

PHYSICS · JEE MAIN

Electromagnetic Waves

Chapter-wise previous year questions, with answer key

101

PYQS

2020–2025

PAPERS

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TOPICS

Maxwell's Equations

Properties of EM Waves

EM Spectrum

Displacement Current

Electromagnetic Spectrum

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

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Maxwell's Equations · 2 PYQs

Q1 JEE Main 2023 · 13 Apr · Shift 1

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

[Step-by-step solution ► prepwiser.in/questions/tfTqeBEswp](https://www.prepwiser.in/questions/tfTqeBEswp)

Q2 JEE Main 2023 · 13 Apr · Shift 1

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

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

[Step-by-step solution ► prepwiser.in/questions/YVL-3LjxY7](https://www.prepwiser.in/questions/YVL-3LjxY7)

Properties of EM Waves · 84 PYQs

Q3 JEE Main 2025 · 7 Apr · Shift 2

The unit of $\sqrt{\frac{2I}{\epsilon_0 c}}$ is :

(I = intensity of an electromagnetic wave, c = speed of light)

- (A) Vm
- (B) NC⁻¹
- (C) NC
- (D) Nm

[Step-by-step solution ► prepwiser.in/questions/T57EIWonL4](https://www.prepwiser.in/questions/T57EIWonL4)

Q4 JEE Main 2025 · 4 Apr · Shift 2

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.

$$(\mu_0 = 4\pi \times 10^{-7} \text{H/m}, \epsilon_0 = 8.85 \times 10^{-12} \text{F/m}, c = 3 \times 10^8 \text{m/s})$$

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/YIqpuHISS3](https://www.prepwiser.in/questions/YIqpuHISS3)

Q5 JEE Main 2025 · 3 Apr · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/U-dE9jAbbF](https://www.prepwisar.in/questions/U-dE9jAbbF)

Q6 JEE Main 2025 · 2 Apr · Shift 1

A light wave is propagating with plane wave fronts of the type $x + y + z = \text{constant}$. The angle made by the direction of wave propagation with the x -axis is :

- (A) $\cos^{-1}(2/3)$
(B) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(C) $\cos^{-1}\left(\frac{1}{3}\right)$
(D) $\cos^{-1}\left(\sqrt{\frac{2}{3}}\right)$

Step-by-step solution ► [prepwisar.in/questions/hFdIelgHa2](https://www.prepwisar.in/questions/hFdIelgHa2)

Q7 JEE Main 2025 · 29 Jan · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/QyuGodxL3r](https://www.prepwisar.in/questions/QyuGodxL3r)

Q8 JEE Main 2025 · 28 Jan · Shift 1

Due to presence of an em-wave whose electric component is given by $E = 100 \sin(\omega t - kx) \text{NC}^{-1}$ 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) $50 \sin(\omega t - kx) \text{NC}^{-1}$
(B) $400 \sin(\omega t - kx) \text{NC}^{-1}$
(C) $200 \sin(\omega t - kx) \text{NC}^{-1}$
(D) $25 \sin(\omega t - kx) \text{NC}^{-1}$

Step-by-step solution ► [prepwisar.in/questions/0dcEIuq0KR](https://www.prepwisar.in/questions/0dcEIuq0KR)

Q9 JEE Main 2025 · 28 Jan · Shift 2

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

The corresponding electric field in S.I. units is:

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

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

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

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

[Step-by-step solution ► prepwiser.in/questions/WOuHczuDRn](https://www.prepwiser.in/questions/WOuHczuDRn)

Q10 JEE Main 2025 · 23 Jan · Shift 1

The electric field of an electromagnetic wave in free space is $\vec{E} =$

$57 \cos [7.5 \times 10^6 t - 5 \times 10^{-3}(3x + 4y)] (4\hat{i} - 3\hat{j}) N/C$. The associated magnetic field in Tesla is

(A) $\vec{B} = \frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3}(3x + 4y)] (\hat{k})$

(B) $\vec{B} = \frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3}(3x + 4y)] (5\hat{k})$

(C) $\vec{B} = -\frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3}(3x + 4y)] (\hat{k})$

(D) $\vec{B} = -\frac{57}{3 \times 10^8} \cos [7.5 \times 10^6 t - 5 \times 10^{-3}(3x + 4y)] (5\hat{k})$

[Step-by-step solution ► prepwiser.in/questions/vfRVGJKc9T](https://www.prepwiser.in/questions/vfRVGJKc9T)

Q11 JEE Main 2025 · 23 Jan · Shift 2

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 $E_y = 9.3 \text{ Vm}^{-1}$. Then, the magnetic field vector of the wave at that point is

(A) $B_z = 1.55 \times 10^{-8} \text{ T}$

(B) $B_z = 6.2 \times 10^{-8} \text{ T}$

(C) $B_z = 3.1 \times 10^{-8} \text{ T}$

(D) $B_z = 9.3 \times 10^{-8} \text{ T}$

[Step-by-step solution ► prepwiser.in/questions/DaQx7j1Y_S](https://www.prepwiser.in/questions/DaQx7j1Y_S)

The magnetic field in a plane electromagnetic wave is

$$B_y = (3.5 \times 10^{-7}) \sin (1.5 \times 10^3 x + 0.5 \times 10^{11} t) \text{ T}$$

. The corresponding electric field will be :

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

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

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

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

Step-by-step solution ► [prepwisar.in/questions/VjvJEc6Nak](https://www.prepwisar.in/questions/VjvJEc6Nak)

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

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

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

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

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

Step-by-step solution ► [prepwisar.in/questions/oCW2W27qYR](https://www.prepwisar.in/questions/oCW2W27qYR)

Average force exerted on a non-reflecting surface at normal incidence is $2.4 \times 10^{-4} \text{ N}$. 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) 20m^2

(B) 0.2m^2

(C) 0.1m^2

(D) 0.02m^2

Step-by-step solution ► [prepwisar.in/questions/0j8fA2nB5B](https://www.prepwisar.in/questions/0j8fA2nB5B)

Q15 JEE Main 2024 · 6 Apr · Shift 2

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

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

Step-by-step solution ► [prepwiser.in/questions/w63x3Vfuxj](https://www.prepwiser.in/questions/w63x3Vfuxj)

Q16 JEE Main 2024 · 6 Apr · Shift 1

Electromagnetic waves travel in a medium with speed of $1.5 \times 10^8 \text{ms}^{-1}$. The relative permeability of the medium is 2.0. The relative permittivity will be:

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

Step-by-step solution ► [prepwiser.in/questions/Uv3ZSfKFPz](https://www.prepwiser.in/questions/Uv3ZSfKFPz)

Q17 JEE Main 2024 · 4 Apr · Shift 1

The electric field in an electromagnetic wave is given by

$$\vec{E} = \hat{i}40 \cos \omega(t - z/c) \text{NC}^{-1}$$

. The magnetic field induction of this wave is (in SI unit) :

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

Step-by-step solution ► [prepwiser.in/questions/ZkhbG359PN](https://www.prepwiser.in/questions/ZkhbG359PN)

Q18 JEE Main 2024 · 1 Feb · Shift 2

If frequency of electromagnetic wave is 60MHz 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) 5
(C) 10 (D) 2

Step-by-step solution ► [prepwiser.in/questions/LYWr9IEsaT](https://www.prepwiser.in/questions/LYWr9IEsaT)

Q19 JEE Main 2024 · 31 Jan · Shift 2

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) Statement I is correct but Statement II is incorrect.
- (D) Both Statement I and Statement II are incorrect.

[Step-by-step solution ► prepwiser.in/questions/EaQ1Q3vtAZ](https://www.prepwiser.in/questions/EaQ1Q3vtAZ)

Q20 JEE Main 2024 · 31 Jan · Shift 1

In a plane EM wave, the electric field oscillates sinusoidally at a frequency of $5 \times 10^{10} \text{ Hz}$ and an amplitude of 50 Vm^{-1} . The total average energy density of the electromagnetic field of the wave is : [Use $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$]

- (A) $4.425 \times 10^{-8} \text{ Jm}^{-3}$
- (B) $2.212 \times 10^{-10} \text{ Jm}^{-3}$
- (C) $2.212 \times 10^{-8} \text{ Jm}^{-3}$
- (D) $1.106 \times 10^{-8} \text{ Jm}^{-3}$

[Step-by-step solution ► prepwiser.in/questions/cUllt_2GzM](https://www.prepwiser.in/questions/cUllt_2GzM)

Q21 JEE Main 2024 · 30 Jan · Shift 1

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

[Step-by-step solution ► prepwiser.in/questions/LWTmk2BDHf](https://www.prepwiser.in/questions/LWTmk2BDHf)

Q22 JEE Main 2024 · 30 Jan · Shift 2

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

- (A) $2.16 \times 10^{-3} \text{ kgm/s}$
- (B) $2.46 \times 10^{-3} \text{ kgm/s}$
- (C) $1.58 \times 10^{-3} \text{ kgm/s}$
- (D) $4.32 \times 10^{-3} \text{ kgm/s}$

Step-by-step solution ► [prepwiser.in/questions/qoVn3FytBW](https://www.prepwiser.in/questions/qoVn3FytBW)

Q23 JEE Main 2024 · 29 Jan · Shift 2

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

- (A) $9.6\hat{j}T$
- (B) $3.2 \times 10^{-8}\hat{i}T$
- (C) $9.6 \times 10^{-8}\hat{k}T$
- (D) $3.2 \times 10^{-8}\hat{k}T$

Step-by-step solution ► [prepwiser.in/questions/ottk160HCG](https://www.prepwiser.in/questions/ottk160HCG)

Q24 JEE Main 2024 · 27 Jan · Shift 1

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

$$E_y = (200 \text{ Vm}^{-1}) \sin [1.5 \times 10^7 t - 0.05x] ;$$

The intensity of the wave is :

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

- (A) 35.4 Wm^{-2}
- (B) 53.1 Wm^{-2}
- (C) 26.6 Wm^{-2}
- (D) 106.2 Wm^{-2}

Step-by-step solution ► [prepwiser.in/questions/8KM1s1iHzn](https://www.prepwiser.in/questions/8KM1s1iHzn)

Q25 JEE Main 2024 · 27 Jan · Shift 2

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

- (A) 6 Nm^{-2}
- (B) 36 Nm^{-2}
- (C) 18 Nm^{-2}
- (D) 2 Nm^{-2}

Step-by-step solution ► [prepwiser.in/questions/pChij--ruf](https://www.prepwiser.in/questions/pChij--ruf)

Q26 JEE Main 2023 · 13 Apr · Shift 2

In an electromagnetic wave, at an instant and at 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) at 45° angle from positive y -axis
- (B) positive y -axis
- (C) negative y -axis
- (D) positive z -axis

Step-by-step solution ► [prepwiser.in/questions/WqIIadt1Yj](https://www.prepwiser.in/questions/WqIIadt1Yj)

Q27 JEE Main 2023 · 11 Apr · Shift 1

The electric field in an electromagnetic wave is given as

$$\vec{E} = 20 \sin \omega \left(t - \frac{x}{c} \right) \vec{j} \text{ NC}^{-1}$$

where ω and c are angular frequency and velocity of electromagnetic wave respectively. The energy contained in a volume of $5 \times 10^{-4} \text{ m}^3$ will be

(Given $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$)

(A) $17 \cdot 7 \times 10^{-13} \text{ J}$

(B) $28 \cdot 5 \times 10^{-13} \text{ J}$

(C) $8 \cdot 85 \times 10^{-13} \text{ J}$

(D) $88 \cdot 5 \times 10^{-13} \text{ J}$

[Step-by-step solution ► prepwiser.in/questions/ZP_iZYBO5U](https://www.prepwiser.in/questions/ZP_iZYBO5U)

Q28 JEE Main 2023 · 11 Apr · Shift 2

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

(A) $-2.2 \times 10^{-8} \hat{i} \text{ T}$

(B) $2.2 \times 10^{-8} \hat{i} \text{ T}$

(C) $2.2 \times 10^{-8} \hat{k} \text{ T}$

(D) $-2.2 \times 10^{-8} \hat{k} \text{ T}$

[Step-by-step solution ► prepwiser.in/questions/grAI9rDnRQ](https://www.prepwiser.in/questions/grAI9rDnRQ)

Q29 JEE Main 2023 · 10 Apr · Shift 1

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

[Step-by-step solution ► prepwiser.in/questions/m7UxjWiEAg](https://www.prepwiser.in/questions/m7UxjWiEAg)

Q30 JEE Main 2023 · 10 Apr · Shift 2

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

(A) $6.0 \times 10^{-7} \text{ Vm}^{-1}$

(B) $5 \times 10^{14} \text{ Vm}^{-1}$

(C) 180 Vm^{-1}

(D) $2 \times 10^{15} \text{ Vm}^{-1}$

[Step-by-step solution ► prepwiser.in/questions/VH7UI86kji](https://www.prepwiser.in/questions/VH7UI86kji)

Q31 JEE Main 2023 · 6 Apr · Shift 2

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) $U_E = \frac{\epsilon_0 E^2}{2}, U_B = \frac{B^2}{2\mu_0}$

(B) $U_E = \frac{E^2}{2\epsilon_0}, U_B = \frac{\mu_0 B^2}{2}$

(C) $U_E = \frac{\epsilon_0 E^2}{2}, U_B = \frac{\mu_0 B^2}{2}$

(D) $U_E = \frac{E^2}{2\epsilon_0}, U_B = \frac{B^2}{2\mu_0}$

[Step-by-step solution ► prepwiser.in/questions/2Gff6UFxQB](https://www.prepwiser.in/questions/2Gff6UFxQB)

Q32 JEE Main 2023 · 6 Apr · Shift 1

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

[Step-by-step solution ► prepwisser.in/questions/hDgZiSPq_S](https://www.prepwisser.in/questions/hDgZiSPq_S)

Q33 JEE Main 2023 · 1 Feb · Shift 2

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

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

[Step-by-step solution ► prepwisser.in/questions/O4GVd7YzSe](https://www.prepwisser.in/questions/O4GVd7YzSe)

Q34 JEE Main 2023 · 31 Jan · Shift 1

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 $= 3 \times 10^8 \text{ ms}^{-1}$ and for the given medium $\mu_r = 1$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/fiEJje1DHI](https://www.prepwisser.in/questions/fiEJje1DHI)

Q35 JEE Main 2023 · 29 Jan · Shift 1

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 options given below:

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

[Step-by-step solution ► prepwisser.in/questions/dq2mD8qc3R](https://www.prepwisser.in/questions/dq2mD8qc3R)

Q36 JEE Main 2023 · 29 Jan · Shift 2

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 $E_0 = \sqrt{\frac{\mu_0}{\epsilon_0}} B_0$.

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

[Step-by-step solution ► prepwisser.in/questions/AdBJgeMdn1](https://www.prepwisser.in/questions/AdBJgeMdn1)

Q37 JEE Main 2023 · 25 Jan · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/ZzDFAYB6kt](https://www.prepwisar.in/questions/ZzDFAYB6kt)

Q38 JEE Main 2023 · 24 Jan · Shift 1

In $\vec{E}$ 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) $\vec{K} \times \vec{E}$
(C) $\omega (\vec{K} \times \vec{E})$
(D) $\omega (\vec{E} \times \vec{K})$

Step-by-step solution ► [prepwisar.in/questions/WsA7QfKm4o](https://www.prepwisar.in/questions/WsA7QfKm4o)

Q39 JEE Main 2023 · 24 Jan · Shift 2

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) $\omega E_0 = kB_0$

Step-by-step solution ► [prepwisar.in/questions/KgQaIS6AQS](https://www.prepwisar.in/questions/KgQaIS6AQS)

Q40 JEE Main 2022 · 28 Jul · Shift 2

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

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

Step-by-step solution ► [prepwisar.in/questions/JSDs8tG-3g](https://www.prepwisar.in/questions/JSDs8tG-3g)

Q41 JEE Main 2022 · 27 Jul · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/P8_1smlP7u](https://www.prepwisser.in/questions/P8_1smlP7u)

Q42 JEE Main 2022 · 27 Jul · Shift 1

A beam of light travelling along X -axis is described by the electric field $E_y = 900 \sin \omega(t - x/c)$. The ratio of electric force to magnetic force on a charge q moving along Y -axis with a speed of $3 \times 10^7 \text{ ms}^{-1}$ will be :

(Given speed of light = $3 \times 10^8 \text{ ms}^{-1}$)

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

[Step-by-step solution ► prepwisser.in/questions/ryrW6Q2L5r](https://www.prepwisser.in/questions/ryrW6Q2L5r)

Q43 JEE Main 2022 · 26 Jul · Shift 2

The oscillating magnetic field in a plane electromagnetic wave is given by

$B_y = 5 \times 10^{-6} \sin 1000\pi (5x - 4 \times 10^8 t) \text{ T}$. The amplitude of electric field will be :

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

[Step-by-step solution ► prepwisser.in/questions/KDkV8628I0](https://www.prepwisser.in/questions/KDkV8628I0)

Q44 JEE Main 2022 · 26 Jul · Shift 1

The magnetic field of a plane electromagnetic wave is given by :

$$\vec{B} = 2 \times 10^{-8} \sin (0.5 \times 10^3 x + 1.5 \times 10^{11} t) \hat{j} \text{ T}$$

The amplitude of the electric field would be :

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

[Step-by-step solution ► prepwiser.in/questions/FzEEwwz_d](https://www.prepwiser.in/questions/FzEEwwz_d)

Q45 JEE Main 2022 · 25 Jul · Shift 2

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

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

[Step-by-step solution ► prepwiser.in/questions/yOA93SGNhu](https://www.prepwiser.in/questions/yOA93SGNhu)

Q46 JEE Main 2022 · 30 Jun · Shift 1

An expression for oscillating electric field in a plane electromagnetic wave is given as $E_z = 300 \sin(5\pi \times 10^3 x - 3\pi \times 10^{11} t) \text{ Vm}^{-1}$

Then, the value of magnetic field amplitude will be :

(Given : speed of light in Vacuum $c = 3 \times 10^8 \text{ ms}^{-1}$)

- (A) $1 \times 10^{-6} \text{ T}$
- (B) $5 \times 10^{-6} \text{ T}$
- (C) $18 \times 10^9 \text{ T}$
- (D) $21 \times 10^9 \text{ T}$

[Step-by-step solution ► prepwiser.in/questions/HFwO5tZj5i](https://www.prepwiser.in/questions/HFwO5tZj5i)

Q47 JEE Main 2022 · 29 Jun · Shift 1

The intensity of the light from a bulb incident on a surface is 0.22 W/m^2 . The amplitude of the magnetic field in this light-wave is _____ $\times 10^{-9} \text{ T}$.

(Given : Permittivity of vacuum $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$, speed of light in vacuum $c = 3 \times 10^8 \text{ ms}^{-1}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/qFOs1xZVT-](https://www.prepwiser.in/questions/qFOs1xZVT-)

A radar sends an electromagnetic signal of electric field (E_0) = 2.25 V/m and magnetic field (B_0) = 1.5×10^{-8} T which strikes a target on line of sight at a distance of 3 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

Step-by-step solution ► [prepwiser.in/questions/KDGSd4yC5](https://www.prepwiser.in/questions/KDGSd4yC5)

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

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

Step-by-step solution ► [prepwiser.in/questions/XW0z4_egKs](https://www.prepwiser.in/questions/XW0z4_egKs)

Q50 JEE Main 2022 · 27 Jun · Shift 2

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

[Step-by-step solution ► prepwisser.in/questions/gzgNGjUYgo](https://www.prepwisser.in/questions/gzgNGjUYgo)

Q51 JEE Main 2022 · 26 Jun · Shift 1

If Electric field intensity of a uniform plane electromagnetic wave is given as

$$E = -301.6 \sin(kz - \omega t) \hat{a}_x + 452.4 \sin(kz - \omega t) \hat{a}_y \frac{V}{m}$$

. Then magnetic intensity 'H' of this wave in Am^{-1} will be :

[Given : Speed of light in vacuum $c = 3 \times 10^8 \text{ ms}^{-1}$, Permeability of vacuum $\mu_0 = 4\pi \times 10^{-7} \text{ NA}^{-2}$]

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

[Step-by-step solution ► prepwisser.in/questions/O4epxB73av](https://www.prepwisser.in/questions/O4epxB73av)

Q52 JEE Main 2022 · 25 Jun · Shift 1

The electric field in an electromagnetic wave is given by $E = 56.5 \sin \omega(t - x/c) \text{ NC}^{-1}$. 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 Wm^{-2}
- (B) 4.24 Wm^{-2}
- (C) $1.9 \times 10^{-7} \text{ Wm}^{-2}$
- (D) 56.5 Wm^{-2}

[Step-by-step solution ► prepwisser.in/questions/px2tMk4TBf](https://www.prepwisser.in/questions/px2tMk4TBf)

Q53 JEE Main 2022 · 25 Jun · Shift 2

The electromagnetic waves travel in a medium at a speed of 2.0×10^8 m/s. 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

[Step-by-step solution ► prepwiser.in/questions/oFMEDNiu7r](https://www.prepwiser.in/questions/oFMEDNiu7r)

Q54 JEE Main 2022 · 24 Jun · Shift 1

A plane electromagnetic wave travels in a medium of relative permeability 1.61 and relative permittivity 6.44. If magnitude of magnetic intensity is 4.5×10^{-2} Am⁻¹ at a point, what will be the approximate magnitude of electric field intensity at that point?

(Given : Permeability of free space $\mu_0 = 4\pi \times 10^{-7}$ NA⁻², speed of light in vacuum $c = 3 \times 10^8$ ms⁻¹)

- (A) 16.96 Vm⁻¹
(B) 2.25×10^{-2} Vm⁻¹
(C) 8.48 Vm⁻¹
(D) 6.75×10^6 Vm⁻¹

[Step-by-step solution ► prepwiser.in/questions/IPc4IwfG0W](https://www.prepwiser.in/questions/IPc4IwfG0W)

Q55 JEE Main 2022 · 24 Jun · Shift 2

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

- (A) 1.19×10^{-8} T
(B) 1.71×10^{-8} T
(C) 0.84×10^{-8} T
(D) 3.36×10^{-8} T

[Step-by-step solution ► prepwiser.in/questions/_grwaFzRg1](https://www.prepwiser.in/questions/_grwaFzRg1)

Q56 JEE Main 2021 · 1 Sep · Shift 2

Electric field of plane electromagnetic wave propagating through a non-magnetic medium is given by

$E = 20\cos(2 \times 10^{10} t - 200x)$ V/m. The dielectric constant of the medium is equal to : (Take $\mu_r = 1$)

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

[Step-by-step solution ► prepwiser.in/questions/ITLek3G4OU](https://www.prepwiser.in/questions/ITLek3G4OU)

Q57 JEE Main 2021 · 31 Aug · Shift 1

The electric field in an electromagnetic wave is given by $E = (50 \text{ NC}^{-1}) \sin \omega (t - x/c)$

The energy contained in a cylinder of volume V is 5.5×10^{-12} J. The value of V is _____ cm³. (given $\epsilon_0 = 8.8 \times 10^{-12} \text{ C}^2 \text{N}^{-1} \text{m}^{-2}$)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/-VsFM6iN7m](https://www.prepwiser.in/questions/-VsFM6iN7m)

Q58 JEE Main 2021 · 31 Aug · Shift 2

The magnetic field vector of an electromagnetic wave is given by $B = B_0 \frac{\hat{i} + \hat{j}}{\sqrt{2}} \cos(kz - \omega t)$; 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 $0.5 c \hat{i}$, (where c is the velocity of light). The ratio of the force acting on charge q_1 to q_2 is :-

(A) $2\sqrt{2} : 1$

(B) $1 : \sqrt{2}$

(C) $2 : 1$

(D) $\sqrt{2} : 1$

[Step-by-step solution ► prepwisar.in/questions/RAFZETLkPf](https://www.prepwisar.in/questions/RAFZETLkPf)

Q59 JEE Main 2021 · 27 Aug · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/cn6Pig2K5K](https://www.prepwisar.in/questions/cn6Pig2K5K)

Q60 JEE Main 2021 · 27 Aug · Shift 1

Electric field in a plane electromagnetic wave is given by $E = 50 \sin(500x - 10 \times 10^{10} t)$ V/m The velocity of electromagnetic wave in this medium is :

(Given C = speed of light in vacuum)

(A) $\frac{3}{2} C$

(B) C

(C) $\frac{2}{3} C$

(D) $\frac{C}{2}$

[Step-by-step solution ► prepwisar.in/questions/8waz8wCsUP](https://www.prepwisar.in/questions/8waz8wCsUP)

Q61 JEE Main 2021 · 26 Aug · Shift 1

The electric field in a plane electromagnetic wave is given by

$$\vec{E} = 200 \cos \left[\left(\frac{0.5 \times 10^3}{m} \right) x - \left(1.5 \times 10^{11} \frac{rad}{s} \times t \right) \right] \frac{V}{m} \hat{j}$$

. If this wave falls normally on a perfectly reflecting surface having an area of 100 cm^2 . If the radiation pressure exerted by the E.M. wave on the surface during a 10 minute exposure is $\frac{x}{10^9} \frac{N}{m^2}$. Find the value of x .

Numerical answer — enter the value.

[Step-by-step solution ► prepwisar.in/questions/8TQIUCNnWC](https://www.prepwisar.in/questions/8TQIUCNnWC)

Q62 JEE Main 2021 · 26 Aug · Shift 2

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 $3 \times 10^7 \text{ ms}^{-1}$. What is the maximum magnetic force exerted on the electron?

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

[Step-by-step solution ► prepwisser.in/questions/X6lhvJeek3](https://www.prepwisser.in/questions/X6lhvJeek3)

Q63 JEE Main 2021 · 27 Jul · Shift 1

The relative permittivity of distilled water is 81. The velocity of light in it will be :

(Given $\mu_r = 1$)

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

[Step-by-step solution ► prepwisser.in/questions/j2JZxtnOJq](https://www.prepwisser.in/questions/j2JZxtnOJq)

Q64 JEE Main 2021 · 25 Jul · Shift 1

A linearly polarized electromagnetic wave in vacuum is

$$E = 3.1 \cos [(1.8)z - (5.4 \times 10^6)t] \hat{i} \text{ N/C}$$

is incident normally on a perfectly reflecting wall at $z = a$. Choose the correct option

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

[Step-by-step solution ► prepwisser.in/questions/n7G1IGI5A-](https://www.prepwisser.in/questions/n7G1IGI5A-)

Q65 JEE Main 2021 · 22 Jul · Shift 2

Intensity of sunlight is observed as 0.092 Wm^{-2} at a point in free space. What will be the peak value of magnetic field at the point?

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

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

[Step-by-step solution ► prepwisser.in/questions/mNErvhWHFI](https://www.prepwisser.in/questions/mNErvhWHFI)

Q66 JEE Main 2021 · 20 Jul · Shift 2

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

- (A) $(\hat{k})$ (B) $\hat{j}$
(C) $(-\hat{k})$ (D) $(-\hat{j})$

Step-by-step solution ► [prepwisser.in/questions/7x-9t3qwMQ](https://www.prepwisser.in/questions/7x-9t3qwMQ)

Q67 JEE Main 2021 · 18 Mar · Shift 1

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

- (A) $0.6 \hat{j} \text{ V/m}$ (B) $6.0 \hat{k} \text{ V/m}$
(C) $6.0 \hat{j} \text{ V/m}$ (D) $0.6 \hat{k} \text{ V/m}$

Step-by-step solution ► [prepwisser.in/questions/IYZ3QZ0-Yp](https://www.prepwisser.in/questions/IYZ3QZ0-Yp)

Q68 JEE Main 2021 · 17 Mar · Shift 1

If $2.5 \times 10^{-6} \text{ N}$ average force is exerted by a light wave on a non-reflecting surface of 30 cm^2 area during 40 minutes of time span, the energy flux of light just before it falls on the surface is _____ W/cm^2 . (Round off to the Nearest Integer)

(Assume complete absorption and normal incidence conditions are there)

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/UO0ETcG6ub](https://www.prepwisser.in/questions/UO0ETcG6ub)

Q69 JEE Main 2021 · 17 Mar · Shift 2

The electric field intensity 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 60W at the same distance is $\sqrt{\frac{x}{5}} E$. Where the value of x = _____.

Numerical answer — enter the value.

Step-by-step solution ► [prepwisser.in/questions/wus2pX_Bnp](https://www.prepwisser.in/questions/wus2pX_Bnp)

Q70 JEE Main 2021 · 16 Mar · Shift 1

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) $U_e \neq U_m$
(C) $U_e < U_m$
(D) $U_e > U_m$

Step-by-step solution ► [prepwisser.in/questions/IzhzF6G4Ej](https://www.prepwisser.in/questions/IzhzF6G4Ej)

Q71 JEE Main 2021 · 16 Mar · Shift 1

A plane electromagnetic wave of frequency 500 MHz is travelling in vacuum along y-direction. At a particular point in space and time,

$\vec{B} = 8.0 \times 10^{-8} \hat{z} \text{ T}$. The value of 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 directions.

(A) $2.6 \hat{x} \text{ V/m}$

(B) $-24 \hat{x} \text{ V/m}$

(C) $24 \hat{x} \text{ V/m}$

(D) $-2.6 \hat{y} \text{ V/m}$

[Step-by-step solution ► prepwisser.in/questions/AUq3cDy5xC](https://www.prepwisser.in/questions/AUq3cDy5xC)

Q72 JEE Main 2021 · 26 Feb · Shift 1

A radiation is emitted by 1000W bulb and it generates an electric field and magnetic field at P, placed at a distance of 2m. The efficiency of the bulb is 1.25%. The value of peak electric field at P is $x \times 10^{-1} \text{ V/m}$.

Value of x is _____. (Rounded off to the nearest integer) [Take $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2\text{N}^{-1} \text{ m}^{-2}$, $c = 3 \times 10^8 \text{ ms}^{-1}$]

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/L8iZ8S0OAg](https://www.prepwisser.in/questions/L8iZ8S0OAg)

Q73 JEE Main 2021 · 25 Feb · Shift 2

The peak electric field produced by the radiation coming from the 8W bulb at a distance of 10 m is

$\frac{x}{10} \sqrt{\frac{\mu_0 c}{\pi}} \frac{\text{V}}{\text{m}}$. The efficiency of the bulb is 10% and it is a point source. The value of x is _____.

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/u4uEF03C xv](https://www.prepwisser.in/questions/u4uEF03C xv)

Q74 JEE Main 2021 · 24 Feb · Shift 1

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/kjFpyj0aFi](https://www.prepwisser.in/questions/kjFpyj0aFi)

Q75 JEE Main 2021 · 24 Feb · Shift 2

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

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/S18GdfUehQ](https://www.prepwisser.in/questions/S18GdfUehQ)

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

$$\vec{B}(x, t) =$$

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

T

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

(speed of light $c = 3 \times 10^8 \text{ ms}^{-1}$)

(A) $\vec{E}(x, t) = [36 \sin (1 \times 10^3 x + 1.5 \times 10^{11} t) \hat{i}]$

$$\frac{V}{m}$$

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

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

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

Step-by-step solution ► [prepwiser.in/questions/vmnnSzz3-N](https://www.prepwiser.in/questions/vmnnSzz3-N)

Suppose that intensity of a laser is $\frac{315}{\pi} \text{ W/m}^2$.

The rms electric field, in units of V/m associated with this source is close to the nearest integer is _____.

$$\epsilon_0 = 8.86 \times 10^{-12} \text{ C}^2 \text{ Nm}^{-2}; c = 3 \times 10^8 \text{ ms}^{-1})$$

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/GRP2ZNR3I7](https://www.prepwiser.in/questions/GRP2ZNR3I7)

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

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

Step-by-step solution ► [prepwiser.in/questions/soqNOOG0Hy](https://www.prepwiser.in/questions/soqNOOG0Hy)

The magnetic field of a plane electromagnetic wave is

$$\vec{B} = 3 \times 10^{-8} \sin[200\pi(y + ct)] \hat{i}$$

T

where $c = 3 \times 10^8 \text{ ms}^{-1}$ is the speed of light. The corresponding electric field is :

(A) $\vec{E} = -10^{-6} \sin[200\pi(y + ct)] \hat{k}$

V/m

(B) $\vec{E} = -9 \sin[200\pi(y + ct)] \hat{k}$

V/m

(C) $\vec{E} = 9 \sin[200\pi(y + ct)] \hat{k}$

V/m

(D) $\vec{E} = 3 \times 10^{-8} \sin[200\pi(y + ct)] \hat{k}$

Step-by-step solution ► [prepwiser.in/questions/ECZ9kLIc0A](https://www.prepwiser.in/questions/ECZ9kLIc0A)

Q80 JEE Main 2020 · 2 Sep · Shift 2

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

Step-by-step solution ► [prepwiser.in/questions/F5x8uUZMs0](https://www.prepwiser.in/questions/F5x8uUZMs0)

Q81 JEE Main 2020 · 2 Sep · Shift 1

A plane electromagnetic wave, has

frequency of 2.0×10^{10} Hz and its energy density is $1.02 \times 10^{-8} \text{ J/m}^3$ in vacuum. The amplitude of the magnetic field of the wave is close to

($\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$ and speed of light $= 3 \times 10^8 \text{ ms}^{-1}$)

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

Step-by-step solution ► [prepwiser.in/questions/bH9MQSyfBm](https://www.prepwiser.in/questions/bH9MQSyfBm)

Q82 JEE Main 2020 · 9 Jan · Shift 2

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

Step-by-step solution ► [prepwiser.in/questions/FbsWzl0ucQ](https://www.prepwiser.in/questions/FbsWzl0ucQ)

Q83 JEE Main 2020 · 9 Jan · Shift 1

The electric fields of two plane electromagnetic plane waves in vacuum are given by

$$\vec{E}_1 = E_0 \hat{j} \cos(\omega t - kx) \text{ and}$$

$$\vec{E}_2 = E_0 \hat{k} \cos(\omega t - ky)$$

At $t = 0$, a particle of charge q is at origin with

a velocity $\vec{v} = 0.8c\hat{j}$ (c is the speed of light in vacuum). The instantaneous force experienced by the particle is :

(A) $E_0 q (0.8\hat{i} - \hat{j} + 0.4\hat{k})$

(B) $E_0 q (-0.8\hat{i} + \hat{j} + \hat{k})$

(C) $E_0 q (0.8\hat{i} + \hat{j} + 0.2\hat{k})$

(D) $E_0 q (0.4\hat{i} - 3\hat{j} + 0.8\hat{k})$

[Step-by-step solution ► prepwisser.in/questions/EY4Ci1_APx](https://www.prepwisser.in/questions/EY4Ci1_APx)

Q84 JEE Main 2020 · 8 Jan · Shift 2

A plane electromagnetic wave of frequency 25 GHz is propagating in vacuum along the z -direction. At a particular point in space and time, the magnetic field is given by $\vec{B} = 5 \times 10^{-8} \hat{j} T$. The corresponding electric field $\vec{E}$ is (speed of light $c = 3 \times 10^8 \text{ ms}^{-1}$)

(A) $15 \hat{i} V / m$

(B) $-15 \hat{i} V / m$

(C) $1.66 \times 10^{-16} \hat{i} V / m$

(D) $-1.66 \times 10^{-16} \hat{i} V / m$

[Step-by-step solution ► prepwisser.in/questions/BZnDIiNUax](https://www.prepwisser.in/questions/BZnDIiNUax)

Q85 JEE Main 2020 · 7 Jan · Shift 2

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 $(x, y, z) = (0, 0, \frac{\pi}{k})$.

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 $\hat{k}$

(B) parallel to $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$

(C) antiparallel to $\frac{\hat{i} + \hat{j}}{\sqrt{2}}$

(D) zero

[Step-by-step solution ► prepwisser.in/questions/K3IoEBENII](https://www.prepwisser.in/questions/K3IoEBENII)

Q86 JEE Main 2020 · 7 Jan · Shift 1

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

Step-by-step solution ► [prepwisar.in/questions/44PTLZKOYG](https://www.prepwisar.in/questions/44PTLZKOYG)

EM Spectrum · 6 PYQs

Q87 JEE Main 2024 · 4 Apr · Shift 2

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

Step-by-step solution ► [prepwisar.in/questions/bUq8_hciph](https://www.prepwisar.in/questions/bUq8_hciph)

Q88 JEE Main 2023 · 15 Apr · Shift 1

Match **List I** with **List II** of Electromagnetic waves with corresponding wavelength range :

List I	List II
(A) Microwave	(I) 400nm to 1nm
(B) Ultraviolet	(II) 1nm to 10^{-3} nm
(C) X-Ray	(III) 1mm to 700nm
(D) Infra-red	(IV) 0.1m to 1mm

Choose the correct answer from the options given below:

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

Step-by-step solution ► [prepwisar.in/questions/AJL4KNxwrh](https://www.prepwisar.in/questions/AJL4KNxwrh)

Q89 JEE Main 2023 · 31 Jan · Shift 1

If a source of electromagnetic radiation having power 15kW produces 10^{16} photons per second, the radiation belongs to a part of spectrum is.

(Take Planck constant $h = 6 \times 10^{-34} \text{Js}$)

- (A) Gamma rays
- (B) Radio waves
- (C) Micro waves
- (D) Ultraviolet rays

Step-by-step solution ► [prepwiser.in/questions/he0DC5TxGD](https://www.prepwiser.in/questions/he0DC5TxGD)

Q90 JEE Main 2022 · 26 Jun · Shift 2

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) $\lambda_{\text{microwave}} < \lambda_{\text{visible}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}}$

Step-by-step solution ► [prepwiser.in/questions/ElIKmZa720](https://www.prepwiser.in/questions/ElIKmZa720)

Q91 JEE Main 2021 · 16 Mar · Shift 2

Red light differs from blue light as they have :

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

Step-by-step solution ► [prepwiser.in/questions/-7IF5_T_k2](https://www.prepwiser.in/questions/-7IF5_T_k2)

Q92 JEE Main 2020 · 4 Sep · Shift 1

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

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

Step-by-step solution ► [prepwiser.in/questions/CGYySG7fZW](https://www.prepwiser.in/questions/CGYySG7fZW)

Displacement Current · 7 PYQs

Q93 JEE Main 2025 · 7 Apr · Shift 1

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 field
- (C) electric current
- (D) electric potential

Step-by-step solution ► [prepwiser.in/questions/n_HSMvr1f7](https://www.prepwiser.in/questions/n_HSMvr1f7)

Q94 JEE Main 2025 · 23 Jan · Shift 2

A time varying potential difference is applied between the plates of a parallel plate capacitor of capacitance $2.5\mu\text{F}$. 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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/pTbXgYXeS3](https://www.prepwiser.in/questions/pTbXgYXeS3)

Q95 JEE Main 2025 · 22 Jan · Shift 2

A parallel plate capacitor of area $A = 16\text{cm}^2$ and separation between the plates 10 cm, is charged by a DC current. Consider a hypothetical plane surface of area $A_0 = 3.2\text{cm}^2$ 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 answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/oVRDZnTScQ](https://www.prepwiser.in/questions/oVRDZnTScQ)

Q96 JEE Main 2024 · 5 Apr · Shift 1

An alternating voltage of amplitude 40V and frequency 4kHz is applied directly across the capacitor of $12\mu\text{F}$. The maximum displacement current between the plates of the capacitor is nearly :

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

[Step-by-step solution ► prepwiser.in/questions/IC4kxpgdD5](https://www.prepwiser.in/questions/IC4kxpgdD5)

Q97 JEE Main 2024 · 1 Feb · Shift 1

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

- (A) $14.3\mu\text{A}$ and $143\mu\text{A}$
(B) $13.8\mu\text{A}$ and $13.8\mu\text{A}$
(C) $13.8\mu\text{A}$ and $138\mu\text{A}$
(D) $1.38\mu\text{A}$ and $1.38\mu\text{A}$

[Step-by-step solution ► prepwiser.in/questions/CpUG-VcHmA](https://www.prepwiser.in/questions/CpUG-VcHmA)

Q98 JEE Main 2022 · 29 Jun · Shift 2

The displacement current of $4.425\mu\text{A}$ is developed in the space between the plates of parallel plate capacitor when voltage is changing at a rate of 10^6Vs^{-1} . The area of each plate of the capacitor is 40cm^2 . The distance between each plate of the capacitor is $x \times 10^{-3}\text{m}$. The value of x is _____.
(Permittivity of free space, $\epsilon_0 = 8.85 \times 10^{-12}\text{C}^2\text{N}^{-1}\text{m}^{-2}$).

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Ro5zffBwv7](https://www.prepwiser.in/questions/Ro5zffBwv7)

Q99 JEE Main 2021 · 20 Jul · Shift 1

AC voltage $V(t) = 20 \sin \omega t$ of frequency 50 Hz is applied to a parallel plate capacitor. The separation between the plates is 2 mm and the area is 1 m^2 . The amplitude of the oscillating displacement current for the applied AC voltage is _____. [Take $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$]

(A) $55.58 \mu\text{A}$

(B) $21.14 \mu\text{A}$

(C) $27.79 \mu\text{A}$

(D) $83.37 \mu\text{A}$

[Step-by-step solution ► prepwiser.in/questions/yAOjHbJ4Yq](https://www.prepwiser.in/questions/yAOjHbJ4Yq)

Electromagnetic Spectrum · 2 PYQs

Q100 JEE Main 2023 · 12 Apr · Shift 1

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 true but R is false

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

(D) A is false but R is true

[Step-by-step solution ► prepwiser.in/questions/xz_XLabbpK](https://www.prepwiser.in/questions/xz_XLabbpK)

Q101 JEE Main 2021 · 24 Feb · Shift 2

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

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

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

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

[Step-by-step solution ► prepwiser.in/questions/ob1PwqnXfU](https://www.prepwiser.in/questions/ob1PwqnXfU)

Answer key — Electromagnetic Waves

Numbers match the question numbers above. For full working, open the solution link under each question.

1	A	2	C	3	B	4	6	5	D	6	B	7	C	8	C
9	B	10	D	11	C	12	A	13	B	14	D	15	A	16	C
17	A	18	B	19	B	20	D	21	B	22	A	23	D	24	B
25	A	26	C	27	C	28	C	29	A	30	C	31	A	32	A
33	D	34	5	35	D	36	B	37	C	38	A	39	C	40	D
41	B	42	C	43	D	44	C	45	A	46	B	47	43	48	B
49	B	50	C	51	C	52	B	53	A	54	C	55	B	56	A
57	500	58	C	59	2	60	C	61	354	62	D	63	C	64	D
65	A	66	D	67	C	68	25	69	3	70	A	71	B	72	137
73	2	74	15	75	667	76	D	77	194	78	D	79	B	80	C
81	C	82	A	83	C	84	A	85	C	86	A	87	A	88	B
89	A	90	B	91	B	92	A	93	C	94	100	95	1200	96	D
97	B	98	8	99	C	100	D	101	B						

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