PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

ELECTROMAGNETIC WAVES

Physics

1. An electromagnetic wave in vacuum has the electric and magnetic field $\vec{E}$ 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.

Answer:

2. The rms value of the electric field of the light from the sun is $720N/C$ The total energy density of the electromagnetic wave is

A. 4. $58 \times 10^{-6} J/m^3$

B. 6. $37 \times 10^{-9} J/m^3$

C. 81. $35 \times 10^{-12} J/m^3$

D.

Answer:

3. In order to establish an instantaneous displacemet current of 1 mA in the space between the plates of $2\mu F$ parallel plate capacitor, the potential difference need to apply is

A. $100Vs^{-1}$

B. $200Vs^{-1}$

C. $300Vs^{-1}$

D.

Answer:

4. During the propagation of electromagnetic waves in a 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.

Answer:

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

A. $\overrightarrow{E} = -E_0\cos\left(\omega t + \frac{2\pi}{\lambda}y\right)\widehat{x}$

B. $\overrightarrow{E} = E_0\cos\left(\omega t - \frac{2\pi}{\lambda}y\right)\widehat{x}$

C. $\overrightarrow{E} = E_0\cos\left(\omega t - \frac{2\pi}{\lambda}y\right)\widehat{z}$

D.

Answer:

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

    A. wavelength is halved and frequency remains unchanged

    B. wavelength is doubled and frequency becomes half

    C. wavelength is doubled and the frequency remains unchanged

    D.

Answer:

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7. The average electric field of electromagnetic waves in certain region of free space is $9 \times 10^{-4} NC^{-1}$. Then the average magnetic field in the same region is of the order of

A. $27 \times 10^{-4}T$

B. $3 \times 10^{-12}T$

C. $\left(\dfrac{1}{3}\right) \times 10^{-12}T$

D.

Answer:

8. The electric field of an electromagnetic wave travelling through vaccum is given by the equation $E = E_0 \sin(kx - \omega t)$ The quantity that is independent of wavelength is

A. $k\omega$

B. $\dfrac{k}{\omega}$

C. $k^2\omega$

D.

Answer:

9. The electric and the magnetic field, associated with an e.m. wave propagating along the $+z$axis, can be represented by

A. $\left[\vec{E} = E_0\hat{i}, \vec{B} = B_0\hat{j}\right]$

B. $\left[\vec{E} = E_0\vec{k}, \vec{B} = B_0\hat{i}\right]$

C. $\left[\vec{E} = E_0\hat{j}, \vec{B} = B_0\hat{i}\right]$

D.

Answer:

10. Light is an electromagnetic wave. Its speed in vacuum is given by the expression

A. $\dfrac{E^2}{2\varepsilon_0} + \dfrac{B^2}{2\mu_0}$

B. $\dfrac{1}{2}\varepsilon_0 E^2 + \dfrac{1}{2}\mu_0 B^2$

C. $\dfrac{E^2 + B^2}{c}$

D.

Answer:

11. A plane electromagnetic wave is incident on a plane surface of area A, normally and is perfectly reflected. If energy E strikes the surface in time t then average pressure exerted on the surface is (c = speed of light)

A. zero

B. E/Atc

C. 2E/Atc

D.

Answer:

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12. An electromagnetic wave travel along z-axis. Which of the following pair of space and time varying fields would generate such a wave?

A. E_x, B_y

B. E_y, B_x

C. E_z, B_x

D.

Answer:

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

    A. 3 V/m

    B. 6V/m

    C. 9V/m

    D.

Answer:

14. 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.

Answer:

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15. Displacement current is

A. continuous when electric field is changing in the circuit

B. continuous when magnetic field is changing in the circuit

C. continuous in both types of fields

D.

Answer:

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16. The electric field associted with an electromagnetic wave in vacuum is given by $\overrightarrow{E} = \hat{i}40\cos(kz = 6 \times 10^8 t)$, when E, z and t are in volt/m metre and second respectively find the wave vector.

A. $2m^{-1}$

B. $0.5m^{-1}$

C. $6m^{-1}$

D.

Answer:

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17. The charge on a parallel plate capacitor varies as $q = q_0\cos2\pi t$. The plates are very large and close together (area = A, separation = d). The displacement current through the capacitor is

A. $q_0 2\pi v \sin \pi vt$

B. $- q_0 2\pi v \sin 2\pi vt$

C. $q_0 2\pi \sin \pi vt$

D.

Answer:

18. A radiation of energy E falls normally on a perfctly refelecting surface . The momentum transferred to the surface is

A. $\dfrac{2E}{C}$

B. $\dfrac{2E}{C^2}$

C. $\dfrac{E}{C^2}$

D.

Answer:

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19. 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 1	List 2
1.	Infrared waves	(i) To treat muscular strain
2.	Radio waves	(ii) For broadcasting
3.	X- rays	(iii) To defect fracture of bones
4.	Ultraviolet rays	(iv) absorbed by the ozone layer of the atmospher

A.

	1	2	3	4
(a)	(iv)	(iii)	(ii)	i

B.

	1	2	3	4
(b)	(i)	(ii)	(iv)	iii

C.

	1	2	3	4
(c)	(iii)	(ii)	(i)	iv

D.

Answer:

20. A plane electromagnetic wave travels in free space along X-direction. If the value of $\overrightarrow{B}$ (in tesla) at a particular point in space and time is $1.2 \times 10^{-8}\hat{k}$. The value of $\overrightarrow{E}$ (in Vm^{-1}) at that point is

A. $1.2\hat{j}$

B. $3.6\hat{k}$

C. $1.2\hat{k}$

D.

Answer:

21. The correct option, if in vacuum the speed of γ-rays, x-rays and micro wave are v_g, v_x and v_m respectively, will

A. $v_s > v_x > v_m$

B. $v_s < v_x < v_m$

C. $v_s > v_x < v_m$

D.

Answer:

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

A. X-ray region

B. Ultra violet region

C. Infrared region

D.

Answer:

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23. A plane electromagnetic wave travels in free space along x-axis. At a particular point in space, the electric field along y-axis is $9.3Vm^{-1}$. The magnetic induction (B) along z-axis is

A. $3.1 \times 10^{-8}T$

B. $3 \times 10^{-5}T$

C. $3 \times 10^{-6}T$

D.

Answer:

24. The ratio of amplitude of magnetic field to the amplitude of electric field for an electromagnetic wave propagating in vacumm is equal to

    A. the speed of light in vacuum

    B. reciprocal of speed of light in vacuum

    C. the ratio of magnetic permeability to the electric susceptibility of

       vacuum

    D.

Answer:

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25. A plane electromagnetic wave is incident on a material surface. The wave delivers momentum p and energy E.

    A. p= 0 , E =0

B. $p \neq 0,\ E \neq 0$

C. $p \neq 0,\ E = 0$

D.

Answer:

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26. The decreasing order of wavelength of infrared, microwave, ultraviolet and gamma rays is

A. microwave, infrared, ultraviolet, gamma rays

B. gamma rays, ultraviolet, infrared, micro-waves

C. microwaves, gamma rays, infrared, ultraviolet

D.

Answer:

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27. Which radiation in sunlight causes heating effect?

    A. Ultraviolet

    B. Infrared

    C. Visible light

    D.

Answer:

28. The speed of electromagnetic wave in vacuum depends upon the source of radiation. It

    A. increases as we move from γ-rays to radio waves

    B. decreases as we move from γ-rays to radio waves

C. is same for all of them

D. None Of These

Answer: C

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29. The displacement current is

A. $\varepsilon_0 d\phi_E / dt$

B. $\dfrac{\varepsilon_0}{R} d\phi_E / dt$

C. $\varepsilon_0 E / R$

D.

Answer:

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30. Electromagnetic radiation of highest frequency is

A. infrared radiations

B. visible radiation

C. radio waves

D.

Answer:

31. A point source of electromagnetic radiation has an average power output of $1500W$. The maximum value of electric field at a distance $3m$ from this source in Vm^{-1} is

A. 500

B. 100

C. $\dfrac{500}{3}$

D.

Answer:

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32. Frequency of a wave is 6×10^{15} Hz. The wave is

    A. radiowave

    B. microwave

    C. x-ray

    D. Ultravoilet

Answer: D

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33. The electromagnetic waves do not transport

A. energy

B. charge

C. momentum

D.

Answer:

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34. Which of the following statement is false for the properties of electromagnetic waves?

A. Both electric and magnetic field vectors attain the maxima and minima at the same place and same time.

B. The energy in electromagnetic wave is divided equally between electric and magnetic vectors

C. Both electric and magnetic field vectors are parallel to each other

and perpendicular to the direction of propagation of wave

D.

Answer:

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35. Which of the following electromagnetic waves has minimum frequency ?

A. Microwaves

B. Audible waves

C. Ultrasonic waves

D.

Answer:

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36. The wave impedance of free space is

A. zero

B. 376.6Ω

C. 33.66Ω

D.

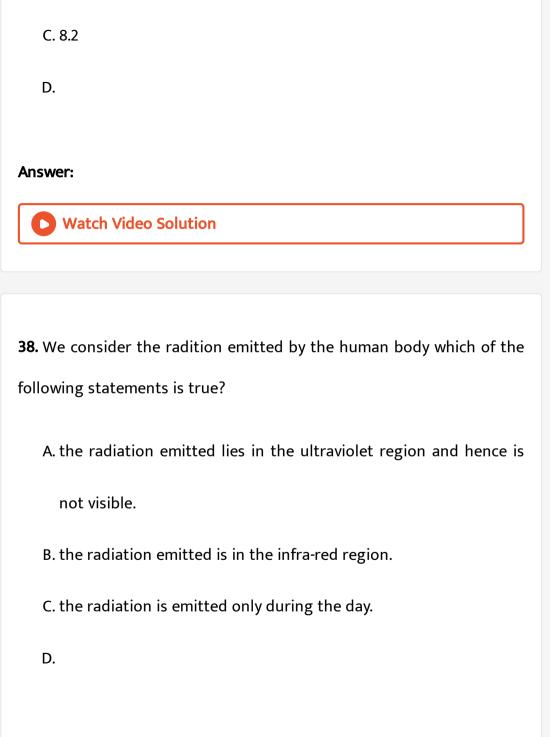**Answer:**

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37. 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.

Answer:

38. We consider the radition emitted by the human body which of the following statements is true?

A. the radiation emitted lies in the ultraviolet region and hence is

not visible.

B. the radiation emitted is in the infra-red region.

C. the radiation is emitted only during the day.

D.

Answer:

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39. In a plane electromagnetic wave propagating in space has an electric field of amplitude $9 \times 10^3 V/m$, then the amplitude of the magnetic field is

A. $2.7 \times 10^{12} T$

B. $9.0 \times 10^{-3} T$

C. $3.0 \times 10^{-4} T$

D.

Answer:

40. Out of the following options which one can be used produce a propagating electromagnetic wave?

    A. A charge moving at constant velocity

    B. A stationary charge

    C. A chargeless particle

    D.

Answer:

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41. Which of the following is used to produce radio waves of constant amplitude?

    A. rectifier

    B. filter

C. F.E.T

D.

Answer:

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42. In an electromagnetic wave

    A. power is transmitted along the magnetic field

    B. power is transmitted along the electric field

    C. power is equally transferred along the electric and magnetic

        fields

    D.

Answer:

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43. If c is the speed of electromagnetic waves in vacuum, its speed in a medium of dielectric K and relative permeability μ_r is

A. $v = \dfrac{1}{\sqrt{\mu_r K}}$

B. $v = c\sqrt{\mu_r K}$

C. $v = \dfrac{c}{\sqrt{\mu_r K}}$

D.

Answer:

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