PHYSICS

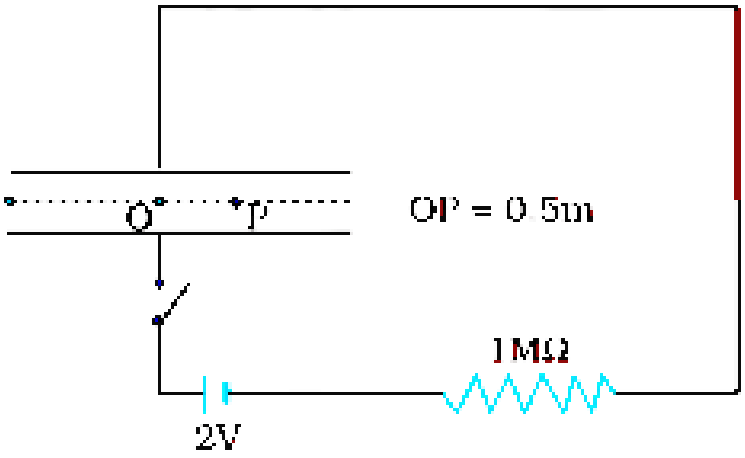
BOOKS - AAKASH SERIES

ELECTROMAGNETIC WAVES

Problem

1. A parallel plate capacitor with circular plates of radius 1 m has a capacitance of 1 nF. ?At t=0, it is connected for charging in series with a

resitor R=1M Ω across a 2V battery (Fig. 8.3) calculate the magnetic field at a point P. halfway between the centre and the periphery of the plates after l=10^{-3}s. (The charge on the capacitor at time l is $q(l) = CV$ [1-exp(-t/r)]. where the time constant r is equal to CR.)



Watch Video Solution

2. A plane electromagnetic wave of frequency 50 MHz travels in free space along the x-direction. At a particular point in space and time, $\vec{E} = 6.3\hat{j}\,\mathrm{V\ m^{-1}}$.

At this point $\vec{B}$ is equal to

Watch Video Solution

3. The magnetic field in a plane electromagnetic wave give by

$B_y = \left(2 \times 10^{-7}\right) T \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right)$

.

(a) What is the wavelength and frequency of the wave?

(b) Write an expression for the electric field.

Watch Video Solution

4. Light with an energy flux of $18W/cm^2$ falls on a non-reflecting surface at normal incidence. If the surface has an area of $20cm^2$. Find the average force exrted on the surface during a 30 minute time span.

Watch Video Solution

5. Calculate the electric and magnetic fields produced by the radiation coming from a 100 W bulb at a distance of 3 m. Assume that the efficiency of the bulb is 2.5% and it is a point source.

Watch Video Solution

Exercise Ia

1. The idea of displacement current was introduced by

A. Hertz

B. Maxwell

C. JC Bose

D. Marconi

Answer: B

Watch Video Solution

2. The SI unit of displacement current is

A. Henry

B. Coulomb

C. Ampere

D. Faraday

Answer: C

Watch Video Solution

3. Displacement current is

A. due to flow of free electrons

B. due to a constant electric field

C. due to flow of both positive and negative free charge carriers

D. due to time varying electrical field

Answer: D

Watch Video Solution

4. The displacement current was named as current because

A. it is similar to conduction curren

B. it produces magnetic field

C. it is a time varying electrical field

D. it is current due to uniformly moving charges

Answer: B

 Watch Video Solution

5. The displacement current is found

A. between the plates of a condenser when it is being charged

B. between the plates of a condenser when it is being discharged

C. between the plates of a condenser when AC is applied to the condenser

D. in the above 1, 2, 3 cases

Answer: D

Watch Video Solution

6. The conduction current is same as displacement current when source is

A. AC only

B. DC only

C. Both AC or DC

D. Neither DC nor AC

Answer: C

 Watch Video Solution

7. Maxwell's equation laws of

A. electricity only

B. magnetism only

C. mechanics only

D. both 1 and 2

Answer: D

 Watch Video Solution

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

A. an e.m.f

B. electric current

C. magnetic field

D. pressure gradient

Answer: C

Watch Video Solution

9. The phase and orientation of the electric field vector linked with electromagnetic wave differ from those of the corresponding magnetic field vector, respectively by:

A. zero and zero

B. zero and $\pi/2$

C. $\pi/2$ and zero

D. $\pi/2$ and $\pi/2$

Answer: C

Watch Video Solution

10. The velocity of electromagnetic wave is parallel to

A. $\overrightarrow{B} \times \overrightarrow{E}$

B. $\overrightarrow{E} \times \overrightarrow{B}$

C. $\overrightarrow{E}$

D. $\overrightarrow{B}$

Answer: B

Watch Video Solution

11. The electromagnetic waves do not transport

A. Charge

B. Energy

C. Momentum

D. Information

Answer: A

 Watch Video Solution

12. Electromagnetic waves are transverse is nature is evident by

A. Polarization

B. nterference

C. reflection

D. Diffraction

Answer: A

Watch Video Solution

13. Choose the only wrong statement from the following about electromagnetic waves

A. are transverse

B. travel with same speed in all media

C. travel with the speed of light in spac

D. are produced by accelerating charge

Answer: B

 Watch Video Solution

14. Which of the following statement is true ?

A. Velocity of light is constant in all media

B. Velocity of light in vacuum is maximum

C. Velocity of light is not same in all reference frames

D. Velocity of light in denser medium is greater than that in rarer medium

Answer: B

 Watch Video Solution

15. An electromagnetic wave going through vacuum is described by

$E = E_0 \sin(kx - \omega t), B = B_0 \sin(kx - \omega t).$

Then

A. $E_0 = B_0$

B. $E_0\omega = B_0 k$

C. $E_0 B_0 = \omega k$

D. $E_0 k = B_0\omega$

Answer: D

Watch Video Solution

16. Which of the following rays has minimum frequency?

A. U.V rays

B. X-rays

C. microwaves

D. infrared rays

Answer: C

Watch Video Solution

17. Which of the following are not electromagnetic waves?

(i) α-rays

(ii) Radio waves

(iii) β-rays

(iv) Sound waves

(v) Micro waves

(vi) Cosmic rays

A. X-rays

B. γ rays

C. β rays

D. heat rays

Answer: C

Watch Video Solution

18. Which of the following electromagnetic waves has smallest wavelength?

A. visible

B. I.R rays

C. UV rays

D. radio waves

Answer: C

Watch Video Solution

19. Which of the following waves has the longest wavelength?

A. x rays

B. I.R rays

C. UV rays

D. radio waves

Answer: D

Watch Video Solution

20. If u_E and u_B be the time average of the electric and magnetic field energy densities at a point due to electromagnetic wave, then

A. $u_E = u_B$

B. $u_E = 2u_B$

C. $2u_E = \mu_B$

D. none of these

Answer: A

21. An electromagnetic radiation has an energy 14.4eV. To which region of electromagnetic spectrum belongs to

A. UV region

B. visible region

C. IR rays region

D. γ ray region

Answer: A

Watch Video Solution

22. The frequency of $\gamma - rays$, X-rays and ultraviolet rays are a,b,c and c respectivley.

A. $a > b, b > c$

B. $a < b, b > c$

C. $a > b, b < c$

D. $a < b, b < c$

Answer: B

Watch Video Solution

23. Assume that a lamp radiates power P uniformly in all directions. The magnitude of

electric field strength at a distance r from the lamp is

A. $E_0 = \frac{P_0}{2\pi\varepsilon_0 cr^2}$

B. $E_0 = \frac{\sqrt{P_0}}{2\pi\varepsilon_0 cr^2}$

C. $E_0 = \frac{\sqrt{P_0}}{4\pi\varepsilon_0 cr^2}$

D. $E_0 = \frac{\sqrt{P_0}}{s8\pi\varepsilon_0 cr}$

Answer: B

Watch Video Solution

24. When a low flying aeroplane passes over head, we sometimes notice a slight shaking of the picture on our TV screen. This is due to

A. diffraction of the signal received from the antenna

B. interference of the direct signal received by the antenna with the weak signal reflected by the passing aircraft

C. Change of magnetic flux occurring due to the passage of aircraft

D. vibrations created by the passage of aircraft

Answer: C

Watch Video Solution

25. A : If the earth did not have an atmosphere, its average surface temperature would have been lower.

R : In the absence of atmosphere, the green house effect will be absent.

A. the same

B. less than the present

C. more than the present

D. -273°C (considering the absorption of EM waves by ozone layer)

Answer: B

Watch Video Solution

26. Ozone layer protestes the living cells from

A. visible ligh

B. u.v. radiation

C. infrared radiation

D. microwave radiation

Answer: B

Watch Video Solution

27. Ozone layer blocks the radiations of wave length:

(1.) less than $3 \times 10 - 7$ m

(2.)equal to 3 × 10 − 7 m

(3.)more than 3 × 10 − 7 m

(4.)All of the above

A. less than 3×10^{-7} m

B. equal to 3×10^{-7} m

C. more than 3×10^{-7} m

D. all of these

Answer: A

Watch Video Solution

28. Practically ozone layer absorbs the radiation of wavelength

A. $< 3000A^{\circ}$

B. $> 3000A^{\circ}$

C. $4000A^{\circ} \rightarrow 8000A^{\circ}$

D. $10^3 \rightarrow 10^6 A^{\circ}$

Answer: A

Watch Video Solution

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

A. E/C

B. 2E/C

C. EC

D. E/C^2

Answer: B

Watch Video Solution

30. The type of electromagnetic wave propagation which is effected as a result of reflection in the upper ionosphere of atmosphere is known as:

A. air wave propagation

B. space wave propagation

C. sky wave propagation

D. tropospheric propagation

Answer: C

Watch Video Solution

31. X-rays are known as to be electromagnetic radiation. Therefore the X-ray photon has

A. electric charge but no magnetic moment

B. magnetic moment but no electric charge

C. both electric charge and magnetic moment

D. neither electric charge nor magnetic moment

Answer: D

Watch Video Solution

32. The altitude of the ozone layer in the atmosphere and the 'type' of the electromagnetic waves emitted by the sun being absorbed by it are respectively:

A. 80 km, infrared rays

B. 40 km, infrared rays

C. 90 km, ultraviolet rays

D. 50 km, ultraviolet rays

Answer: D

Watch Video Solution

33. Four atmospheric layers are given below, namely (i) stratosphere (ii) Thermosphere, (iii) mesosphere and (iv) troposphere The lowermost and higher most layers are respectively :

A. i) and (iv)

B. iii) and (i)

C. (iv) and (ii)

D. (iii) and (ii)

Answer: C

34. Infrared radiations are detected by

A. spectrometer

B. pyrometer

C. nanometer

D. photometer

Answer: B

35. Finger prints on a piece of paper may be detected by sprinkling fluorescent powder on the paper and then looking it into

A. dark light

B. sun light

C. Infra red light

D. Ultra violet ligh

Answer: D

Watch Video Solution

36. The atmosphere above the height of 80 km is called

A. stratosphere

B. Troposphere

C. mesosphere

D. Thermosphere

Answer: D

37. The frequency from 3Hz to 30MHz is known as

A. Audio band

B. Medium frequency band

C. Very high frequency band

D. High frequency band

Answer: A,B,D

Watch Video Solution

38. The frequency from $3 \times 10^9 Hz$ to 3×10^{10} Hz is

A. High frequency band

B. Super high frequency band

C. Ultra high frequency band

D. Very high frequency band

Answer: B

Watch Video Solution

39. A cube of edge a has its edges parallel to X, Y and Z -axis of rectangular coordinate system. A uniform electric held E is parallel to Y-axis and uniform magnetic field B parallel to x axis.

The rate at which energy flows through each face of the cube is

A. $\frac{a^2EB}{2\mu_0}$ parallel to X-Y plane and zero in others

B. $\frac{a^2EB}{\mu_0}$ parallel to Y-Z plane and zero in others

C. $\frac{a^2EB}{2\mu_0}$ from all faces

D. $\frac{a^2EB}{2\mu_0}$ parallel to X-Z faces and zero in others

Answer: B

Watch Video Solution

40. Green house effect is

A. absorption of ultraviolet radiation by ozone layer

B. transmission of visible light by atmosphere

C. good weather

D. reflection of infrated rays emitted by earth by atmosphere

Answer: D

41. One requires 11eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in

A. Visible region

B. Infrared region

C. Ultraviolet region

D. Microwave region

Answer: C

Watch Video Solution

42. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is

A. $C:1$

B. $C^2 : 1$

C. $1 : 1$

D. $\sqrt{c : 1}$

Answer: C

43. An electromagnetic wave radiates outwards from a dipole antenna, with E_0 as the amplitude of its electric field vector. The electric

field E_0 which transports significant energy from the source falls off as

A. $\frac{1}{r^3}$

B. $\frac{1}{r^2}$

C. $\frac{1}{r}$

D. remains constants

Answer: C

Watch Video Solution

44. A variable frequency AC source is connected a capacitor . How will the displacement current change with decrease in frequency?

A. Increase

B. decrease

C. remains same

D. becomes zero

Answer: B

Watch Video Solution

45. The condition under which a microwave oven heats up a food item containing water molecules most efficiently is

A. The frequency of the microwave must match the resonant frequency of the water molecules

B. The frequency of the microwaves has no relation with natural frequency of water molecules

C. Microwaves are heat waves, so always produce heating

D. Infra-red waves produce heating in a microwave oven

Answer: A

Watch Video Solution

46. Match List-I (Electromagnetic wave type) with List-II (Its association/application) and select the correct option from the choice 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

Watch Video Solution

47. Electromagnetic waves with wavelength

(i) λ_1 is used in satellite communication.

(ii) λ_2 is used to kill germs in water purifies.

(iii) λ_3 is used to detect leakage of oil in underground pipelines.

(iv) λ_4 is used to inprove visibility in runways during fog and mist conditions.

(a) Identify and name the part of electromagnetic spectrum to which these radiations belong.

(b) Arrange these wavelengths in ascending order their magnitude.

(c) Write one more application of each.

A. $\lambda_3 > \lambda_2 > \lambda_4 > \lambda_1$

B. $\lambda_3 < \lambda_2 < \lambda_4 < \lambda_1$

C. $\lambda_3 < \lambda_4 < \lambda_1 < \lambda_2$

D. $\lambda_3 < \lambda_2 < \lambda_4 < \lambda_1$

Answer: D

Watch Video Solution

Exercise Ib

1. Statement 1: Electric field produced by changing magnetic field is nonconservative.

Statement 2: For the electric field $\vec{E}$ induced by a changing magnetic field which has closed lines of force, $\oint \vec{E} \cdot \vec{dl} = 0$

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

2. (A): When a capacitor is getting charged the conduction current in the connecting wires at any instant is equal to the displacement

current in between the capacitor plates. (R) : Conduction current is always greater than the displacement current.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: C

Watch Video Solution

3. (A): The tails of comets are always oriented in a direction away from Sun (R) : Electromagentic waves exert pressure.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

4. (A) : The radiation force on an absorbing surface is twice that on a reflecting surface. (R) : The radiation force on a reflecting surface is twice that on an absorbing surface.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: D

Watch Video Solution

5. (A) : A light beam or a radio beam of same intensity will have same values of $\vec{E}$ and $\vec{B}$ (R)

: A light beam or a radio beam of same intensity will have different values of $\vec{E}$ and $\vec{B}$

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: C

 Watch Video Solution

6. (A) : UV rays are used for sterilizing surgical instruments in hospitals. (R) : IR rays are used for sterilizing surgical instruments in hospitals.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: C

Watch Video Solution

7. (A) : A magnetic field is produced either by a steady current or by a time varying electric field

(R) : According to Ampere's law $\oint \overline{B}.\,\bar{d}\,l = \mu_0 i_0 + \mu_0 \varepsilon_0 \frac{d\oint_E}{dt}$

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: C

Watch Video Solution

8. (A) : When a mixer in a kitchen is switched on the sound from a radio in the kitchen gets

nosiy. (R) : The sparking inside the mixer generates electromagnetic waves

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

 Watch Video Solution

9. (A) : In an electromagnetic wave, the electric and magnetic fields oscillate in phase (R) : In an electromagnetic wave, the electric and magnetic fields oscillate out of phase.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: C

Watch Video Solution

10. (A) : Electromagnetic waves are tranverse in nature. (R) : The Poynting,s vector which gives the power density is given by $\vec{P} = \vec{E} \times \vec{B}$

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

11. (A) : We do not feel the pressure when sun shines on our hand even the energy being absorbed from the EM waves (Our hands get

warm). (R) : EM waves transfer momentum to our hands but because speed of light is very large so the momentum transfered is very small.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

12. (A) : In micro wave oven the energy is not wasted in heating up the vessel. (R) : The principle of microwave oven is to generate microwave radiation with magnetron source of appropriate frequency in the work space of the oven where we keep food.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

13. A : infrared waves are often called heat waves.

R : Infrared waves vibrate not only the electrons, but entire atoms or molecules of a substance which increases the internal energy and temperature of the substance.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

14. A : The centre of sensitivity of our eyes coincides with the centre of the wavelength distribution of the sun.

R : Humans have evolved with visions most

sensitive to the strongest wavelength from the sun.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

 Watch Video Solution

15. A current I is flowing in a straight conductor of length L. The magnetic induction at a point distant $\frac{L}{4}$ from its centre will be

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: D

16. (A) : In Ampere Maxwell law, displacement current has same physical effect as conduction current. (R) : The units and dimensions of displacement current and conduction current are same.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: B

 Watch Video Solution

17. (A): Speed of EM wave in a medium depends on electrical permittivity and magnetic permeability of the medium (R) E.M wave

transport energy in the form of oscillating electric and magnetic fields

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

18. (A): E.M. waves can show diffraction effect

(R) : E.M waves are transverse waves.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

19. (A): In electromagnetic wave, electric and magnetic fields oscillate in the same plane and in the same phase. (R) Electric field is the primary energy carrier in the electromagnetic wave.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: D

Watch Video Solution

20. (A): The light can travel in vacuum but sound cannot do so (R) : Light is an electromagnetic wave and sound is a mechanical wave

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

21. (A): Gamma rays are more energetic than X-rays (R) : Gamma rays are of nuclear origin but X-rays are produced due to sudden deceleration of high energy electron while falling on a metal of high atomic number

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

22. Assertion : The earth without its atmosphere would be inhospitably cold. Reason : All heat would escape in the absence of atmosphere .

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

23. A : Environmental damage has depleted the ozone layer in the atmosphere.

R : Increase in ozone decreases the amount of UV radiation to earth.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: D

 Watch Video Solution

24. (A) : The microwaves are better carriers of signals than radio waves. (R) : The electromagnetic waves do not require any medium for propagation.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: B

Watch Video Solution

25. Assertion (A) : The presence of CO_2 in the air accelerates corrosion.

Reason (R) : CO_2 is a poisonous gas.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

26. A satellite orbiting close to the surface of earth does not fall down because the gravitational pull of earth :

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

27. (A) : The average magnitude of poynting vector $\overrightarrow{S}$ is the intensity of electromagnetic wave. (R) : Poynting vector is given by $\overrightarrow{S} = \frac{\overrightarrow{E} \times \overrightarrow{B}}{2\mu_0}$

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: C

Watch Video Solution

28. A : Long distance radio broadcasts use short-wave bands.

R : Ionosphere reflects waves in these bands.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

29. A : It is necessary to use satellites for long distance TV transmission.

R : Television signals are not properly reflected by the ionosphere therefore, reflection is effected by satellites.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

30. A : Optical and radio telescopes are built on the ground but X-ray astronomy is possible only from satellites orbiting the earth.

R : Atmosphere absorbs X-rays, while visible and radiowaves can penetrate it.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

31. The ozone layer on the top of the stratosphere is crucial for human survival.Explain why?

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

32. Assertion A pulsar is a source of radio waves that varies in intensity at regular intervals

Reason A pulsar is a rotating neutron star

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

33. (A) : Quasar emits radiowaves more than radio galaxy. (R) : Quasar has very small size.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: B

Watch Video Solution

34. (A) : Dipole oscillations produce electro-magnetic waves. (R) : Accelerated charge produces electromagnetic waves.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

35. Assertion (A) : $\wedge_{m(H^{\oplus})}$ and $\wedge_{m\left(\overset{c}{O}H\right)}$ ions are very much higher than those of other ions.

Reason (R) : It is due to proton jump from one water molecule to another resulting in a more rapid transfer of positive charge form one region to another.

(a)If both (A) and (R) are correct, and (R) is

the correct explanation of (A).

(b)If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

(c)If (A) is correct, but (R) is incorrect.

(d)If (A) is incorrect, (R) is correct.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: A

Watch Video Solution

36. (A) : In electromagnetic waves electric field and magnetic field lines are perpendicular to each other. (R) : Electric field and magnetic field are self sustaining.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: B

 Watch Video Solution

37. The transverse nature of electromagnetic waves is proved by which of the following?

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'.

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A

C. A' is true and 'R' is false

D. 'A' is false and R' is true

Answer: B

Watch Video Solution

Exercise Ii

1. A parallel plate capacitor consists of two circular plates each of radius 2cm, separated by a distance of 0.1mm. If the potential difference across the plates is varying at the rate of $5 \times 10^{6} Vs^{-1}$, then the value of displacement current is

A. $5.50A$

B. 5.56×10^{-2}A

C. 5.56×10^{-4}A

D. 2.28×10^{4}A

Answer:

Watch Video Solution

2. The cell potential of a hydrogen electrode at pH =10

A. $1 \times 10^9 Vs^{-1}$

B. $2 \times 10^9 Vs^{-1}$

C. $3 \times 10^9 Vs^{-1}$

D. $2 \times 10^{10} Vs^{-1}$

Answer: B

3. Lesch Nyhan disease is an X-linked recessive disorder that causes neurological damage in human beings. A survey of 500 males from a caucasion population revealed that 20 were effected with this disorder. What is the frequency of the normal allele in this population ?

A. $6.9\mu A$

B. $2.3\mu A$

C. $9.2\mu A$

D. $4.6\mu A$

Answer:

Watch Video Solution

4. A parallel plate capacitor of plate separation 2 mm is connected in an electric circuit having source voltage 400V. If the plate area is 60 cm2,

then the value of displacement current for 10^{-6} sec. will be

A. 1.062 amp

B. 1.062×10^{-2} amp

C. 1.062×10^{-3} amp

D. 1.062×10^{-4} amp

Answer:

Watch Video Solution

5. A condenser has two conducting plates of radius 10cm separated by a distance of 5mm. It is charged with a constant cunent of 0.15 A. The magnetic field at a point 2cm from the axis in the gap is

A. 6×10^{-8} T

B. 3×10^{-8} T

C. 6×10^{-6} T

D. 3×10^{-6} T

Answer:

Watch Video Solution

6. An AC rms voltage of 2V having a frequency of 50 KHz is applied to a condenser of capacity of $10\mu F$. The maximum value of the magnetic field between the plates of the condenser if the radius of plate is 10cm is

A. $0.4\mu T$

B. $2\mu T$

C. $4\sqrt{2}\mu T$

D. $40\mu T$

Answer:

Watch Video Solution

7. A condenser is charged using a constant current. The ratio of the magnetic fields at a distance of R/2 and R from the axis is (R is the radius of plate)

A. $1:1$

B. $2:1$

C. $1:2$

D. $1:4$

Answer:

Watch Video Solution

8. The magnetic field between the plates of radius 12 cm separated by distance of 4mm of a parallel plate capacitor of capacitance 100 pF. along the axis of plates having conduction current of 0.15 A is

A. zero

B. $1.5T$

C. 15 T

D. $0.15T$

Answer:

9. A wave of the wavelength 5900Å emitted by an atom or molecule must have some finite total length which is known as coherence length. For the mentioned wave, this length is

2.4 cm. The number of oscillations in this length will be.

A. 4.068×10^4 Hz

B. 4.068×10^5 Hz

C. 4.068×10^6 Hz

D. 4.068×10^7 Hz

Answer:

Watch Video Solution

10. Electron exicted from lower orbit to higher orbit and returns back to ground state from excited state with a life time1 nanosecond by emitting a photon of wave length 600nm. Calculate uncertainity in the energy of the excited state. Also calculate the percentage uncertainity, if the energy is measured from ground state.

A. 5ω

B. 379.6ω

C. 3776ω

D. 1883ω

Answer:

11. The cell constant is given by

A. 1.5

B. 1.1414

C. 1.732

D. 1.6

Answer:

Watch Video Solution

12. An electromagnetic wave of frequency $v = 3$ MHz passes from vacuum into a dielectric medium with permittivity $\varepsilon = 4$. Then

A. wave length doubled and frequency re mains unchanged

B. wave length is doubled and frequency be comes half

C. wave length is halved and frequency remains constant

D. wave length and frequency both remain unchanged

Answer:

Watch Video Solution

13. A plane electromagnetic wave of frequency 50 MHz travels in free space along the x-direction. At a particular point in space and

time, $\overrightarrow{E} = 6.3\hat{j}\text{V m}^{-1}$.

At this point $\overrightarrow{B}$ is equal to

A. $4.2 \times 10^{-8}\hat{k}T$

B. $2.1 \times 10^{-8}\hat{k}T$

C. $18.9 \times 10^{-8}\hat{k}T$

D. $2.1 \times 10^{-8}\hat{i}T$

Answer:

Watch Video Solution

14. A plane electromagnetic wave of frequency 40 MHz travels in free space in the x-direction. At some point and at some instant , the the electrical field $\overrightarrow{E}$ has it maximum value of $750NNC^{-1}$ in the y - direction . The magnitude and direction of the magnetic field will be -

A. $2.5\mu T$ alon X axis

B. $2.5\mu T$ alon Y axis

C. $2.5\mu T$ alon Z axis

D. μT alon Z axis

Answer:

Watch Video Solution

15. In an apparatus, the electric field was found to oscillate with an amplitude to $18Vm^{-1}$. The magnitude of the oscillating magnetic field will be

A. 6×10^{-8} T

B. 4.23×10^{-8} T

C. 9×10^{-8} T

D. 7.0×10^{-8} T

Answer:

Watch Video Solution

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

A. $\left(\hat{i} - 2\hat{j}\right)$ and $\left(2\hat{i} - \hat{j}\right)$

B. $\left(-2\hat{i}-3\hat{j}\right)$ and $\left(3\hat{i}-2\hat{j}\right)$

C. $\left(2\hat{i}+3\hat{j}\right)$ and $\left(\hat{i}+2\hat{j}\right)$

D. $\left(3\hat{i}+4\hat{j}\right)$ and $\left(4\hat{i}-3\hat{j}\right)$

Answer:

Watch Video Solution

17. The amplitude of electric field in an electromagnetic wave is $60Vm^{-1}$. Then the amplitude of magnetic field is

A. 12×10^7 T

B. 6×10^7 T

C. 6×10^{-7} T

D. 2×10^{-7} T

Answer:

Watch Video Solution

18. Light with an energy flux of $18 W / cm^2$ falls on a non-reflecting surface at normal incidence. The pressure exerted on the surface is

A. $1.2 \times 10^{-6} kgms^{-1}$

B. $2.16 \times 10^{-3} kgms^{-1}$

C. $1.8 \times 10^{-3} kgms^{-1}$

D. $3.2 \times 10^{-3} kgms^{-1}$

Answer:

Watch Video Solution

19. A uniform round object of mass M, radius R and moment of inertia about its centre of mass I_{cm} has a light, thin string wrapped several

times around its circumference. The free end of string is attaced to the celling and the object is released from rest. Find the acceleration of centre of the object and tension n the string. [Take $\frac{I_{cm}}{MR^2} = k$]

A. $1.1\mu kgms^{-1}$

B. $2.2\mu kgms^{-1}$

C. $3.3\mu kgms^{-1}$

D. $4.4\mu kgms^{-1}$

Answer:

Watch Video Solution

20. Light with energy flux 36w/cm2 is incident on a well polished metal square plate of side 2cm. The force experienced by it is

A. $0.96\mu N$

B. $0.24\mu N$

C. $0.12\mu N$

D. $0.36\mu N$

Answer: 0.96

Watch Video Solution

Watch Video Solution

21. The maximum electric field of a plane electro- mag-netic wave is 88 V/m. The average energy density is

A. $3.4 \times 10^{-8} Jm^{-3}$

B. $13.7 \times 10^{-8} Jm^{-3}$

C. $6.8 \times 10^{-8} Jm^{-3}$

D. $1.7 \times 10^{-8} Jm^{-3}$

Answer:

Watch Video Solution

Watch Video Solution

22. The maximum electric field of a plane electro- mag-netic wave is 88 V/m. The average energy density is

A. $4.3 \times 10^{-7} Jm^{-3}, 2.15 \times 10^{-7} Jm^{-3}$

B. $4.1 \times 10^{-7} Jm^{-3}, 8.6 \times 10^{-7} Jm^{-3}$

C. $2.15 \times 10^{-7} Jm^{-3}, 4.3 \times 10^{-7} Jm^{-3}$

D. $8.6 \times 10^{-7} Jm^{-3}, 4.3 \times 10^{-7} Jm^{-3}$

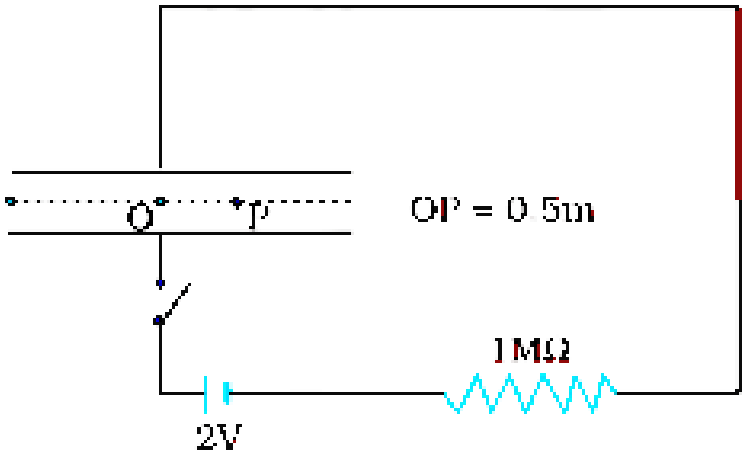
Answer:

Watch Video Solution

Example 1

1. A parallel plate capacitor with circular plates of radius 1 m has a capacitance of 1 nF. ?At t=0, it is connected for charging in series with a resitor R=1M Ω across a 2V battery (Fig. 8.3) calculate the magnetic field at a point P. halfway between the centre and the periphery of the plates after l=10^{-3}s. (The charge on the capacitor at time l is $q(l) = CV$ [1-exp(-t/r)].

where the time constant r is equal to CR.)



Watch Video Solution

Example 2

1. A plane electromagnetic wave of frequency 50 MHz travels in free space along the x-

direction. At a particular point in space and time, $\vec{E} = 6.3\hat{j}\,\mathrm{V\ m^{-1}}$.

At this point $\vec{B}$ is equal to

Watch Video Solution

Example 3

1. The magnetic field in a plane electromagnetic wave is given by

$B_y = 2 \times 10^7 T \sin\left(0.5 \times 10^3 x + 1.5 \times 10^{11} t\right) T$

(a) What is the wavelength and frequency of

the wave?

(b) Write an expression for the eletric field.

Watch Video Solution

Example 4

1. Light with an energy flux of $18 W / cm^2$ falls on a non-reflecting surface at normal incidence. If the surface has an area of $20 cm^2$. Find the average force exrted on the surface during a 30 minute time span.

Watch Video Solution

Example 5

1. Calculate the electric and magnetic fields produced by the radiation coming from a 100 W bulb at a distance of 3 m. Assume that the efficiency of the bulb is 2.5% and it is a point source.

Watch Video Solution