PHYSICS

BOOKS - MODERN PUBLICATION PHYSICS (KANNADA ENGLISH)

ELECTROMAGNETIC WAVES

Multiple Choice Questions Level I

1. Dimensions of $1/(\mu_0\varepsilon_0)$ is:

A. L^2/T^2

B. T^2/L^2

C. T/L

D. L/T

Answer: A

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2. Electromagnetic waves are produced by:

A. an accelerating charge

B. a static charge

C. chargeless particle

D. a moving charge.

Answer: A

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3. An electric field $\vec{E}$ and a magnetic field $\vec{B}$ exist in a region. The fields are not perpendicular to each other :

A. This is not possible

B. No electromagnetic wave is passing through the region.

C. An electromagnetic wave may be passing through the region.

D. An electromagnetic wave is certainly passing through the region.

Answer: C

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4. Consider the following two statements regarding a linearly polarized plane electromagnetic wave :

(A) the electric field and the magnetic field have equal average values.

(B) the electric energy and the magnetic energy have equal average values.

A. A is false but B is true.

B. Both A and B are true.

C. B is false but A is true.

D. Both A and B are false.

Answer: B

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5. Speed of electromagnetic wave is the same :

A. for all wavelengths

B. for all frequencies

C. in all media

D. for all intensities.

Answer: D

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6. For television broadcasting, the frequency employed is normally:

A. 30 - 300 MHz.

B. 30 - 300 GHz.

C. 30 - 300 kHz.

D. 30 - 300 Hz.

Answer: A

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7. Speed c of e.m. waves through vacuum is equal to :

A. $\sqrt{\mu_0 \varepsilon_0}$

B. $1 / \sqrt{\mu_0 \varepsilon_0}$

C. $\sqrt{\mu_0 / \varepsilon_0}$

D. $\sqrt{\varepsilon_0 / \mu_0}$

Answer: B

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8. If there were no atmosphere, the average temperature on the surface of the earth would be:

A. lower

B. higher

C. same as now

D. $0^{\circ} C$

Answer: A

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9. The frequency of e.m. wave which is best suited to observe a particle of radius $3 \times 10^{-4} cm$ is of the order of :

A. 10^{15}

B. 10^{14}

C. 10^{13}

D. 10^{12}

Answer: B

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10. Which of the following electromagnetic radiations has the smallest wavelength ?

A. Microwaves

B. Ultraviolet

C. X-rays

D. Gamma rays

Answer: D

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11. IfgV_g, V_x and V_m are the speeds of gamma rays, X-rays and microwaves respectively in vacuum, then :

A. $V_g < V_x < V_m$

B. $V_g > V_x > V_m$

C. $V_g > V_x < V_m$

D. $V_g = V_x = V_m$

Answer: D

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12. The oscillating electric and magnetic field vectors of an electromagnetic waves are oriented along :

A. mutually perpendicular directions and are in phase

B. mutually perpendicular directions and differ in phase by 90°

C. the same directions but differ in phase by 90°

D. the same direction and are in phase.

Answer: A

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13. The wavelength of microwaves is:

A. smaller than the wavelength of violet light

B. smaller than the wavelength of yellow light

C. larger than the wavelength of red light

D. larger than the wavelength of radio waves

Answer: B

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14. If μ_0 be the permeability and ko the dielectric constant of a medium , its refractive index is given by :

A. $\frac{1}{\sqrt{\mu_0 k_0}}$

B. $\frac{1}{\mu_0 k_0}$

C. $\sqrt{\mu_0 k_0}$

D. $\mu_0 k_0$

Answer: C

View Text Solution

15. Microwaves are electromagnetic waves with

frequency, in the range of

A. micro hertz

B. mega hertz

C. giga hertz

D. hertz

Answer: C

View Text Solution

16. The amplitude of electric and magnetic fields related to each other are :

A. $E_0 = B_0$

B. $E_0 = cB_0$

C. $E_0 = B_0 / c$

D. $E_0 = c / B_0$

Answer: B

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17. The phase and orientation of the magnetic vector associated with electromagnetic

oscillations differ respectively from those of the corresponding electric vector by :

A. zero and zero

B. zero and $\pi/2$

C. $\pi/2$ and $\pi/2$

D. $\pi/2$ and zero

Answer: B

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18. Which of the following is the infrared wavelength ?

A. $10^{-4}cm$

B. $10^{-5}cm$

C. $10^{-6}cm$

D. $10^{-7}cm.$

Answer: A

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19. Maxwell's equations describe the fundamental laws of :

A. electricity only

B. magnetism only

C. mechanics only

D. both (a) and (b)

Answer: D

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20. The frequencies of X-ray, γ-rays and ultraviolet rays are respectively a, b, and c. Then :

A. $a < b, b < c$

B. $a > b, b > c$

C. $a > b, b < c$

D. $a < b, b > c$

Answer: A

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21. The velocity of light in vacuum can be changed by changing :

A. frequency

B. amplitude

C. wavelength

D. none of these

Answer: D

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22. Which of the following statements is correct in relation to electromagnetic waves in an isotropic medium?

A. Energy due to electric field is equal to that due to magnetic field

B. Electric vector $\overrightarrow{E}$ and magnetic vector $\overrightarrow{B}$ are in phase

C. For a given amplitude of $\overrightarrow{E}$, the intensity increases as the first power of frequency f

D. None of these

Answer: C

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23. Which of the following have zero average value in a plane electromagnetic wave ?

A. electric energy

B. magnetic energy

C. magnetic field

D. electric field

Answer: A

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24. Displacement current goes through the gap between the plates of a capacitor when the charge of the capacitor :

A. is zero

B. decreases

C. does not change

D. increases

Answer: C

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25. Ozone layer above earth's atmosphere will:

A. prevent infrared radiations from sun reaching earth

B. prevent infrared rays reflected from earth from escaping earth's atmosphere

C. prevent ultraviolet rays from sun

D. reflect back radiowaves

Answer: A

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26. Which of the following pairs of space and time varying $\overrightarrow{E}$ and $\overrightarrow{B}$ fields would generate a

plane electromagnetic wave travelling along the Z-direction ?

A. E_x, B_x

B. E_y, B_z

C. E_x, B_y

D. E_y, B_x

Answer: C

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27. The area of Television telecast is made twice, the height of antenna will be changed as:

A. halved

B. doubled

C. quadrupled

D. kept unchanged

Answer: B

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28. The frequency of visible light is of the order of:

A. 10^{15} Hz

B. 10^{10} Hz

C. 10^{6} Hz

D. 10^{4} Hz

Answer: A

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29. Which of the following wavelengths falls in X-rays region?

A. $1\dot{A}$

B. $10\dot{A}$

C. $10^{-2}\dot{A}$

D. $10^{-3}\dot{A}$

Answer: A

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30. In electromagnetic wave, the average energy density is associated to:

A. electric field only

B. magnetic field only

C. equally with electric and magnetic field

D. average energy density is zero.

Answer: C

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31. In X-ray tube the accelerating potential applied at the anode is V volt. The minimum wavelength of the emitted X-rays will be :

A. eV/h

B. h/eV

C. eV/ch

D. hc/eV.

Answer: D

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32. A magnetic field is produced by :

A. a changing electric field

B. a moving charge

C. both of them

D. none of them.

Answer: C

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33. A compass needle is placed in the gap of a parallel plate capacitor. The capacitor is connected to battery through a resistance. The compass needle :

A. deflects and gradually comes to the original position in a time which is large compared to the time constant

B. does not deflect

C. deflects and remains deflected as long as the battery is connected

D. deflects for a very short time and then comes back to the original position.

Answer: A

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34. A free electron is placed in the path of plane electromagnetic wave. The electron will start moving:

A. along the direction of propagation of the wave

B. in a plane containing the magnetic field and the direction of propagation

C. along the electric field

D. along the magnetic field.

Answer: C

View Text Solution

35. The energy contained in a small volume through which an electromagnetic wave is passing oscillates with:

A. double the frequency of the wave

B. zero frequency

C. the frequency of the wave

D. half the frequency of the wave.

Answer: A

View Text Solution

36. Which of the following can be expressed in coulomb :

A. $\oint \vec{B} \cdot \vec{dl}$

B. $\oint \vec{E} \cdot \vec{dl}$

C. $\oint_s \varepsilon_0 \vec{E} \cdot \vec{ds}$

D. $\oint_s \frac{\vec{B}}{\mu_0} \cdot \vec{ds}$

Answer: C

View Text Solution

37. The sound waves after being converted into electrical waves are not transmitted as such because :

A. they travel with the speed of sound.

B. the frequency is not constant.

C. they are heavily absorbed by the atmosphere.

D. the height of antenna has to be increased several times.

Answer: C

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38. The process of superimposing signal frequency (i.e. audio wave) on the carrier wave is known as:

A. transmission

B. reception

C. modulation

D. detection.

Answer: C

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39. In an amplitude modulated wave for audio-frequency of $500 \text{cycles} / \text{second}$, the appropriate carrier frequency will be:

A. $50 \text{cycles} / s$

B. $100 \text{cycles} / s$

C. $500 \text{cycles} / s$

D. $50,000 \text{cycles} / s$

Answer: D

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40. The conduction current in ideal casc through a circuit is zero when charge on capacitor is:

A. zero

B. maximum

C. depends on value of C and R

D. any transient value.

Answer: B

View Text Solution

41. When capacitor is connected to the circuit, the current when key is pressed, is:

A. zero

B. maximum

C. depends on capacitor used

D. any transient value.

Answer: B

View Text Solution

42. Radio frequency is generated with:

A. Filter

B. Rectifier

C. FET

D. Oscillator

Answer: D

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43. According to Maxwell's hypothesis, a changing electric field gives rise to :

A. an emf

B. electric current

C. magnetic field

D. pressure radiant.

Answer: C

View Text Solution

44. In an apparatus, the electric field was found to oscillate with an amplitude of $18V/m$. The magnitude of the oscillating magnetic field will be :

A. $4 \times 10^{-6}T$

B. $6 \times 10^{-8}T$

C. $9 \times 10^{-9}T$

D. $11 \times 10^{-11}T$

Answer: B

View Text Solution

45. The wavelength of X-rays is of the order of:

A. $10^{-3}m$

B. $10^{-5}m$

C. $10^{-10}m$

D. $10^{-12}m$

Answer: C

View Text Solution

46. X-rays are produced by jumping of:

A. electrons from lower to higher energy orbit of atom

B. electrons from higher to lower energy orbit of atom

C. proton from lower to higher energy orhit of nucleus

D. proton from higher to lower energy orbit of nucleus.

Answer: B

View Text Solution

47. Which one is not an e.m. wave.

A. X-rays

B. γ-rays

C. Cathode rays

D. Microwaves.

Answer: A

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48. The wavelength of X-rays lies between:

A. maximum to finite limits

B. minimum to certain limits

C. minimum to infinite limits

D. infinite to finite limits

Answer: B

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49. The penetrating power of X-ray increases with the increase in its :

A. velocity

B. intensity

C. frequency

D. wavelength.

Answer: C

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50. The production of X-rays is a phenomenon for the conservation of:

A. mass into potential energy

B. energy into heat

C. kinetic energy into radiant energy

D. charge.

Answer: C

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51. X-rays travel in space with the velocity of:

A. cosmic rays

B. light waves

C. water waves

D. ultrasonic waves.

Answer: C

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52. The shortest wavelength of X-rays emitted from an X- ray tube depends upon :

A. nature of the gas in the tube

B. voltage applied to tube

C. current in the tube

D. nature of target of the tube.

Answer: B

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53. The voltage applied across an X-rays tube is nearly equal to :

A. 10 V

B. 100 V

C. 1000 V

D. 10,000 V

Answer: D

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54. X-rays and γ-rays of same energies are distinguished by their :

A. frequencies

B. charges

C. ionising power

D. method of production.

Answer: B

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55. X-rays are not used for radar purposes, because they are not :

A. reflected by target

B. partly absorbed by target

C. electromagnetic waves

D. completely absorbed by target.

Answer: A

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56. Hydrogen atom does not emit X-rays because :

A. it has single electron

B. it has no neutron

C. it has single neutron

D. its energy levels are too close to each other.

Answer: A

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57. The energy of X-rays photon is $3.3 \times x10^{-16} J$. Its frequency is :

A. $2 \times 10^{19} Hz$

B. $5 \times 10^{18} Hz$

C. $5 \times 10^{17} Hz$

D. $5 \times 10^{16} Hz$.

Answer: C

View Text Solution

58. The wavelength of ultraviolet rays is of the order of:

A. $10^{-3}m$

B. $10^{-6}m$

C. $10^{-8}m$

D. between 'b' and 'c'.

Answer: D

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59. The wavelength of infrared rays is of the order of:

A. $5 \times 10^{-7} m$

B. $10^{-3} m$

C. between 'b' and 'c'.

D. none of these.

Answer: C

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60. The minimum frequency $v_{\min}$ of continuous X-rays is related to the applied pot. diff. V as :

A. $v_{\min} \propto V$

B. $v_{\min} \propto V^{1/2}$

C. $v_{\min} \propto V^{1-3}$

D. $v_{\min} \propto V^{4}$

Answer: A

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61. A gold leaf electroscope is charged and the leaves are observed to diverge by a certain amount. A beam of X-rays is allowed to fall upon the electroscope for a short period. The leaves would :

A. collapse

B. melt

C. diverge more

D. not diverge more.

Answer: D

View Text Solution

62. Which of the following have zero average value in a plane electromagnetic wave ?

A. electric field

B. magnetic potential

C. electric energy

D. magnetic energy.

Answer: A

View Text Solution

63. An electromagnetic wave propagating along north has its electric field vector upwards. Its magnetic field vector point towards.

A. North

B. East

C. West

D. Downwards.

Answer: B

View Text Solution

64. Which one of the following is INCORRECT statement in the transmission of electromagnetic waves

A. Ground wave propagation is for high frequency transmission

B. Sky wave propagation is facilitated by ionospheric layers

C. Space wave is of high frequency and is suitable for line of sight communication

D. Space wave is used for satellite communication

Answer: A

View Text Solution

65. Infrared radiation was discovered in 1800 by

A. William Wollaston

B. William Herschel

C. Wilhelm Roentgen

D. Thomas Young.

Answer: B

View Text Solution

66. The wavelength of the matter waves is independent of

A. Charge

B. Momentum

C. Velocity

D. Mass

Answer: A

View Text Solution

67. A. The wavelength of microwaves is greater than that of UV-rays.

B. The wavelength of IR rays is lesser than that

of UV- rays.

C. The wavelength of microwaves is lesser than that of IR rays.

D. Gamma rays has shortest wavelength in the electromagnetic spectrum.

A. A and B are true

B. B and C are true

C. C and D are true

D. A and D are true

Answer: D

View Text Solution

68. A signal emitted by an antenna from a certain point can be received at another point of the surface in the form of

A. Sky wave

B. Ground wave

C. Sea wave

D. Both (a) and (b).

Answer: D

View Text Solution

69. Approximate height of ozone layer above the ground is

A. 60 to 70 km

B. 59 km to 80 km

C. 70 km to 100 km

D. 100 km to 200 km.

Answer: A

View Text Solution

70. Which scientist experimentally proved the existence of electromagnetic waves

A. Sir J.C. Bose

B. Maxwell

C. Marconi

D. Hertz.

Answer: D

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

A. Radiowave

B. Microwaves

C. X-ray

D. None of these.

Answer: D

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72. The region of the atmosphere above troposphere is known as

A. Lithosphere

B. Uppersphere

C. Ionosphere

D. Stratosphere.

Answer: D

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73. Which of the following electromagnetic waves have minimum frequency

A. Microwaves

B. Audible waves

C. Ultrasonic waves

D. Radiowaves.

Answer: B

View Text Solution

74. Which of the following shows greenhouse effect

A. Ultraviolet rays

B. Infrared rays

C. X-rays

D. None of these.

Answer: B

View Text Solution

75. Electromagnetic waves are transverse in nature is evident by

A. Polarization

B. Interference

C. Reflection

D. Diffraction.

Answer: A

View Text Solution

76. Electromagnetic waves are transverse in nature as in evident by :

A. polarisation

B. interference

C. reflection

D. diffraction

Answer: A

View Text Solution

77. Which of the following are not electromagnetic waves ?

A. cosmic rays

B. gamma rays

C. β-rays

D. X-rays

Answer: C

View Text Solution

78. Which of the following radiations has the least wave- lengths ?

A. γ-rays

B. β-rays

C. α-rays

D. X-rays.

Answer: A

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79. An electromagnetic wave of v = 3MHz passes from vacuum into dielectric medium with $\varepsilon = 4.0\varepsilon_0$. Then :

A. wavelength is doubled and frequency becomes half

B. wavelength is doubled and freq. is same.

C. wavelength and frequency both remain unchanged.

D. wavelength is halved but frequency remains same.

Answer: D

View Text Solution

Multiple Choice Questions Level Ii

1. A plane electromagnetic wave is incident on a material surface. The wave delivers momentum p and energy E, then :

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

B. p = 0, E = 0

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

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

Answer: A

View Text Solution

2. An electromagnetic wave going through vacuum is described by $E = E_0 \sin(kx - \omega t)$ which of the following is/are independent of the wavelength ?

A. k

B. k / ω

C. $k\omega$

D. ω

Answer: B

View Text Solution

3. The unit of expression $\mu_0 \varepsilon_0$ are :

A. m / s

B. m^2 / s^2

C. s / m

D. s^2 / m^2

Answer: D

View Text Solution

4. In an electromagnetic wave the average energy density associated with electric field is :

A. $CV^2 / 2$

B. $Q^2/2C$

C. $\varepsilon_0^2/2E$

D. $\varepsilon_0 E^2/2$

Answer: D

View Text Solution

5. Given the wave function (in S.I. units) for a wave to be,

$\Psi(x,t) = 10^3 \sin\pi\left(3 \times 10^6 x - 9 \times 10^{14} t\right).$

The speed of the wave is :

A. $3 \times 10^6 m/s$

B. $3 \times 10^7 m/s$

C. $3 \times 10^8 m/s$

D. $9 \times 10^{14} m/s$

Answer: B

View Text Solution

6. The electric amplitude of the wave is $5Vm^{-1}$. The magnetic amplitude of this wave is:

A. $5AWb/m^2$

B. $1.67 \times 10^{-10}Wb/m^2$

C. $1.67 \times 10^{-8}Wb/m^2$

D. $5 \times 10^{-10}Wb/m^2$

Answer: C

View Text Solution

7. Dimensions of $\varepsilon_0 \frac{d\phi_E}{dt}$ are of :

A. potential

B. charge

C. capacitance

D. current

Answer: D

View Text Solution

8. The T.V. transmission tower in Delhi has a height of 240 m. The distance up to which the broadcast can be received, (taking the radius of earth to be 6.4×10^6 m).

A. 100 km

B. 60 km

C. 55 km

D. 50 km

Answer: C

View Text Solution

9. In a plane e.m. wave, the electric field oscillates sinusoidally at a frequency of

2.5×10^{10} Hz and amplitude $480V/m$. The amplitude of oscillating magnetic field will be:

A. $1.52 \times 10^{-8} Wb/m^2$

B. $1.52 \times 10^{-7} Wb/m^2$

C. $1.6 \times 10^{-6} Wb/m^2$

D. $1.6 \times 10^{-7} Wb/m^2$

Answer: C

View Text Solution

10. In question 84, the wavelength of the wave will be :

A. 1.2 m

B. 1.2 cm

C. 3 m

D. 3 cm

Answer: B

View Text Solution

11. If the magnetic monopoles existed then which of the following Maxwell's equations would be modified ?

A. $\oint \vec{E} \cdot \vec{ds} = \frac{q}{\varepsilon_0}$

B. $\oint \vec{B} \cdot \vec{ds} = 0$

C. $\oint \vec{E} \cdot \vec{dl} = -\frac{d}{dt}\int \vec{B} \cdot \vec{ds}$

D. $\oint \vec{B} \cdot \vec{dl} = \mu_0 \varepsilon_0 \frac{d}{dt}\int \vec{E} \cdot \vec{ds} + \mu_0 I$

Answer: B

View Text Solution

12. If ε_0 and μ_0 represent the permittivity and permeability of vaccum and ε and μ represent the permittivity and permeability of medium, then refractive index of the medium is given by :

A. $\sqrt{\frac{\varepsilon_0\mu_0}{\varepsilon\mu}}$

B. $\sqrt{\frac{\varepsilon\mu}{\varepsilon_0\mu_0}}$

C. $\sqrt{\frac{\varepsilon}{\mu_0\varepsilon_0}}$

D. $\sqrt{\frac{\mu_0\varepsilon_0}{\varepsilon}}$

Answer: B

View Text Solution

13. In an electromagnetic wave, the electric and magnetising fields are $100V/m$ and $0.265A/m$. The maximum energy flow is :

A. $26.5W/m^2$

B. $36.5W/m^2$

C. $46.5W/m^2$

D. $76.5W/m^2$

Answer: A

View Text Solution

14. If a source is transmitting electromagnetic waves of frequency 8.2×10^6 Hz, then wavelength of the electromagnetic waves transmitted from the source will be :

A. 36.6 m

B. 40.5 m

C. 42.3 m

D. 50.9 m

Answer: A

View Text Solution

15. Which one of the following groups of electromagnetic waves is in order of increasing frequency?

A. microwaves, ultraviolet rays, X-rays

B. radiowaves, visible light and infrared radiation

C. gamma rays, visible light, ultraviolet rays

D. gamma rays, ultraviolet rays, radiowaves

Answer: A

View Text Solution

16. An electromagnetic wave going through vacuum is described by:

$$E = E_0 \sin(kx - \omega t)$$

$$B = B_0 \sin(kx - \omega t)$$

A. $E_0 B_0 = \omega k$

B. $E_0\omega = B_0k$

C. $E_0k = B_0\omega$

D. None of these

Answer: C

View Text Solution

17. A flood light is covered with a fitter that transmits red light. The electric field of the emerging beam is represented by a sinusoidal plane wave

$E_x = 36\sin\left(1.20 \times 10^7 z - 3.6 \times 10^{15} t\right) V/m$

The average intensity of beam in watt $/$ $(\text{metre})^2$ will be :

A. 6.88

B. 3.44

C. 1.72

D. 0.86

Answer: C

View Text Solution

18. A plane electromagnetic wave of wave intensity $6W/m^2$ strikes a small mirror of area $39cm^2$, held perpendicular to the approaching wave. The momentum transferred in $kgms^{-1}$ by the wave to the mirror each second will be:

A. 1.2×10^{-10}

B. 2.4×10^{-9}

C. 3.6×10^{-8}

D. 4.8×10^{-7}

Answer: A

View Text Solution

19. The intensity of sun light (in W/m^2) at the solar surface will be:

A. 5.6×10^6

B. 5.6×10^7

C. 4.2×10^6

D. 4.2×10^7

Answer: B

View Text Solution

20. In an electromagnetic wave, the average energy density associated with magnetic field is :

A. $Li_0^2/2$

B. $B^2/2\mu_0$

C. $\mu_0 B^2/2$

D. $\mu_0/2B^2$

Answer: B

View Text Solution

21. A parallel plate capacitor consists of two circular plates each of radius 12 cm and separated by 5.0 mm. The capacitor is being charged by external source. The charging current is constant and is equal to 0.15 A. The rate of change of potential difference between the plates will be :

A. $1.873 \times 10^7 V/s$

B. $1.873 \times 10^8 V/s$

C. $1.873 \times 10^9 V/s$

D. $1.873 \times 10^{10} V/s$

Answer: C

View Text Solution

22. The sun delivers $10^3 W/m^2$ of electromagnetic flux to the earth's surface.

The total power that is incident on a roof of dimensions $8m \times 20m$, will be:

A. $2.56 \times 10^4 W$

B. $6.4 \times 10^5 W$

C. $4.0 \times 10^5 W$

D. $1.6 \times 10^5 W$

Answer: D

View Text Solution

23. In Q. 103, the radiation force on the roof will be :

A. $8.53 \times 10^{-5} W$

B. $2.3 \times 10^{-3} W$

C. $1.33 \times 10^{-3} W$

D. $5.33 \times 10^{-4} W$

Answer: D

View Text Solution

24. The average magnetic energy density of an electromagnetic wave of wavelength travelling in free space is given by

A. $\frac{B^2}{2\lambda}$

B. $\frac{B^2}{2\mu_0}$

C. $\frac{2B^2}{\mu_0\lambda}$

D. $\frac{B}{\mu_0\lambda}$

Answer: B

View Text Solution

25. Light waves travel in vacuum along the y-axis. Which of the following may represent the wavefront

A. $y = \text{constant}$

B. $x = \text{constant}$

C. $z = \text{constant}$

D. $x + y + z = \text{constant}$.

Answer: A

View Text Solution

26. A new system of units is evolved in which the values of μ_0 and ε_0 are 2 and 8 respectively. Then the speed of light in the system will be

A. 0.25

B. 0.5

C. 0.75

D. 1.

Answer: A

View Text Solution

27. The dielectric constant of air is 1.006. The speed of electromagnetic wave travelling in air is $a \times 10^8 ms^{-1}$, where a is about

A. 3

B. 3.88

C. 2.5

D. 3.2

Answer: A

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28. A plane electromagnetic wave travels in free space along 2-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. $9.3 \times 10^{-6}T$

Answer: A

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29. What is ozone hole

A. Hole in the ozone layer

B. Formation of ozone layer

C. Thinning of ozone layer in troposphere

D. Reduction in ozone thickness in stratosphere.

Answer: D

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30. Which rays are not the portion of electromagnetic spectrum

A. X-rays

B. Microwaves

C. α -rays

D. Radio waves

Answer: C

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31. Radio waves diffract around building although light waves do not. The reason is that radio waves

A. Travel with speed larger than c

B. Have much larger wavelength than light

C. Carry news

D. Are not electromagnetic waves.

Answer: B

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32. Radio waves and visible light in vacuum have

A. Same velocity but different wavelength

B. Continuous emission spectrum

C. Band absorption spectrum

D. Line emission spectrum.

Answer: A

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33. TV waves have a wavelength range of 1-10 meter. Their frequency range in MHz is

A. 30-300

B. 11018

C. 300-3000

D. 401828

Answer: A

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34. Pick out the longest wavelength from the following types of radiations

A. Blue light

B. γ -rays

C. X-rays

D. Red light

Answer: D

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35. Wave which cannot travel in vacuum is

A. X-rays

B. Infrasonic

C. Ultraviolet

D. Radiowaves

Answer: B

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36. The range of wavelength of the visible light is

A. $10Åto100Å$

B. $4,000Åto8,000Å$

C. $8,000Åto10,000Å$

D. $10,000Åto15,000Å$

Answer: B

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37. Which radiation in sunlight, causes heating effect

A. Ultraviolet

B. Infrared

C. Visible light

D. All of these.

Answer: B

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38. Which of the following represents an infrared wavelength

A. $10^{-4}cm$

B. $10^{-5}cm$

C. $10^{-6}cm$

D. $10^{-7}cm$

Answer: A

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

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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40. The maximum distance upto which TV transmission from a TV tower of height h can be received is proportional to

A. $h^{1/2}$

B. h

C. h

D. h^2

Answer: A

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41. Which of the following are not electromagnetic waves

A. Cosmic rays

B. Gamma rays

C. β-rays

D. X-rays.

Answer: C

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42. Ozone is found in

A. Stratosphere

B. Ionosphere

C. Mesosphere

D. Troposphere.

Answer: A

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43. The electromagnetic waves travel with a velocity

A. Equal to velocity of sound

B. Equal to velocity of light

C. Less than velocity of light

D. None of these.

Answer: B

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44. Which of the following radiations has the least wavelength

A. γ -rays

B. β -rays

C. α -rays

D. X-rays

Answer: A

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45. Dimensions of $\frac{1}{\mu_0 \varepsilon_0}$, where symbols have their usual meanings, are :

A. $\left[L^{-1}T\right]$

B. $\left[L^{-2}T^{2}\right]$

C. $\left[L^{2}T^{-2}\right]$

D. $\left[LT^{1}\right]$

Answer: C

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46. The r.m.s. value of electric field of the light coming from sun in $720N/C$. The average energy density of e.m.f. is :

A. $3.3 \times 10^{-3} J/m^3$

B. $4.58 \times 10^{-6} J/m^3$

C. $6.37 \times 10^{-9} J/m^3$

D. $81.35 \times 10^{-12} J/m^3$

Answer: B

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Multiple Choice Questions Level Ii Assertion

1. Statement I: Electric and magnetic fields satisfy the wave equation, which can be obtained from Maxwell's third and fourth equation

$$\frac{\partial^2 E}{\partial x^2} = \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$$ and

$$\frac{\partial^2 B}{\partial x^2} = \mu_0 \varepsilon_0 \frac{\partial^2 E}{\partial t^2}$$

Statement II: The electric and magnetic fields of sinusoidal plane e.m. waves in the positive x-direction can be written as.

$$E = E_0 \sin(kx - \omega t)$$

$$B = B_0 \sin(kx - \omega t)$$

A. Statement I is true, statement II is false.

B. Statement I is false, statement II is true.

C. Statement I is true, statement II is true, statement II is correct explanation of statement I.

D. Statement I is true, statement II is true, statement II is not correct explanation of statement I.

Answer: C

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2. Statement I: The energy of e.m wave is

$\frac{1}{2}\varepsilon_0 E_0^2$

Statement II: The intensity of radiation of e.m. wave is

$\frac{1}{2}\varepsilon_0 cE^2$

A. Statement I is correct, statement II is false.

B. Statement I is false and that II is true.

C. Both statement I and II are true but II is not explanation of I.

D. Both statement 'I and II are true but II is explanation of I.

Answer: D

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Multiple Choice Questions Level Ii Paragraph

1. Apparatus is set up to propagate e.m. waves in the x-direction, having wavelength of 6 mm. An electric field of magnitude $33Vm^{-1}$ is applied in y-direction.

The suitable equation of electric vector of electric field (as function of x and t) is :

A. $E_y = 33\cos\pi\left(t - \frac{x}{c}\right)$

B. $E_y = 33\sin\pi \times 10^{11}(t - x/c)$

C. $E_y = 33\sin 2\pi\left(t - \frac{x}{c}\right)$

D. $E_y = 33\sin\pi(t - x/c)$

Answer: B

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2. Apparatus is set up to propagate e.m. waves in the x-direction, having wavelength of 6 mm. An electric field of magnitude $33Vm^{-1}$ is applied in y-direction.

The suitable equation for magnetic field (as function of x and t) is :

A. $B_z = 1.1 \times 10^{-7} \sin \pi(t - x/c)$

B. $B_z = 1.1 \times \sin \pi (t - x/c)$

C. $B_z = 1.1 \times 10^{-7} \sin \pi \times 10^{11} (t - x/c)$

D. $B_z = 1.1 \sin 2\pi (t - x/c)$

Answer: C

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3. A T.V transmission tower at a particular station has height 160 m, earth's radius is 6400 km.

Coverage range of antenna is

A. 55.8 km

B. 45.2 km

C. 60 km

D. 85 km

Answer: B

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4. A T.V transmission tower at a particular station has height 160 m, earth's radius is 6400 km.

What is population covered if population density is $1200 / km^2$

A. 50 lac

B. 60.2 lac

C. 77.24 lac

D. 100.5 lac

Answer: C

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Multiple Choice Questions Level Iii

1. 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. $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{B} \times \vec{E}$

B. $\vec{X} \parallel \vec{B}$ and $\vec{k} \parallel \vec{B} \times \vec{E}$

C. $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$

D. $\vec{X} \parallel \vec{B}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$

Answer: C

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

A. $6V/m$

B. $9V/m$

C. $12V/m$

D. $3V/m$

Answer: A

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3. During the propagation of electromagnetic waves in a medium :

A. Both electric and magnetic energy densities are zero.

B. Electric energy density is double of the magnetic energy density.

C. Electric energy density is half of the magnetic energy density

D. Electric energy density is equal to the magnetic energy density.

Answer: D

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4. 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		List–II	
(A)	Infrared waves	(*i*)	To treat muscular strain
(B)	Radio waves	(*ii*)	For broadcasting
(C)	X-rays	(*iii*)	To detect fracture of bones
(D)	Ultraviolet rays	(*iv*)	Absorbed by the ozone layer of the atmosphere

A. $\begin{matrix} A & B & C & D \\ (\text{i}) & (\text{ii}) & (\text{iii}) & (\text{iv}) \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ (\text{iv}) & (\text{iii}) & (ii) & (i) \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ (\text{i}) & (\text{ii}) & (\text{iv}) & (\text{iii}) \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ (\text{iii}) & (\text{ii}) & (\text{i}) & (\text{iv}) \end{matrix}$

Answer: A

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Recent Competitive Questions

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

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 the above.

Answer: C

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2. Spectrum of sunlight is an example of:

A. continuous absorption spectrum

B. band emission spectrum

C. line absorption spectrum

D. continuous emission spectrum.

Answer: D

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3. The figure shows the energy level of certain atom. When the electron de excites from 3E to E, an electromagnetic wave of wavelength λ is emitted. What is the wavelength of the electromagnetic wave emitted when the electron de excites from $\frac{5E}{3}$ to E?

.....3E

.....$5E/2$

.....E.

A. 3λ

B. 2λ

C. 5λ

D. $\frac{3\lambda}{5}$

Answer: A

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4. A plane electromagnetic wave of frequency 20 MHz travels through a space along x-direction. If the electric field vector at a certain

point in space is $6Vm^{-1}$, what is the magnetic field vector at that point ?

A. $2 \times 10^{-3}T$

B. $\frac{1}{2} \times 10^{-8}T$

C. 2T

D. $\frac{1}{2}T$

Answer: A

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