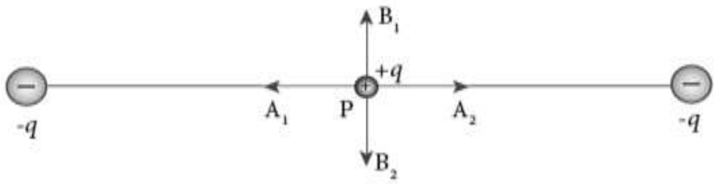
ONE MARK QUESTIONS

UNIT – I : ELECTROSTATICS

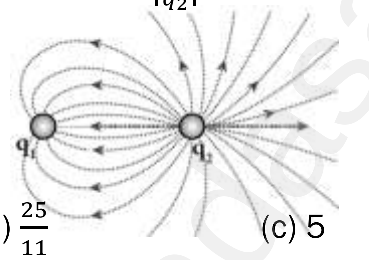
1. Two identical point charges of magnitude –q are fixed as shown in the figure below. A third charge +q is placed midway between the two charges at the point P. Suppose this charge +q is displaced a small distance from the point P in the directions indicated by the arrows, in which direction(s) will +q be stable with respect to the displacement?



(a) A_1 and A_2 (b) B_1 and B_2 (c) both directions (d) No stable

2. Which charge configuration produces a uniform electric field?
(a) point charge (b) uniformly charged infinite line
(c) uniformly charged infinite plane (d) uniformly charged spherical shell

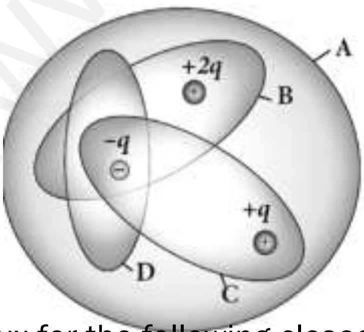
3. What is the ratio of the charges $\left|\frac{q_1}{q_2}\right|$ for the following electric field line pattern?



(a) $\frac{1}{5}$ (b) $\frac{25}{11}$ (c) 5 (d) $\frac{11}{25}$

4. An electric dipole is placed at an alignment angle of 30^0 with an electric field of 2×10^5 N C^{-1}. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm is
(a) 4 mC (b) 8 mC (c) 5 mC (d) 7 Mc

5. Four Gaussian surfaces are given below with charges inside each Gaussian surface. Rank the electric flux through each Gaussian surface in increasing order.



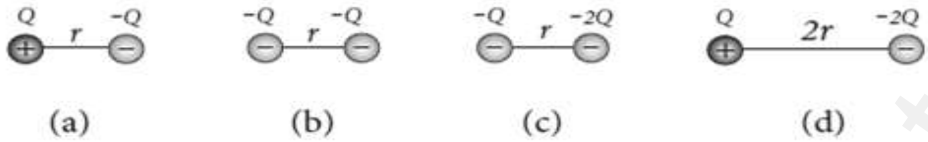
(a) D < C < B < A (b) A < B = C < D
(c) C < A = B < D (d) D > C > B > A

6. The total electric flux for the following closed surface which is kept inside water

(a) $\frac{80q}{\varepsilon_0}$ (b) $\frac{q}{40\varepsilon_0}$ (c) $\frac{q}{80\varepsilon_0}$ (d) $\frac{q}{160\varepsilon_0}$

7. Two identical conducting balls having positive charges q_1 and q_2 are separated by a centre to centre distance r. If they are made to touch each other and then separated to the same distance, the force between them will be
(a) less than before (b) same as before (c) more than before (d) zero

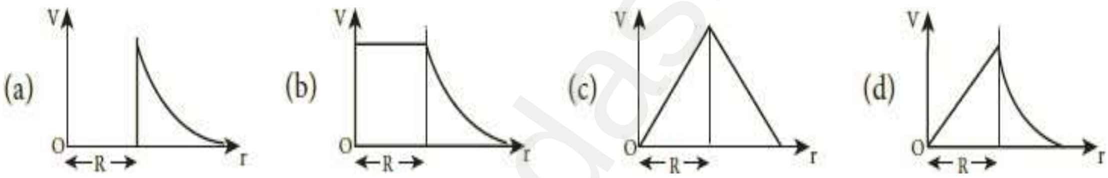
8. Rank the electrostatic potential energies for the given system of charges in increasing order.



(a) 1 = 4 < 2 < 3 (b) 2 = 4 < 3 < 1
(c) 2 = 3 < 1 < 4 (d) 3 < 1 < 2 < 4

9. An electric field $\vec{E} = 10x\hat{i}$ exists in a certain region of space. Then the potential difference $V = V_0 - V_A$, where V_0 is the potential at the origin and V_A is the potential at x = 2 m is :
(a) 10V (b) –20 V (c) +20 V (d) –10 V

10. A thin conducting spherical shell of radius R has a charge Q which is uniformly distributed onits surface. The correct plot for electrostatic potential due to this spherical shell is

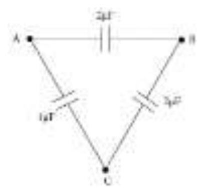


11. Two points A and B are maintained at a potential of 7 V and –4 V respectively. The work done in moving 50 electrons from A to B is
(a) 8.80×10^{-17}J (b) -8.80×10^{-17}J (c) 4.40×10^{-17}J (d) 5.80×10^{-17}J

12. If voltage applied on a capacitor is increased from V to 2V, choose the correct conclusion.
(a) Q remains the same, C is doubled (b) Q is doubled, C doubled
(c) C remains same, Q doubled (d) Both Q and C remain same

13. Parallel plate capacitor stores a charge Q at a voltage V. Suppose the area of the Parallel plate capacitor and the distance between the plates are each doubled then which is the quantity that will change?
(a) Capacitance (b) Charge (c) Voltage (d) Energy density

14. Three capacitors are connected in triangle as shown in the figure. The equivalent capacitance between the points A and C is

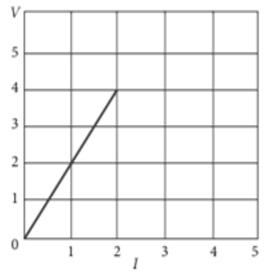


(a) 1μF (b) 2μF (c) 3μF (d) $\frac{1}{4}$ μF

15. Two metallic spheres of radii 1 cm and 3 cm are given charges of -1×10^{-2} C and 5×10^{-2} C respectively. If these are connected by a conducting wire, the final charge on the bigger sphere is
(a) 3×10^{-2}C (b) 4×10^{-2}C (c) 1×10^{-2}C (d) 2×10^{-2}C

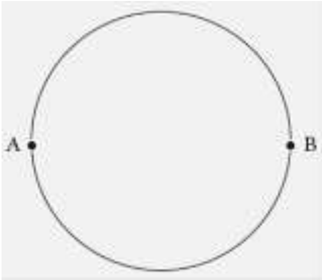
UNIT – 2 : CURRENT ELECTRICITY

16. The following graph shows current versus voltage values of some unknown conductor. What is the resistance of this conductor?



(a) 2 ohm (b) 4 ohm (c) 8 ohm (d) 1 ohm

17. A wire of resistance 2 ohms per meter is bent to form a circle of radius 1m. The equivalent resistance between its two diametrically opposite points, A and B as shown in the figure is



(a) π Ω (c) $\frac{\pi}{2}$ Ω (c) 2π Ω (d) $\frac{\pi}{4}$ Ω

18. A toaster operating at 240V has a resistance of 120 Ω. The power is
(a) 240W (b) 400W (c) 2W (d) 480W

19. A carbon resistor of (47 ± 4.7) k Ω to be marked with rings of different colours for its identification. The colour code sequence will be.....
(a) Yellow – Green – Violet – Gold (b) Yellow – Violet – Orange – Silver
(c) Violet – Yellow – Orange – Silver (d) Green – Orange – Violet - Gold

20. What is the value of resistance of the following resistor?

(a)100 k Ω (b)10 k Ω (c) 1k Ω (d)1000 k Ω

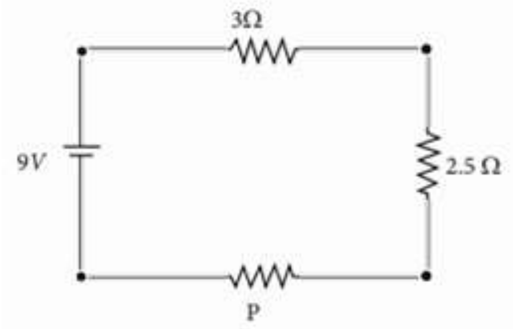
21. Two wires of A and B with circular cross section are made up of the same material with equal lengths. Suppose R_A = 3 R_B, then what is the ratio of radius of wire A to that of B?
(a) 3 (b) $\sqrt{3}$ (c) $\frac{1}{\sqrt{3}}$ (d) $\frac{1}{3}$

22. A wire connected to a power supply of 230 V has power dissipation P_1. Suppose the wire is cut into two equal pieces and connected parallel to the same power supply. In this case power dissipation is P_2 . The ratio $\frac{P_2}{P_1}$ is
(a) 1 (b) 2 (c) 3 (d) 4

23. In India electricity is supplied for domestic use at 220 V. It is supplied at 110 V in USA. If the resistance of a 60Wbulb for use in India is R, the resistance of a 60W bulb for use in USA will be
(a) R (b) $\frac{R}{4}$ (c) 2R (d) $\frac{R}{2}$

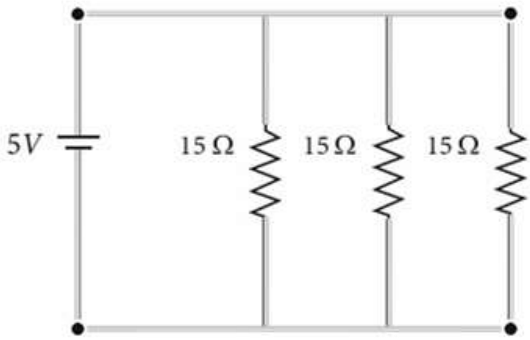
24. In a large building, there are 15 bulbs of 40W, 5 bulbs of 100W, 5 fans of 80W and 1 heater of 1kW are connected. The voltage of electric mains is 220V. The minimum capacity of the main fuse of the building will be
(a) 14 A (b) 8 A (c) 10 A (d) 12 A

25. There is a current of 1.0 A in the circuit shown below. What is the resistance of P ?



(a) 1.5 Ω (b) 2.5 Ω (c) 3.5 Ω (d) 4.5 Ω

26. What is the current drawn out from the battery?



(a) 1A (b) 2A (c) 3A (d) 4A

27. The temperature coefficient of resistance of a wire is 0.00125 per °C. At 20°C, its resistance is 1 Ω. The resistance of the wire will be 2 Ω at

(a) 800 °C (b) 700 °C (c) 850 °C (d) 820 °C

28. The internal resistance of a 2.1 V cell which gives a current of 0.2 A through a resistance of 10 Ω is

(a) 0.2 Ω (b) 0.5 Ω (c) 0.8 Ω (d) 1.0 Ω

29. A piece of copper and another of germanium are cooled from room temperature to 80 K. The resistance of

(a) each of them increases

(b) each of them decreases

(c) copper increases and germanium decreases

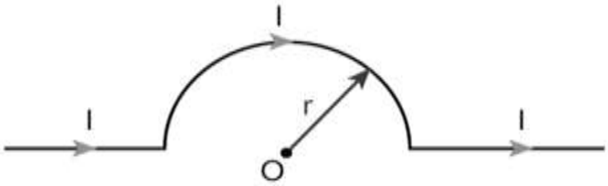
(d) copper decreases and germanium increases

30. In Joule's heating law, when R and t are constant, if the H is taken along the y axis and I^2 along the x axis, the graph is

(a) straight line (b) parabola (c) circle (d) ellipse

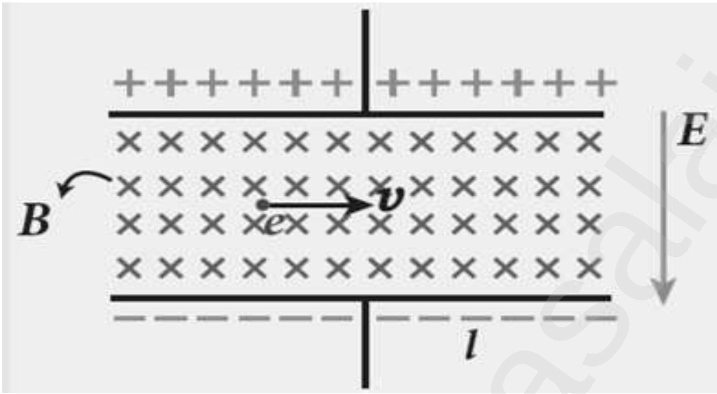
UNIT – 3 : MAGNETISM AND MAGNETIC EFFECTS OF ELECTRIC CURRENT

31. The magnetic field at the centre O of the following current loop is



(a) $\frac{\mu_0 I}{4r} \otimes$ (b) $\frac{\mu_0 I}{4r} \odot$ (c) $\frac{\mu_0 I}{2r} \otimes$ (d) $\frac{\mu_0 I}{2r} \odot$

32. An electron moves in a straight line inside a charged parallel plate capacitor of uniform charge density σ. The time taken by the electron to cross the parallel plate capacitor un-deflected when the plates of the capacitor are kept under constant magnetic field of induction $\vec{B}$ is



(a) $\varepsilon_0 \frac{elB}{\sigma}$ (b) $\varepsilon_0 \frac{lB}{\sigma l}$ (c) $\varepsilon_0 \frac{lB}{e\sigma}$ (d) $\varepsilon_0 \frac{lB}{\sigma}$

33. The force experienced by a particle having mass m and charge q accelerated through a potential difference V when it is kept under perpendicular magnetic field $\vec{B}$is

(a) $\sqrt{\frac{2q^3BV}{m}}$ (b) $\sqrt{\frac{q^3B^2V}{2m}}$ (c) $\sqrt{\frac{2q^3B^2V}{m}}$ (d) $\sqrt{\frac{2q^3BV}{m^3}}$

34. A circular coil of radius 5 cm and 50 turns carries a current of 3 ampere. The magnetic dipole moment of the coil is

(a) 1.0 amp – m^2 (b) 1.2 amp – m^2 (c) 0.5 amp – m^2 (d) 0.8 amp – m^2

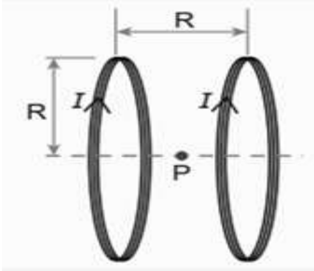
35. A thin insulated wire forms a plane spiral of N = 100 tight turns carrying a current I=8 m A (milli ampere). The radii of inside and outside turns are a=50 mm and b=100 mm respectively. The magnetic induction at the centre of the spiral is

(a) 5 μT (b) 7 μT (c) 8 μT (d) 10 μT

36. Three wires of equal lengths are bent in the form of loops. One of the loops is circle, another is a semi-circle and the third one is a square. They are placed in a uniform magnetic field and same electric current is passed through them. Which of the following loop configuration will experience greater torque?

(a) circle (b) semi-circle c) square (d) all of them

37. Two identical coils, each with N turns and radius R are placed coaxially at a distance R as shown in the figure. If I is the current passing through the loops in the same direction, then the magnetic field at a point P at a distance of R/2 from the centre of each coil is

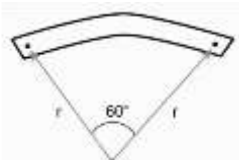


(a) $\frac{8N\mu_0 I}{\sqrt{5}R}$ (b) $\frac{8N\mu_0 I}{5^{\frac{3}{2}}R}$ (c) $\frac{8N\mu_0 I}{5R}$ (d) $\frac{4N\mu_0 I}{\sqrt{5}R}$

38. A wire of length l carries a current I along the Y direction and magnetic field is given by $\vec{B} = \frac{\beta}{\sqrt{3}}(\vec{i} + \vec{j} + \vec{k})T$. The magnitude of Lorentz force acting on the wire is

(a) $\sqrt{\frac{2}{\sqrt{3}}}\beta Il$ (b) $\sqrt{\frac{1}{\sqrt{3}}}\beta Il$ (c) $\sqrt{2}\beta Il$ (d) $\sqrt{\frac{1}{\sqrt{2}}}\beta Il$

39. A bar magnet of length l and magnetic moment p_m is bent in the form of an arc as shown in figure. The new magnetic dipole moment will be

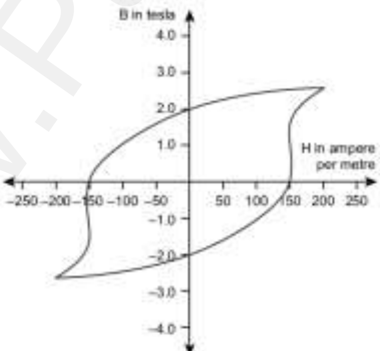


(a) p_m (b) $\frac{3}{\pi}p_m$ (c) $\frac{2}{\pi}p_m$ (d) $\frac{1}{2}p_m$

40. A non-conducting charged ring carrying a charge of q, mass m and radius r is rotated about its axis with constant angular speed ω. Find the ratio of its magnetic moment with angular momentum is

(a) $\frac{q}{m}$ (b) $\frac{q}{2m}$ (c) $\frac{2q}{m}$ (d) $\frac{q}{4m}$

41. The BH curve for a ferromagnetic material is shown in the figure. The material is placed inside a long solenoid which contains 1000 turns/cm. The current that should be passed in the solenonid to demagnetize the ferromagnet completely is



(a) 1.00 m A (b) 1.25 mA (c) 1.50 mA (d) 1.75 mA

42. Two short bar magnets have magnetic moments 1.20 Am^2 and 1.00 Am^2 respectively. They are kept on a horizontal table parallel to each other with their north poles pointing towards the south. They have a common magnetic equator and are separated by a distance of 20.0 cm. The value of the resultant horizontal magnetic induction at the mid-point O of the line joining their centers is (Horizontal components of Earth's magnetic induction is 3.6×10^{-5} Wb m^{-2})

(a) 3.60×10^{-5} Wb m^{-2} (b) 3.5×10^{-5} Wb m^{-2}

(c) 2.56×10^{-4} Wb m^{-2} (d) 2.2×10^{-4} Wb m^{-2}

43. The vertical component of Earth's magnetic field at a place is equal to the horizontal component. What is the value of angle of dip at this place?

(a) 30^{o} (b) 45^{o} (c) 60^{o} (d) 90^{o}

44. A flat dielectric disc of radius R carries an excess charge on its surface. The surface charge density is σ. The disc rotates about an axis perpendicular to its plane passing through the centre with angular velocity ω. Find the magnitude of the torque on the disc if it is placed in a uniform magnetic field whose strength is B which is directed perpendicular to the axis of rotation

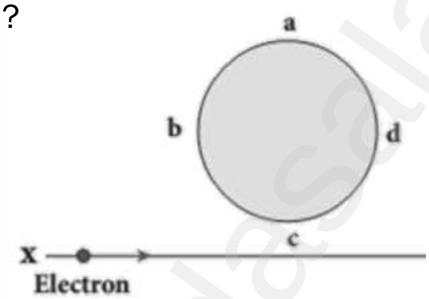
(a) $\frac{1}{4}\sigma\omega\pi BR$ (b) $\frac{1}{2}\sigma\omega\pi BR^2$ (c) $\frac{1}{4}\sigma\omega\pi BR^3$ (d) $\frac{1}{4}\sigma\omega\pi BR^4$

45. The potential energy of magnetic dipole whose dipole moment is $\vec{p}_m = (-5\hat{\imath} + 0.4\hat{\jmath})$ Am^2 kept in uniform magnetic field $\vec{B} = 0.2\hat{\imath}$

(a) −0.1 J (b) −0.8 J (c) 0.1 J (d) 0.8 J

UNIT – IV : ELECTROMAGNETIC INDUCTION AND ALTERNATING CURRENT

46. An electron moves on a straight line path XY as shown in the figure. The coil abcd is adjacent to the path of the electron. What will be the direction of current, if any, induced in the coil?

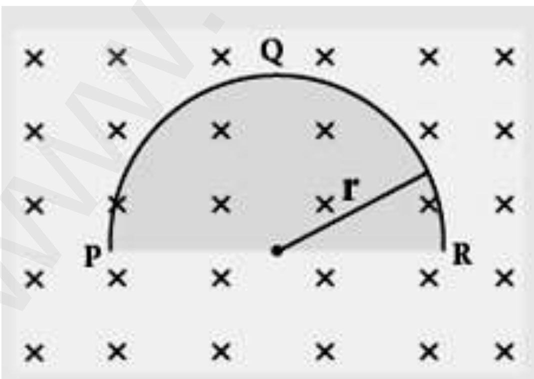


(a) The current will reverse its direction as the electron goes past the coil

(b) No current will be induced (c) abcd

(d) adcb

47. A thin semi-circular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in the figure.



The potential difference developed across the ring when its speed v , is

(a) Zero

(b) $\frac{Bv\pi r^2}{2}$ and P is at higher potential

(c) πrBv and R is at higher potential

(d) $2rBv$ and R is at higher potential

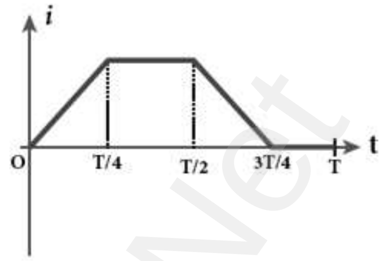
48. The flux linked with a coil at any instant t is given by $\Phi_B = 10t^2 - 50t + 250$. The induced emf at t = 3s is

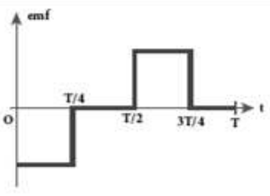
(a) −190 V (b) −10 V (c) 10 V (d) 190 V

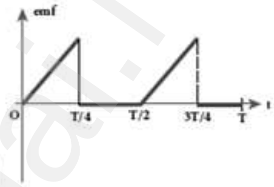
49. When the current changes from +2A to −2A in 0.05 s, an emf of 8 V is induced in a coil. The co-efficient of self-induction of the coil is

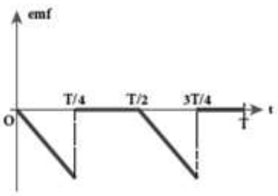
(a) 0.2 H (b) 0.4 H (c) 0.8 H (d) 0.1 H

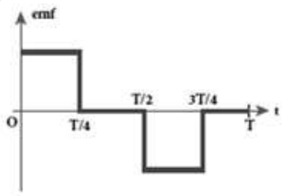
50. The current *i* flowing in a coil varies with time as shown in the figure. The variation of induced emf with time would be



(a)


(b)


(c)


(d)


51. A circular coil with a cross-sectional area of 4 cm² has 10 turns. It is placed at the centre of a long solenoid that has 15 turns/cm and a cross-sectional area of 10 cm². The axis of the coil coincides with the axis of the solenoid. What is their mutual inductance?

(a) 7.54 μH (b) 8.54 μH (c) 9.54 μH (d) 10.54 μH

52. In a transformer, the number of turns in the primary and the secondary are 410 and 1230 respectively. If the current in primary is 6A, then that in the secondary coil is

(a) 2 A (b) 18 A (c) 12 A (d) 1 A

53. A step-down transformer reduces the supply voltage from 220 V to 11 V and increase the current from 6 A to 100 A. Then its efficiency is

(a) 1.2 (b) 0.83 (c) 0.12 (d) 0.9

54. In an electrical circuit, RLC and AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and current in the circuit is $\frac{\pi}{3}$. Instead, if C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) 1 (d) $\frac{\sqrt{3}}{2}$

55. In a series RL circuit, the resistance and inductive reactance are the same. Then the phase difference between the voltage and current in the circuit is
(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{6}$ (d) zero

56. In a series resonant RLC circuit, the voltage across 100 Ω resistor is 40 V. The resonant frequency ω is 250 rad/s. If the value of C is 4 μF, then the voltage across L is
(a) 600 V (b) 4000 V (c) 400V (d) 1 V

57. An inductor 20 mH, a capacitor 50 μF and a resistor 40 Ω are connected in series across a source of emf v = 10 sin 340 t. The power loss in AC circuit is
(a) 0.76 W (b) 0.89 W (c) 0.46 W (d) 0.67 W

58. The instantaneous values of alternating current and voltage in a circuit are $i = \frac{1}{\sqrt{2}}\sin(100\,\pi\pi t)$ A and $v = \frac{1}{\sqrt{2}}\sin(100\,\pi\pi t+\frac{\pi}{3})$ V. The average power in watts consumed in the circuit is
(a) $\frac{1}{4}$ (b) $\frac{\sqrt{3}}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{8}$

59. In an oscillating LC circuit, the maximum charge on the capacitor is Q. The charge on the capacitor when the energy is stored equally between the electric and magnetic fields is
(a) $\frac{Q}{2}$ (b) $\frac{Q}{\sqrt{3}}$ (c) $\frac{Q}{\sqrt{2}}$ (d) Q

60. $\frac{20}{\pi^2}$ H inductor is connected to a capacitor of capacitance C. The value of C in order to impart maximum power at 50 Hz is
(a) 50 μF (b) 0.5 μF (c) 500 μF (d) 5 μF

UNIT – V : ELECTROMAGNETIC WAVES

61. The dimension of $\frac{1}{\mu_0\varepsilon_0}$ is
(a) $[L\,T^{-1}]$ (b) $[L^2\,T^{-2}]$ (c) $[L^{-1}\,T]$ (d) $[L^{-2}\,T^2]$

62. If the amplitude of the magnetic field is 3×10^{-6} T, then amplitude of the electric field for a electromagnetic waves is
(a) 100 Vm^{-1} (b) 300 Vm^{-1} (c) 600 Vm^{-1} (d) 900 Vm^{-1}

63. Which of the following electromagnetic radiation is used for viewing objects through fog
(a) microwave (b) gamma rays (c) X- rays (d) infrared

64. Which of the following are false for electromagnetic waves
(a) transverse (b) mechanical waves
(c) longitudinal (d) produced by accelerating charges

65. Consider an oscillator which has a charged particle oscillating about its mean position with a frequency of 300 MHz. The wavelength of electromagnetic waves produced by this oscillator is
(a) 1 m (b) 10 m (c) 100 m (d) 1000 m

66. The electric and the magnetic field, associated with an electromagnetic wave, propagating along X axis can be represented by

(a) $\vec{E} = E_0\vec{j}$ and $\vec{B} = B_0\vec{k}$
(b) $\vec{E} = E_0\vec{k}$ and $\vec{B} = B_0\vec{j}$
(c) $\vec{E} = E_0\vec{i}$ and $\vec{B} = B_0\vec{j}$
(d) $\vec{E} = E_0\vec{j}$ and $\vec{B} = B_0\vec{i}$

67. In an electromagnetic wave travelling in free space the rms value of the electric field is 3 V m^{-1}. The peak value of the magnetic field is

(a) 1.414×10^{-8} T
(b) 1.0×10^{-8} T
(c) 2.828×10^{-8} T
(d) 2.0×10^{-8} T

68. An e.m. wave is propagating in a medium with a velocity $\vec{v} = v\vec{i}$. The instantaneous oscillating electric field of this e.m. wave is along +y-axis, then the direction of oscillating magnetic field of the e.m. wave will be along:

(a) –y direction
(b) –x direction
(c) +z direction
(d) –z direction

69. If the magnetic monopole exists, then which of the Maxwell's equation to be modified?

(a) $\oint \vec{E}.d\vec{A} = \frac{Q_{enclosed}}{\varepsilon_0}$
(b) $\oint \vec{E}.d\vec{A} = 0$
(c) $\oint \vec{E}.d\vec{A} = \mu_0 I_{enclosed} + \mu_0\varepsilon_0 \frac{d}{dt}\int \vec{E}.d\vec{A}$
(d) $\vec{E}.d\vec{l} = -k\frac{d}{dt}\phi_B$

70. Fraunhofer lines are an example of _______ spectrum.

(a) line emission
(b) line absorption
(c) band emission
(d) band absorption

71. Which of the following is an electromagnetic wave?

(a) α - rays (b) β - rays (c) γ - rays (d) all of them

72. Which one of them is used to produce a propagating electromagnetic wave?

(a) an accelerating charge
(b) a charge moving at constant velocity
(c) a stationary charge
(d) an uncharged particle

73. Let E = $E_o\sin[10^6 x - \omega t]$ be the electric field of plane electromagnetic wave, the value of ω is

(a) 0.3×10^{-14} rad s^{-1}
(b) 3×10^{-14} rad s^{-1}
(c) 0.3×10^{14} rad s^{-1}
(d) 3×10^{14} rad s^{-1}

74. Which of the following is NOT true for electromagnetic waves?

(a) it transports energy
(b) it transports momentum
(c) it transports angular momentum
(d) in vacuum, it travels with different speeds which depend on their frequency

75. The electric and magnetic fields of an electromagnetic wave are

(a) in phase and perpendicular to each other
(b) out of phase and not perpendicular to each other
(c) in phase and not perpendicular to each other
(d) out of phase and perpendicular to each other

UNIT – VI : RAY OPTICS

76. The speed of light in an isotropic medium depends on,
(a) its intensity (b) its wavelength
(c) the nature of propagation
(d) the motion of the source w.r.t medium

77. A rod of length 10 cm lies along the principal axis of a concave mirror of focal length 10 cm in such a way that its end closer to the pole is 20 cm away from the mirror. The length of the image is,
(a) 2.5 cm (b) 5cm (c) 10 cm (d) 15cm

78. An object is placed in front of a convex mirror of focal length of f and the maximum and minimum distance of an object from the mirror such that the image formed is real and magnified.
(a) 2f and c (b) c and ∞ (c) f and O (d) None of these

79. For light incident from air on a slab of refractive index 2, the maximum possible angle of refraction is,
(a) 30^0 (b) 45^0 (c) 60^0 (d) 90^0

80. If the velocity and wavelength of light in air is V_a and λ_a and that in water is V_w and λ_w , then the refractive index of water is,
(a) $\frac{V_w}{V_a}$ (b) $\frac{V_a}{V_w}$ (c) $\frac{\lambda_w}{\lambda_a}$ (d) $\frac{V_a \lambda_a}{V_w \lambda_w}$

81. Stars twinkle due to,
(a) reflection (b) total internal reflection
(c) refraction (d) polarisation

82. When a biconvex lens of glass having refractive index 1.47 is dipped in a liquid, it acts as a plane sheet of glass. This implies that the liquid must have refractive index,
(a) less than one (b) less than that of glass
(c) greater than that of glass (d) equal to that of glass

83. The radius of curvature of curved surface at a thin Plano convex lens is 10 cm and the refractive index is 1.5. If the plane surface is silvered, then the focal length will be,
(a) 5 cm (b) 10 cm (c) 15 cm (d) 20 cm

84. An air bubble in glass slab of refractive index 1.5 (near normal incidence) is 5 cm deep when viewed from one surface and 3 cm deep when viewed from the opposite face. The thickness of the slab is,
(a) 8 cm (b) 10 cm (c) 12 cm (d) 16 cm

85. A ray of light travelling in a transparent medium of refractive index n falls, on a surface separating the medium from air at an angle of incidents of 45^0. The ray can undergo total internal reflection for the following n,
(a) n = 1.25 (b) n = 1.33 (c) n = 1.4 (d) n = 1.5

UNIT – 7 : WAVE OPTICS

86. A plane glass is placed over a various coloured letters (violet, green, yellow, red) The letter which appears to be raised more is,
(a) red (b) yellow (c) green (d) violet

87. Two point white dots are 1 mm apart on a black paper. They are viewed by eye of pupil diameter 3 mm approximately. The maximum distance at which these dots can be resolved by the eye is, [take wavelength of light, λ= 500 nm]
(a) 1 m (b) 5 m (c) 3 m (d) 6m

88. In a Young's double-slit experiment, the slit separation is doubled. To maintain the same fringe spacing on the screen, the screen-to-slit distance D must be changed to,
(a) 2D (b) $\frac{D}{2}$ (c) $\sqrt{2D}$ (d) $\frac{D}{\sqrt{2}}$

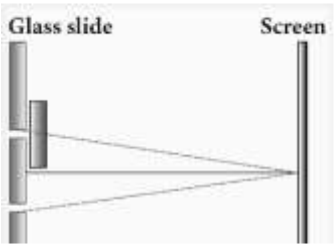
89. Two coherent monochromatic light beams of intensities I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are.
(a) 5I and I (b) 5I and 3I (c) 9I and I (d) 9I and 3I

90. When light is incident on a soap film of thickness 5×10^{-5} cm, the wavelength of light reflected maximum in the visible region is 5320 Å. Refractive index of the film will be,
(a) 1.22 (b) 1.33 (c) 1.51 (d) 1.83.

91. First diffraction minimum due to a single slit of width 1.0×10^{-5} cm is at 30^{o}. Then wavelength of light used is,
(a) 400 Å (b) 500 Å (c) 600 Å (d) 700 Å

92. A ray of light strikes a glass plate at an angle 60^{0}. If the reflected and refracted rays are perpendicular to each other, the refractive index of the glass is,
(a) $\sqrt{3}$ (b) $\frac{3}{2}$ (c) $\sqrt{\frac{3}{2}}$ (d) 2

93. One of the of Young's double slits is covered with a glass plate as shown in figure. The position of central maximum will,



(a) get shifted downwards (b) get shifted upwards
(c) will remain the same (d) data insufficient to conclude

94. Light transmitted by Nicol prism is,
(a) partially polarised (b) unpolarised
(c) plane polarised (d) elliptically polarized

95. The transverse nature of light is shown in,
(a) interference (b) diffraction (c) scattering (d) polarization

UNIT – 8 : DUAL NATURE OF RADIATION AND MATTER

96. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by

(a) $\lambda_p \propto \lambda_e$ (b) $\lambda_p \propto \sqrt{\lambda_e}$ (c)) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$ (d) $\lambda_p \propto \lambda_e^2$

97. In an electron microscope, the electrons are accelerated by a voltage of 14 kV. If the voltage is changed to 224 kV, then the de Broglie wavelength associated with the electrons would

(a) increase by 2 times (b) decrease by 2 times
(c) decrease by 4 times (d) increase by 4 times

98. The wave associated with a moving particle of mass 3×10^{-6} g has the same wavelength as an electron moving with a velocity 6×10^{6} ms^{-1} .The velocity of the particle is

(a) 1 82 x 10^{-18} ms^{-1} (b) 9 x 10^{-2} ms^{-1}
(c) 3 x 10^{-31} ms^{-1} (d) 1. 82 x 10^{-15} ms^{-1}

99. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ, the stopping potential is $\frac{V}{4}$. The threshold wavelength for the metallic surface is

(a) 4λ (b) 5λ (c) $\frac{5}{2}\lambda$ (d) 3λ

100. If a light of wavelength 330 nm is incident on a metal with work function 3.55 eV, the electrons are emitted. Then the wavelength of the wave associated with the emitted electron is (Take $h = 6.6 \times 10^{-34}$ Js)

(a) $< 2.75 \times 10^{-9}$ m (b) $\geq 2.75 \times 10^{-9}$ m
(c) $\leq 2.75 \times 10^{-12}$ m (d) $< 2.75 \times 10^{-10}$ m

101. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that in the first case, the work function of the material is

(a) $\frac{hc}{\lambda}$ (b) $\frac{2hc}{\lambda}$ (c) $\frac{hc}{3\lambda}$ (d) $\frac{hc}{2\lambda}$

102. In photoelectric emission, a radiation whose frequency is 4 times threshold frequency of a certain metal is incident on the metal. Then the maximum possible velocity of the emitted electron will be

(a) $\sqrt{\frac{h\nu_0}{m}}$ (b) $\sqrt{\frac{6h\nu_0}{m}}$ (c) $2\sqrt{\frac{h\nu_0}{m}}$ (d) $\sqrt{\frac{h\nu_0}{2m}}$

103. Two radiations with photon energies 0.9 eV and 3.3 eV respectively are falling on a metallic surface successively. If the work function of the metal is 0.6 eV, then the ratio of maximum speeds of emitted electrons in the two cases will be

(a) 1:4 (b) 1:3 (c) 1:1 (d)1:9

104. A light source of wavelength 520 nm emits 1.04×10^{15} photons per second while the second source of 460 nm produces 1.38×10^{15} photons per second. Then the ratio of power of second source to that of first source is
(a) 1.00 (b) 1.02 (c) 1.5 (d) 0.98

105. If the mean wavelength of light from sun is taken as 550 nm and its mean power as 3.8×10^{26} W, then the average number of photons received by the human eye per second from sunlight is of the order of
(a) 10^{45} (b) 10^{42} (c) 10^{54} (d) 10^{51}

106. The threshold wavelength for a metal surface whose photoelectric work function is 3.313 eV is
(a) 4125Å (b) 3750Å (c) 6000Å (d) 2062.5Å

107. A light of wavelength 500 nm is incident on a sensitive metal plate of photoelectric work function 1.235 eV. The kinetic energy of the photo electrons emitted is (Take $h = 6.6 \times 10^{-34}$ Js)
(a) 0.58 eV (b) 2.48 eV (c) 1.24 eV (d) 1.16 Ev

108. Photons of wavelength λ are incident on a metal. The most energetic electrons ejected from the metal are bent into a circular arc of radius R by a perpendicular magnetic field having magnitude B. The work function of the metal is
(a) $\frac{hc}{\lambda} - m_e + \frac{e^2B^2R^2}{2m_e}$ (b) $\frac{hc}{\lambda} + 2m_e\left[\frac{eBR}{2m_e}\right]^2$
(c) $\frac{hc}{\lambda} - m_ec^2 - \frac{e^2B^2R^2}{2m_e}$ (d) $\frac{hc}{\lambda} - 2m_e\left[\frac{eBR}{2m_e}\right]^2$

109. The work functions for metals A, B and C are 1.92 eV, 2.0 eV and 5.0 eV respectively. The metal/metals which will emit photoelectrons for a radiation of wavelength 4100Å is/are
(a) A only (b) both A and B (c) all these metals (d) none

110. Emission of electrons by the absorption of heat energy is called.........emission.
(a) photoelectric (b) field (c) thermionic (d) secondary

UNIT – 9 : ATOMIC AND NUCLEAR PHYSICS

111. Suppose an alpha particle accelerated by a potential of V volt is allowed to collide with a nucleus of atomic number Z, then the distance of closest approach of alpha particle to the nucleus is

(a) $14.4 \frac{Z}{V}$ Å (b) $14.4 \frac{V}{Z}$ Å (c) $1.44 \frac{Z}{V}$ Å (b) $1.44 \frac{V}{Z}$ Å

112. In a hydrogen atom, the electron revolving in the fourth orbit, has angular momentum equal to

(a) h (b) $\frac{h}{\pi}$ (c) $\frac{3h}{\pi}$ (d) $\frac{2h}{\pi}$

113. Atomic number of H – like atom with ionization potential 122.4 V for n = 1 is

(a) 1 (b) 2 (c) 3 (d) 4

114. The ratio between the first three orbits of hydrogen atom is

(a) 1:2:3 (b) 2:4:6 (c) 1:4:9 (d) 1:3:5

115. The charge of cathode ray's particle is

(a) positive (b) negative (c) neutral (d) not defined

116. In J.J.Thomson e/m experiment, electrons are accelerated through 2.6 kV enter the region of crosses electric filled and magnetic field of strength$3.0 x 10^4$ Vm and 1.0×10^{-3} T, respectively, and pass through it and un-deflected, then the specific charge is

(a) $1.6x10^{10}$ Ckg^{-1} (b) $1.7x10^{11}$ Ckg^{-1} (c) $1.5x10^{11}$ Ckg^{-1} (d) $1.8x10^{11}$ Ckg^{-1}

117. The ratio of the wavelengths radiation emitted for the transition from n =2 to n = 1 in Li^{++}, He^+ and H is

(a)1: 2: 3 (b) 1: 4: 9 (c) 3:2:1 (d) 4:9:36

118. The electric potential between a proton and an electron is given by $V = V_0 \ln\left(\frac{r}{r_0}\right)$, where r_0 is a constant. Assume that Bohr atom model is applicable to potential, then variation of radius of n^{th} orbit r_n with the principal quantum number n is

(a) $r_n \propto \frac{1}{n}$ (b) $r_n \propto n$ (c) $r_n \propto \frac{1}{n^2}$ (d) $r_n \propto n^2$

119. If the nuclear radius of ^{27}Al is 3.6 fermi, the approximate nuclear radius of ^{64}Cu in fermi is

(a) 2.4 (b) 1.2 (c) 4.8 (d)3.6

120. The nucleus is approximately spherical in shape. Then the surface area of nucleus having mass number A varies as

(a) $A^{\frac{2}{3}}$ (b) $A^{\frac{4}{3}}$ (c) $A^{\frac{1}{3}}$ (d) $A^{\frac{5}{3}}$

121. The mass of a $^7Li_3$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The average binding energy per nucleon of $^7Li_3$ nucleus is nearly

(a) 46 MeV (b) 5.6 MeV (c) 3.9 MeV (d) 23 MeV

122. M_p denotes the mass of the proton and M_n denotes mass of a neutron. A given nucleus of binding energy B, contains Z protons and N neutrons. The mass M(N,Z) of the nucleus is given by(where c is the speed of light)

(a) $M(N,Z) = NM_n + ZM_p - BC^2$ (b) $M(N,Z) = NM_n + ZM_p + BC^2$

(c) $M(N,Z) = NM_n + ZM_p - B/C^2$ (d) $M(N,Z) = NM_n + ZM_p + B/C^2$

123. A radioactive nucleus (initial mass number A and atomic number Z) emits two α-particles and 2 positrons. The ratio of number of neutrons to that of proton in the final nucleus will be

(a) $\frac{A-Z-4}{Z-2}$ (b) $\frac{A-Z-2}{Z-6}$ (c) $\frac{A-Z-4}{Z-6}$ (d) $\frac{A-Z-12}{Z-4}$

124. The half-life period of a radioactive element A is same as the mean life time of another radioactive element B. Initially both have the same number of atoms. Then

(a) A and B have the same decay rate initially

(b) A and B decay at the same rate always

(c) B will decay at faster rate than A (d) A will decay at faster rate than B.

125. A radiative element has N_0 number of nuclei at t=0. The number of nuclei remaining after half of a half-life (that is, at time t = ½ $T_{½}$)

(a) $\frac{N_0}{2}$ (b) $\frac{N_0}{\sqrt{2}}$ (c) $\frac{N_0}{4}$ (d) $\frac{N_0}{8}$

UNIT – 10 : ELECTRONICS AND COMMUNICATION

126. The barrier potential of a silicon diode is approximately,

(a) 0.7 V (b) 0.3V (c) 2.0 V (d) 2.2V

127. Doping a semiconductor results in

(a) The decrease in mobile charge carriers

(b) The change in chemical properties

(c) The change in the crystal structure

(d) The breaking of the covalent bond

128. In an unbiased p-n junction, the majority charge carriers (that is, holes) in the p-region diffuse into n-region because of

(a) the potential difference across the p-n junction

(b) the higher hole concentration in p-region than that in n-region

(c) the attraction of free electrons of n-region

(d) the higher concentration of electrons in the n-region than that in the p-region.

129. If a positive half –wave rectified voltage is fed to a load resistor, for which part of a cycle there will be current flow through the load?

(a) 0^0 –90^0 (b) 90^0–180^0 (c) 0^0–180^0 (d) 0^0–360^0

130. The zener diode is primarily used as

(a) Rectifier (b) Amplifier (c) Oscillator (d) Voltage regulator

131. The principle based on which a solar cell operates is

(a) Diffusion (b) Recombination (c) Photovoltaic action (d) Carrier flow

132. The light emitted in an LED is due to

(a) Recombination of charge carriers

(b) Reflection of light due to lens action

(c) Amplification of light falling at the junction

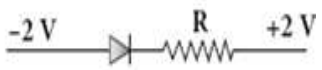
(d) Large current capacity.

133. The barrier potential of a p-n junction depends on i) type of semiconductor material ii) amount of doping iii) temperature. Which one of the following is correct?
(a) (i) and (ii) only (b) (ii) only (c) (ii) and (iii) only (d) (i) (ii) and (iii)

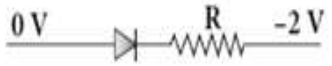
134. To obtain sustained oscillation in an oscillator,
(a) Feedback should be positive
(b) Feedback factor must be unity
(c) Phase shift must be 0 or 2π (d) All the above

135. If the input to the NOT gate is A = 1011, its output is
(a) 0100 (b) 1000 (c) 1100 (d) 0011

136. Which one of the following represents forward bias diode?

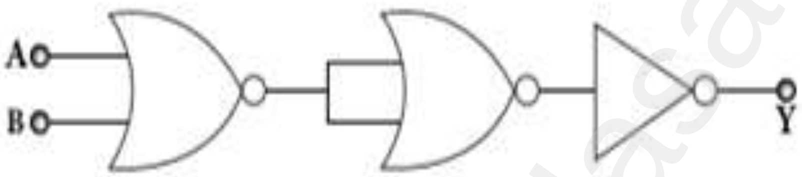
(a) 

(b) 

(c) 

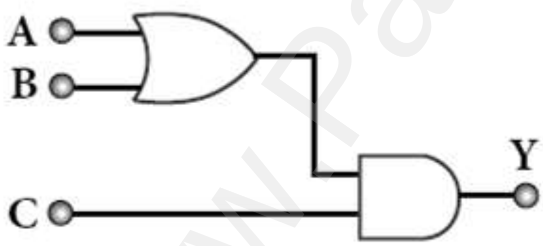
(d) 

137. The given electrical network is equivalent to



(a) AND gate (b) OR gate (c) NOR gate (d) NOT gate

138. The output of the following circuit is 1 when the input ABC is



(a) 101 (b) 100 (c) 110 (d) 010

139. The variation of frequency of carrier wave with respect to the amplitude of the modulating signal is called
(a) Amplitude modulation (b) Frequency modulation
(c) Phase modulation (d) Pulse width modulation

140. The frequency range of 3 MHz to 30 MHz is used for
(a) Ground wave propagation (b) Space wave propagation
(c) Sky wave propagation (d) Satellite communication

UNIT – 11 : RECENT DEVELOPMENTS IN PHYSICS

141. The particle size of ZnO material is 30 nm. Based on the dimension it is classified as
(a) Bulk material (b) Nanomaterial
(c) Soft material (d) Magnetic material

142. Which one of the following is the natural nanomaterial.
(a) Peacock feather (b) Peacock beak
(c) Grain of sand (d) Skin of the Whale

143. The blue print for making ultra-durable synthetic material is mimicked from
(a) Lotus leaf (b) Morpho butterfly
(c) Parrot fish (d) Peacock feather

144. The method of making nanomaterial by assembling the atoms is called
(a) Top down approach (b) Bottom up approach
(c) Cross down approach (d) Diagonal approach

145. "Ski wax" is an application of nano product in the field of
(a) Medicine (b) Textile (c) Sports (d) Automotive industry

146. The materials used in Robotics are
(a) Aluminium and silver (b) Silver and gold
(c) Copper and gold (d) Steel and aluminum

147. The alloys used for muscle wires in Robots are
(a) Shape memory alloys (b) Gold copper alloys
(c) Gold silver alloys (d) Two dimensional alloys

148. The technology used for stopping the brain from processing pain is
(a) Precision medicine (b) Wireless brain sensor
(c) Virtual reality (d) Radiology

149. The particle which gives mass to protons and neutrons are
(a) Higgs particle (b) Einstein particle
(c) Nanoparticle (d) Bulk particle

150. The gravitational waves were theoretically proposed by
(a) Conrad Rontgen (b) Marie Curie
(c) Albert Einstein (d) Edward Purcell

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