parts of the electromagnetic spectrum are denoted respectively by M, X, I, G, U, R and V the following is the arrangement in ascending order of the wavelength

(A) I, M, R, U, V, X and G
(B) R, M, I, V, U, X and G
(C) M, R, V, X, U, G and I
(D) G, X, U, V, I, M and R

Answer: (D) G, X, U, V, I, M and R · Key from source paper

EdLoop JEE

Q166 JEE Main 2014 · 12 Apr · Online MCQ

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

(A) $1.34\ \mathrm{V/m}$
(B) $2.68\ \mathrm{V/m}$
(C) $4.02\ \mathrm{V/m}$
(D) $5.36\ \mathrm{V/m}$

Answer: (B) $2.68\ \mathrm{V/m}$ · Key from source paper

Q167 JEE Main 2014 · 11 Apr · Online MCQ

An electromagnetic wave of frequency 1×10^{14} hertz is propagating along z-axis. The amplitude of electric field is $4\ \mathrm{V/m}$. If $\varepsilon_0 = 8.8 \times 10^{-12}\mathrm{C^2/N-m^2}$, then average energy density of electric field will be:

(A) $35.2 \times 10^{-10}\ \mathrm{J/m^3}$
(B) $35.2 \times 10^{-11}\ \mathrm{J/m^3}$
(C) $35.2 \times 10^{-12}\ \mathrm{J/m^3}$
(D) $35.2 \times 10^{-13}\ \mathrm{J/m^3}$

Answer: (C) $35.2 \times 10^{-12}\ \mathrm{J/m^3}$ · Key from source paper

Q168 JEE Main 2014 · 11 Apr · Online MCQ

Match the List-I (Phenomenon associated with electromagnetic radiation) with List-II (Part of electromagnetic spectrum) and select the correct code from the choices given below this lists:
(see the figure above)

EdLoop JEE

Q28. Match the List-I (Phenomenon associated with electromagnetic radiation) with List-II (Part of electromagnetic spectrum) and select the correct code from the choices given below this lists:

List I		List II	
I	Doublet of sodium	(A)	Visible radiation
II	Wavelength corresponding to temperature associated with the isotropic radiation filling all space	(B)	Microwave
III	Wavelength emitted by atomic hydrogen in interstellar space	(C)	Short radio wave
IV	Wavelength of radiation arising from two close energy levels in hydrogen	(D)	X-rays

(1) (I)-(A), (II)-(B), (III)-(B),,(IV)-(C)
(2) (I)-(A), (II)-(B), (III)-(C), (IV)-(C)
(3) (I)-(D), (II)-(C), (III)-(A), (IV)-(B)
(4) (I)-(B), (II)-(A), (III)-(D), (IV)-(A)

A (I)-(A), (II)-(B), (III)-(B),,(IV)-(C)
B (I)-(A), (II)-(B), (III)-(C), (IV)-(C)
C (I)-(D), (II)-(C), (III)-(A), (IV)-(B)
D (I)-(B), (II)-(A), (III)-(D), (IV)-(A)

Answer: (B) (I)-(A), (II)-(B), (III)-(C), (IV)-(C) · Checked by our team

Q169 JEE Main 2014 · 9 Apr · Online MCQ

Match List I (Wavelength range of electromagnetic spectrum) with List II (Method of production of these waves) and select the **correct** option from the options given below the lists.

List I | List II

(a) 700 nm to 1 mm | (i) Vibration of atoms and molecules.

(b) 1 nm to 400 nm | (ii) Inner shell electrons in atoms moving from one energy level to a lower level.

(c) $< 10^{-3}$ nm | (iii) Radioactive decay of the nucleus.

(d) 1 mm to 0.1 m | (iv) Magnetron valve.

A (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)
B (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)
C (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)
D (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)

Answer: (B) (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv) · Key from source paper

Q170 JEE Main 2014 · 6 Apr · Offline MCQ

During the propagation of electromagnetic wave in a particular medium :-

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

Answer: (C) Electric energy density is equal to the magnetic energy density · Key from source paper

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Q171 JEE Main 2014 · 6 Apr · Offline MCQ

Match List - I (Electromagnetic wave type) with List - II (Its association/application) and select the correct option from the choices given below the lists :

List - I
(a) Infrared waves
(b) Radio waves
(c) X - rays
(d) Ultraviolet rays

List - II
(i) To treat muscular strain
(ii) For broadcasting
(iii) To detect fracture of bones
(iv) Absorbed by the ozone layer of the atmosphere

(A) (a) (iv), (b) (iii), (c) (ii), (d) (i)
(B) (a) (i), (b) (ii), (c) (iv), (d) (iii)
(C) (a) (iii), (b) (ii), (c) (i), (d) (iv)
(D) (a) (i), (b) (ii), (c) (iii), (d) (iv)

Answer: (D) (a) (i), (b) (ii), (c) (iii), (d) (iv) · Key from source paper

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Q172 JEE Main 2013 · 25 Apr · Online MCQ

This question has Statement-1 and Statements2. Of the four choices given after the Statements, choose the one that best describes the two Statements. Statement-1 : Out of radio waves and microwaves, the radio waves undergo more diffraction. Statement-2 : Radio waves have greater frequency compared to microwaves.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is the correct explanation of Statement-1
(B) Statement-1 is false, Statement-2 is true.
(C) Statement-1 is true, Statement-2 is false.
(D) Statement-1 is true, Statement-2 is true but Statement-2 is not the correct explanation of Statement-1

Answer: (C) Statement-1 is true, Statement-2 is false. · Key from source paper

EdLoop JEE

Q173 JEE Main 2013 · 23 Apr · Online MCQ

A parallel plate capacitor of area $60\ \mathrm{cm}^2$ and separation 3 mm is charged initially to $90\mu\mathrm{C}$. If the medium between the plate gets slightly conducting and the plate loses the charge initially at the rate of $2.5 \times 10^{-8}\mathrm{C/s}$, then what is the magnetic field between the plates ?

(A) 2.5×10^{-8} T
(B) 2.0×10^{-7} T
(C) 1.63×10^{-11} T
(D) Zero

Answer: (D) Zero · Key from source paper

Q174 JEE Main 2013 · 23 Apr · Online MCQ

Select the correct statement from the following :

(A) Electromagnetic waves cannot travel in vacuum.
(B) Electromagnetic waves are longitudinal waves.
(C) Electromagnetic waves are produced by charges moving with uniform velocity.
(D) Electromagnetic waves carry both energy and momentum as they propagate through space.

Answer: (D) Electromagnetic waves carry both energy and momentum as they propagate through space. · Key from source paper

Q175 JEE Main 2013 · 22 Apr · Online MCQ

To establish an instantaneous current of $2\ \mathrm{A}$ through a $1\mu\mathrm{F}$ capacitor ; the potential difference across the capacitor plates should be changed at the rate of:

(A) $2 \times 10^4\ \mathrm{V/s}$
(B) $4 \times 10^6\ \mathrm{V/s}$
(C) $2 \times 10^6\ \mathrm{V/s}$
(D) $4 \times 10^4\ \mathrm{V/s}$

Answer: (C) $2 \times 10^6\ \mathrm{V/s}$ · Key from source paper

Q176 JEE Main 2013 · 22 Apr · Online MCQ

A plane electromagnetic wave in a non-magnetic dielectric medium is given by $\vec{E} = \vec{E}_0\left(4 \times 10^{-7}x - 50t\right)$ with distance being in meter and time in seconds. The dielectric constant of the medium is :

(A) 2.4
(B) 5.8
(C) 8.2
(D) 4.8

Answer: (B) 5.8 · Key from source paper

Q177 JEE Main 2013 · 9 Apr · Online MCQ

Photons of an electromagnetic radiation has an energy 11keV each. To which region of electromagnetic spectrum does it belong ?

(A) X-ray region
(B) Ultra violet region
(C) Infrared region
(D) Visible region

Answer: (A) X-ray region · Key from source paper

Q178 JEE Main 2013 · 7 Apr · Offline MCQ

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

(A) $9\ \mathrm{V\ m^{-1}}$
(B) $12\ \mathrm{V\ m^{-1}}$
(C) $3\ \mathrm{V\ m^{-1}}$
(D) $6\ \mathrm{V\ m^{-1}}$

Answer: (D) $6\ \mathrm{V\ m^{-1}}$ · Key from source paper

Q179 AIEEE 2012 · 26 May · Online MCQ

A radio transmitter transmits at 830kHz. At a certain distance from the transmitter magnetic field has amplitude 4.82×10^{-11} T. The electric field and the wavelength are respectively

(A) 0.014 N/C, 36 m
(B) 0.14 N/C, 36 m
(C) 0.14 N/C, 360 m
(D) 0.014 N/C, 360 m

Answer: (D) 0.014 N/C, 360 m · Key from source paper

Q180 AIEEE 2012 · 26 May · Online MCQ

The frequency of X-rays; γ-rays and ultraviolet rays are respectively a, b and c then

(A) $a < b; b > c$
(B) $a > b; b > c$
(C) $a < b < c$
(D) $a = b = c$

Answer: (A) $a < b; b > c$ · Key from source paper

Q181 AIEEE 2012 · 19 May · Online MCQ

An electromagnetic wave with frequency ω and wavelength λ travels in the $+y$ direction. Its magnetic field is along $+x$-axis. The vector equation for the associated electric field (of amplitude E_0) is

(A) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right) \hat{x}$
(B) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right) \hat{x}$
(C) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right) \hat{z}$
(D) $\vec{E} = -E_0 \cos\left(\omega t + \frac{2\pi}{\lambda} y\right) \hat{z}$

Answer: (C) $\vec{E} = E_0 \cos\left(\omega t - \frac{2\pi}{\lambda} y\right) \hat{z}$ · Key from source paper

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Q182 AIEEE 2012 · Offline MCQ

An electromagnetic wave in vacuum has the electric and magnetic fields $\vec{E}$ and $\vec{B}$, which are always perpendicular to each other. The direction of polarization is given by $\vec{X}$ and that of wave propagation by $\vec{k}$. Then :

(A) $\vec{X} \parallel \vec{B}$ and $\vec{k} \parallel \vec{B} \times \vec{E}$
(B) $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$
(C) $\vec{X} \parallel \vec{B}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$
(D) $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{B} \times \vec{E}$

Answer: (B) $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$ · Checked by our team

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Q183 AIEEE 2006 MCQ

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) $3.3 \times 10^{-3}\ \mathrm{J/m^3}$
(B) $4.58 \times 10^{-6}\ \mathrm{J/m^3}$
(C) $6.37 \times 10^{-9}\ \mathrm{J/m^3}$
(D) $81.35 \times 10^{-12}\ \mathrm{J/m^3}$

Answer: (B) $4.58 \times 10^{-6}\ \mathrm{J/m^3}$ · Key from source paper

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Q184 AIEEE 2004 MCQ

An electromagnetic wave of frequency v = 3.0MHz passes from vacuum into a dielectric medium with permittivity ε = 4.0. Then

(A) wavelength is doubled and the frequency remains unchanged
(B) wavelength is doubled and frequency becomes half
(C) wavelength is halved and frequency remains unchanged
(D) wavelength and frequency both remain unchanged.

Answer: (C) wavelength is halved and frequency remains unchanged · Key from source paper

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Q185 AIEEE 2004 MCQ

A radiation of energy E falls normally on a perfectly reflecting surface. The momentum transferred to the surface is

(A) E/c
(B) 2E/c
(C) Ec
(D) $\mathrm{E/c^2}$

Answer: (B) 2E/c · Key from source paper

Q186 AIEEE 2003 MCQ

Which of the following radiations has the least wavelength?

(A) γ-rays
(B) β-rays
(C) α-rays
(D) X-rays

Answer: (A) γ-rays · Key from source paper

Q187 AIEEE 2002 MCQ

Electromagnetic waves are transverse in nature is evident by

(A) polarization
(B) interference
(C) reflection
(D) diffraction

Answer: (A) polarization · Key from source paper

Q188 AIEEE 2002 MCQ

Infra red radiation is detected by

(A) spectrometer
(B) pyrometer
(C) nanometer
(D) photometer

Answer: (B) pyrometer · Key from source paper

Q189 AIEEE 2002 MCQ

Which of the following are not electromagnetic waves?

(A) cosmic rays
(B) gamma rays
(C) β-rays
(D) X- rays

Answer: (C) β-rays · Key from source paper

EdLoop JEE