12

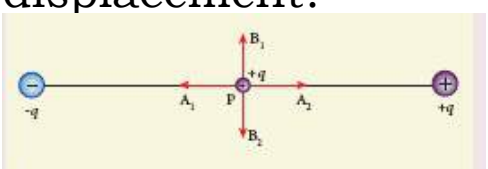
M

12th Standard

Physics

155 x 1 = 155

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?



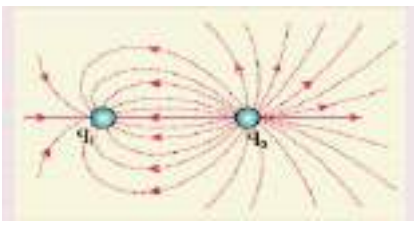
(a) A_1 and A_2 (b) B_1 and B_2 (c) both directions (d) No stable

2) Which charge configuration produces a uniform electric field?

(a) point Charge (b) infinite uniform line charge

(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?

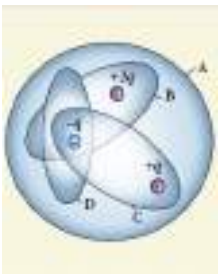


(a) $\frac{1}{5}$ (b) $\frac{25}{11}$ (c) 5 (d) $\frac{11}{25}$

4) An electric dipole is placed at an alignment angle of 30^0 with an electric field of 2 x 10^5 NC^{-1}. It experiences a torque equal to 8 N m. Th e 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

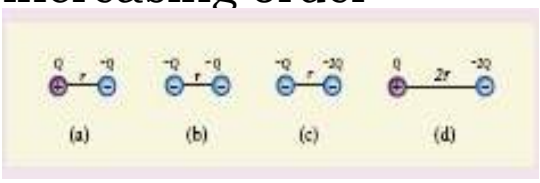
6) The total electric flux for the following closed surface which is kept inside water

(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 center to center distance r. If they are made to touch each other and then separated to the same distance, the force between them 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

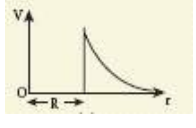
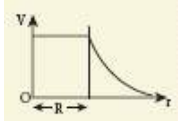
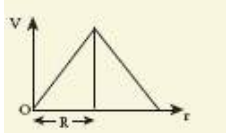
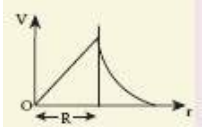


(a) 1 = 4 < 2 < 3 (b) 2 = 4 < 3 < 1 (c) 2 = 3 < 1 < 4 (d) 3 < 1 < 2 < 4

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

(a) 10 V (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 on its surface. The correct plot for electrostatic potential due to this spherical shell is _____

(a)  (b)  (c)  (d) 

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 _____

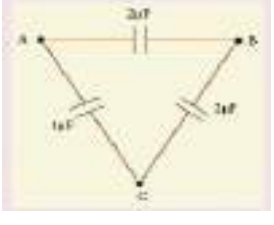
(a) Q remains the same, C is doubled (b) Q is doubled, C doubled

(c) C remains same, Q doubled (d) Both Q and C remain same

13) A 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 _____

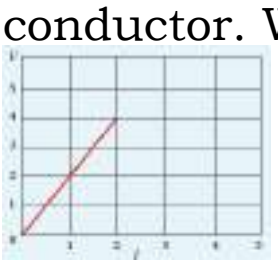


(a) 1μF (b) 2μF (c) 3μF (d) $\frac{1}{4}$μF

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 _____

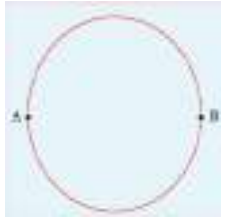
(a) 3×10^{-2} C (b) 4×10^{-2} C (c) 1×10^{-2} C (d) 2×10^{-2} C

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) $\pi\Omega$ (b) $\frac{\pi}{2}\Omega$ (c) $2\pi\Omega$ (d) $\frac{\pi}{4}\Omega$

18) A toaster operating at 240 V has a resistance of 120 Ω. The power is _____

(a) 400 W (b) 2 W (c) 480 W (d) 240 W

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 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

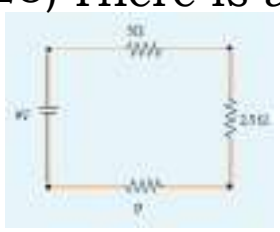
23) In India electricity is supplied for domestic use at 220 V. It is supplied at 110 V in USA. If the resistance of a 60W bulb for use in India is R, the resistance of a 60W bulb for use in USA will be _____

(a) R (b) 2R (c) $\frac{R}{4}$ (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 _____

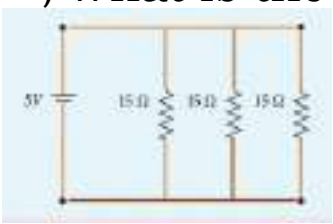
(a) 14 A (b) 8 A (c) 10 A (d) 12 A

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 300 K, its resistance is 1 Ω. The resistance of the wire will be 2 Ω at _____

(a) 1154 K (b) 1100 K (c) 1400 K (d) 1127 K

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

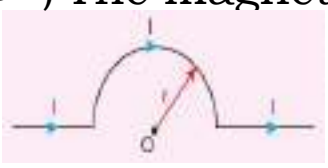
(c) copper increases and germanium decreases

(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

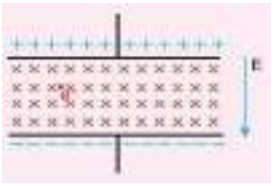
(a) straight line (b) parabola (c) circle (d) ellipse

31) The magnetic field at the center O of the following current loop is _____



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

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 undeflected when the plates of the capacitor are kept under constant magnetic field of induction $\vec{B}$ is _____



(a) $\varepsilon_\circ \frac{eIB}{\sigma}$ (b) $\varepsilon_\circ \frac{IB}{\sigma I}$ (c) $\varepsilon_\circ \frac{IB}{e\sigma}$ (d) $\varepsilon_\circ \frac{IB}{\sigma}$

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

_____

(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 nearly _____

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

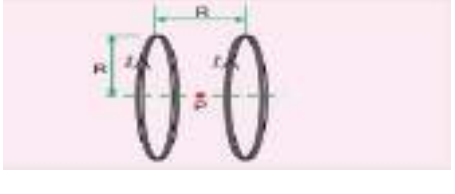
35) A thin insulated wire forms a plane spiral of N = 100 tight turns carrying a current I = 8 m A (milli ampere). The radii of inside and outside turns are a = 50 mm and b = 100 mm respectively. The magnetic induction at the centre of the spiral is _____

(a) $5\mu T$ (b) $7\mu T$ (c) $8\mu T$ (d) $10\mu T$

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 _____

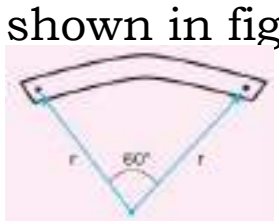


(a) $\frac{8N\mu_\circ I}{\sqrt{5}R}$ (b) $\frac{8N\mu_\circ I}{5\frac{3}{2}R}$ (c) $\frac{8N\mu_\circ I}{5R}$ (d) $\frac{4N\mu_\circ I}{\sqrt{5}R}$

38) A wire of length l carries a current I along the Y direction is kept in the magnetic field is given by $\vec{B} = \frac{\beta}{\sqrt{3}} = (\hat{i} + \hat{j} + \hat{k})T$. 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) $\sqrt{\frac{1}{2}\beta Il}$

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 _____

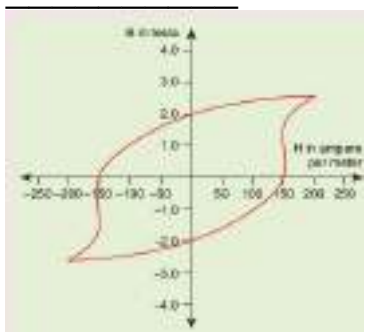


(a) P_m (b) $\frac{3}{\pi}p_m$ (c) $\frac{2}{\pi}p_m$ (d) $\frac{1}{2}p_m$

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) $\frac{2q}{m}$ (c) $\frac{q}{2m}$ (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 solenoid 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 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 centres 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° (b) 45° (c) 60° (d) 90°

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.

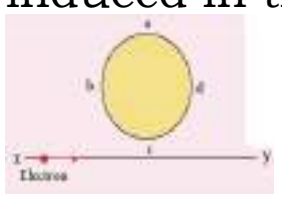
(a) $\frac{1}{4}\sigma\omega\pi BR$ (b) $\frac{1}{4}\sigma\omega\pi BR^2$ (c) $\frac{1}{4}\sigma\omega\pi BR^3$ (d) $\frac{1}{4}\sigma\omega\pi BR^4$

45) The potential energy of magnetic dipole whose dipole moment is

$\vec{p}_m = (-0.5\hat{i} + 0.4\hat{j})\text{Am}^2$ kept in uniform magnetic field $\vec{B} = 0.2\hat{i}$ T.

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

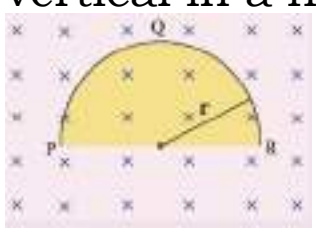
46) An electron moves on a straight line path XY as shown in the figure. The coil abcd is adjacent to the path of the electron. What will be the direction of current, if any, induced in the coil?



(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) $\frac{B\nu\pi r^2}{2}$ and P is at higher potential (c) πrBv and R is at higher potential

(d) 2rBv and R is at higher potential

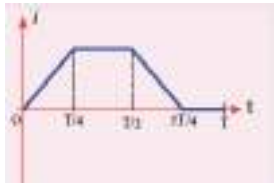
48) The flux linked with a coil at any instant t is given by $\Phi_B = 10t^2 - 50t + 250$. The induced emf at t = 3s is _____

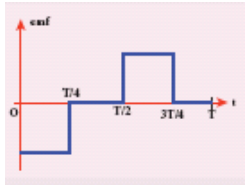
(a) −190 V (b) −10 V (c) 10 V (d) 190 V

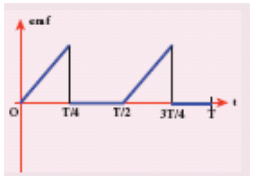
49) When the current changes from +2A to −2A in 0.05 s, an emf of 8 V is induced in a coil. The co-efficient of self-induction of the coil is _____

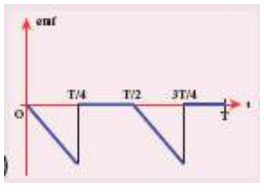
(a) 0.2H (b) 0.4H (c) 0.8H (d) 0.1H

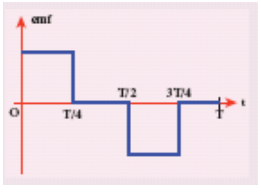
50) The current i flowing in a coil varies with time as shown in the figure. The variation of induced emf with time would be _____



(a) 

(b) 

(c) 

(d) 

51) A circular coil with a cross-sectional area of 4 cm^2 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 cm^2. 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, R, L, C, 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) $1/2$ (b) $1/\sqrt{2}$ (c) 1 (d) $\sqrt{3}/2$

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) 400 V (d) 1 V

57) An inductor 20 mH, a capacitor 50 μF and a resistor 40Ω 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 $i = \frac{1}{\sqrt{2}} sin(100\pi t)$ A and v $= \frac{1}{\sqrt{2}} sin\left(100\pi t + \frac{\pi}{3}\right) V$. 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

61) The dimension of $\frac{1}{\mu_0\varepsilon_0}$ is _____

(a) $[LT^{-1}]$ (b) $[L^2T^{-2}]$ (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 V m^{-1} (c) 600 V m^{-1} (d) 900 V m^{-1}

63) Which of the following electromagnetic radiations is used for viewing objects through fog _____

(a) microwave (b) gamma rays (c) X- rays (d) infrared

64) Which of the following is 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 fields, associated with an electromagnetic wave, propagating along negative X axis can be represented by _____

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

(d) $\vec{E} = E_0\hat{j}$ and $\vec{B} = B_0\hat{i}$

67) In an electromagnetic wave traveling 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) If the magnetic monopole exists, then which of the Maxwell's equation to be modified?.

(a) $\oint \vec{E}.d\vec{A} = \frac{Q_{enclosed}}{\in_0}$ (b) $\oint \vec{E}.d\vec{A} = 0$ (c) $\oint \vec{E}.d\vec{A} = \mu_0 I_{enclosed} + \mu_0 \in_0 \frac{d}{dt}\oint \vec{E}.d\vec{A}$

(d) $\oint \vec{E}.d\vec{l} = -\frac{d}{dt}\Phi_B$

69) Which of the following is an electromagnetic wave?

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

70) 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

71) If $E = E_o \sin[10^6 x - \omega t]$ be the electric field of a 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}

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

(a) it transport energy (b) it transport momentum

(c) it transport angular momentum

(d) in vacuum, it travels with different speeds which depend on their frequency

73) 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

74) An e.m. wave is propagating in a medium with a velocity $\vec{v} = v\hat{i}$. 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

75) Fraunhofer lines are an example of _____ spectrum.

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

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° (b) 45° (c) 60° (d) 90°

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) $\frac{V_a\lambda_W}{V_W\lambda_a}$

81) Stars twinkle due to _____

(a) reflection (b) total internal refl ection (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 planoconvex lens is 10 cm and the refractive index is 1.5. If the plane surface is silvered, then the focal length will be _____

(a) 5cm (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^{o} . 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

86) The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by _____

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

87) 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

88) 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) $1.82 \times 10^{-18} ms^{-1}$ (b) $9 \times 10^{-2} ms^{-1}$ (c) $3 \times 10^{-15} ms^{-1}$ (d) $1.82 \times 10^{-15} ms^{-1}$

89) 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

90) 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) $< 2.5 \times 10^{-10} m$

91) A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and λ /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) (d)

92) 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) $\sqrt{\frac{hv_0}{m}}$ (b) $\sqrt{\frac{6hv_0}{m}}$ (c) $2\sqrt{\frac{hv_0}{m}}$ (d) $\sqrt{\frac{hv_0}{2m}}$

93) 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

94) 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

95) 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}

96) The threshold wavelength for a metal surface whose photoelectric work function is 3.313 eV is _____

(a) 4125 $\mathring{A}$ (b) 3750$\mathring{A}$ (c) 6000$\mathring{A}$ (d) 2062.5$\mathring{A}$

97) 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 photoelectrons 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

98) 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) $\frac{hc}{\lambda} - 2m_e\left[\frac{eBR}{2m_e}\right]^2$

99) 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 4100 Å is/are _____

(a) A only (b) both A and B (c) all these metals (d) none

100) Emission of electrons by the absorption of heat energy is called_____emission.

(a) photoelectric (b) field (c) thermionic (d) secondary

101) 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) $14.4\frac{Z}{V}\mathring{A}$ (b) $14.4\frac{V}{Z}\mathring{A}$ (c) $1.44\frac{Z}{V}\mathring{A}$ (d) $1.44\frac{V}{Z}\mathring{A}$

102) In a hydrogen atom, the electron revolving in the fourth orbit has angular momentum equal to _____

(a) h (b) $\frac{h}{\pi}$ (c) $\frac{4h}{\pi}$ (d) $\frac{2h}{\pi}$

103) Atomic number of of H-like atom with ionization potential 122.4 V for n = 1 is _____

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

104) 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

105) The charge of cathode rays particle is _____

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

106) In J.J. Thomson e/m experiment, a beam of electron is replaced by that of muons (particle with same charge as that of electrons but mass 208 times that of electrons). No deflection condition is achieved only if _____

(a) B is increased by 208 times (b) B is decreased by 208 times

(c) B is increased by 14.4 times (d) B is decreased by 14.4 times

107) 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

108)

The electric potential of an electron is given by $V = V_0 in\left(\frac{r}{r_0}\right)$, where r_0 is a constant. If Bohr atom model is valid, then variation of radius of n^{th} orbit r_n with the principal quantum number n _____

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

109) If the nuclear radius of ^{27}Al is 3.6 fermi, the approximate nuclear radius of ^{64}Cu, in femi is _____

(a) 2:4 (b) 1.2 (c) 4.8 (d) 3.6

110) The nucleus is approximately spherical in shape. Then the surface area of nucleus having mass number a varies as _____

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

111) The mass of a $_3{}^7Li$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of $_3{}^7Li$ nucleus is nearly _____

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

112) M_p denotes the mass of the proton and Mn 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) $M(N,Z) = NM_n = ZM_p + B/c^2$

113) A radio active nucleus (initial mass number A and atomic number Z) emits two α-particles and 2 positons. 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) $\frac{A-Z-12}{Z-4}$

114) 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.

115) 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 = $\frac{q}{2} T\frac{1}{2}$)

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

116) 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

117) Which one of the following is the natural nanomaterial.

(a) Peacock feather (b) Peacock beak (c) Grain of sand (d) Skin of the Whale

118) The blue print for making ultra durable synthetic material is mimicked from _____

(a) Lotus leaf (b) Morpho butterfly (c) Parrot fish (d) Peacock feather

119) 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

120) "Sky wax" is an application of nano product in the field of _____

(a) Medicine (b) Textile (c) Sports (d) Automotive industry

121) The materials used in Robotics are _____

(a) Aluminium and silver (b) Silver and gold (c) Copper and gold (d) Steel and aluminum

122) 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

123) The technology used for stopping the brain from processing pain is _____

(a) Precision medicine (b) Wireless brain sensor (c) Virtual reality (d) Radiology

124) The particle which gives mass to protons and neutrons are _____

(a) Higgs particle (b) Einstein particle (c) Nanoparticle (d) Bulk particle

125) The gravitational waves were theoretically proposed by _____

(a) Conrad Rontgen (b) Marie Curie (c) Albert Einstein (d) Edward Purcell

126) 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

127) 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) 6 m

128) 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) $\sqrt{2}$D (d) $\frac{D}{\sqrt{2}}$

129) 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

130) When light is incident on a soap film of thickness 5 x 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

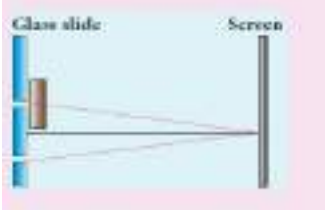
131) First diffraction minimum due to a single slit of width 1.0×10^{-5} cm is at 30°. Then wavelength of light used is _____

(a) 400 $\mathring{A}$ (b) 500 $\mathring{A}$ (c) 600 $\mathring{A}$ (d) 700 $\mathring{A}$

132) A ray of light strikes a glass plate at an angle 60°. 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

133) 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

134) Light transmitted by Nicol prism is _____

(a) partially polarised (b) unpolarised (c) plane polarised (d) elliptically polarised

135) The transverse nature of light is shown in _____

(a) interference (b) diffraction (c) scattering (d) polarisation

136) The barrier potential of a silicon diode is approximately _____

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

137) 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

138) A forward biased diode is treated as _____.

(a) An open switch with infi nite resistance

(b) A closed switch with a voltage drop of 0V

(c) A closed switch in series with a battery voltage of 0.7V

(d) A closed switch in series with a small resistance and a battery

139) If a half –wave rectifi ed voltage is fed to a load resistor, which part of a cycle the load current will fl ow?

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

140) Th e primary use of a zener diode is

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

141) The principle based on which a solar cell operates is _____

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

142) 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

143) When a transistor is fully switched on, it is said to be _____.

(a) Shorted (b) Saturated (c) Cut-off (d) Open

144) The specific characteristic of a common emitter amplifier is _____.

(a) High input resistance (b) Low power gain (c) Signal phase reversal

(d) Low current gain

145) 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

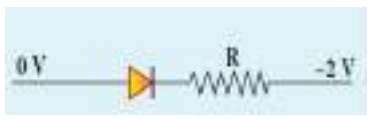
146) If the input to the NOT gate is A = 1011, its output is _____

(a) 0100 (b) 1000 (c) 1100 (d) 0011

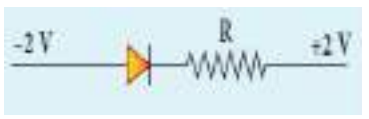
147) The electrical series circuit in digital form is

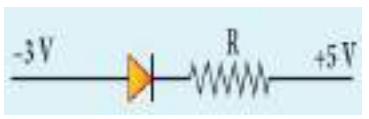
(a) AND (b) OR (c) NOR (d) NAND

148) Which one of the following represents forward bias diode?

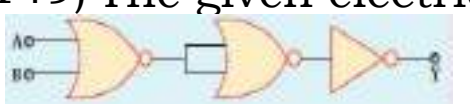
(a) 

(b) 

(c) 

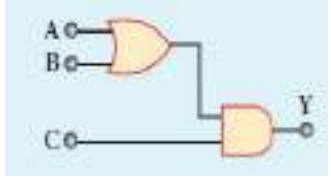
(d) 

149) The given electrical network is equivalent to _____



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

150) The output of the following circuit is 1 when the input ABC is _____



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

151) The output transducer of the communication system converts the radio signal into _____.

(a) Sound (b) Mechanical energy (c) Kinetic energy (d) None of the above

152) The signal is aff ected by noise in a communication system _____.

(a) At the transmitter (b) At the modulator (c) In the channel (d) At the receiver

153) 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

154) The internationally accepted frequency deviation for the purpose of FM broadcasts _____.

(a) 75 kHz (b) 68 kHz (c) 80 kHz (d) 70 kHz

155) 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

****

155 × 1 = 155

1) (b) B_1 and B_2

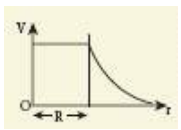
2) (c) uniformly charged infinite plane

3) (d) $\frac{11}{25}$

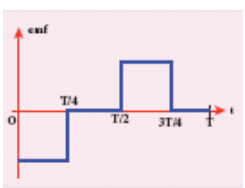
4) (b) 8 mC

5) (a) D < C < B < A

6) (b) $\frac{q}{40\varepsilon_0}$

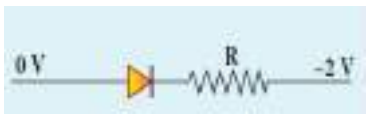
7) (c) more than before
8) (a) 1 = 4 < 2 < 3
9) (b) -20 V
10) (b) 

11) (a) 8.80×10^{-17} J
12) (c) C remains same, Q doubled
13) (d) Energy density
14) (b) 2μF
15) (a) 3×10^{-2} C
16) (a) 2 ohm
17) (b) $\frac{\pi}{2}\Omega$
18) (c) 480 W
19) (b) Yellow – Violet – Orange – Silver
20) (a) 100 k Ω
21) (c) $\frac{1}{\sqrt{3}}$
22) (d) 4
23) (c) $\frac{R}{4}$
24) (d) 12 A
25) (c) 3.5 Ω
26) (a) 1A
27) (d) 1127 K
28) (b) 0.5 Ω
29) (d) copper decreases and germanium increases
30) (a) straight line
31) (a) $\frac{\mu_\circ I}{4r} \otimes$
32) (d) $\varepsilon_\circ \frac{IB}{\sigma}$
33) (c) $\sqrt{\frac{2q^3B^2V}{m}}$
34) (b) 1.2 A m^2
35) (b) $7\mu T$
36) (a) circle
37) (b) $\frac{8N\mu_\circ I}{5^{\frac{3}{2}}R}$
38) (a) $\sqrt{\frac{2}{\sqrt{3}}}\beta Il$
39) (b) $\frac{3}{\pi}p_m$
40) (c) $\frac{q}{2m}$
41) (b) 1.25 mA

42) (c) 2.56×10^{-4} Wb m^{-2}
43) (b) 45°
44) (d) $\frac{1}{4}\sigma\omega\pi BR^4$
45) (c) 0.1 J
46) (a) The current will reverse its direction as the electron goes past the coil
47) (d) 2rBv and R is at higher potential
48) (b) −10 V
49) (d) 0.1H
50) (a) 

51) (a) 7.54 μH
52) (a) 2 A
53) (b) 0.83
54) (c) 1
55) (a) $\frac{\pi}{4}$
56) (c) 400 V
57) (c) 0.46 W
58) (d) $\frac{1}{8}$
59) (c) $\frac{Q}{\sqrt{2}}$
60) (d) 5 μF
61) (b) $[L^2T^{-2}]$
62) (d) 900 V m^{-1}
63) (d) infrared
64) (c) longitudinal
65) (a) 1 m
66) (b) $\vec{E} = E_0\hat{k}$ and $\vec{B} = B_0\hat{j}$
67) (a) 1.414×10^{-8} T
68) (b) $\oint \vec{E}.d\vec{A} = 0$
69) (c) γ - rays
70) (a) an accelerating charge
71) (d) 3×10^{14} rad s^{-1}
72) (d) in vacuum, it travels with different speeds which depend on their frequency
73) (a) in phase and perpendicular to each other
74) (c) +z direction
75) (b) line absorption
76) (b) its wavelength
77) (b) 5cm
78) (d) None of these
79) (a) 30°
80) (b) $\frac{V_a}{V_W}$
81) (c) refraction

82) (d) equal to that of glass
83) (b) 10 cm
84) (c) 12 cm
85) (d) n= 1.5
86) (d) $\lambda_p \alpha \lambda_e^2$
87) (c) decrease by 4 times
88) (d) $1.82 \times 10^{-15} ms^{-1}$
89) (d) 3λ
90) (a) < $2.75 \times 10^{-9} m$
91) (d)
92) (b) $\sqrt{\frac{6hv_0}{m}}$
93) (b) 1:3
94) (c) 1.5
95) (a) 10^{45}
96) (b) $3750 \mathring{A}$
97) (c) 1.24 eV
98) (d) $\frac{hc}{\lambda} - 2m_e \left[\frac{eBR}{2m_e}\right]^2$
99) (b) both A and B
100) (c) thermionic
101) (c) $1.44 \frac{Z}{V} \mathring{A}$
102) (d) $\frac{2h}{\pi}$
103) (c) 3
104) (c) 1:4:9
105) (b) negative
106) (c) B is increased by 14.4 times
107) (d) 4:9:36
108) (b) $r_n \alpha n$
109) (c) 4.8
110) (a) $A^{2/3}$
111) (b) 5.6 MeV
112) (c) M (N,Z) = $NM_n = ZM_p - B/c^2$
113) (b) $\frac{A-Z-2}{Z-6}$
114) (c) B will decay at faster rate than A
115) (b) $\frac{N_0}{\sqrt{2}}$
116) (b) Nanomaterial
117) (a) Peacock feather
118) (c) Parrot fish
119) (b) Bottom up approach

120) (c) Sports
121) (d) Steel and aluminum
122) (a) Shape memory alloys
123) (c) Virtual reality
124) (a) Higgs particle
125) (c) Albert Einstein
126) (d) violet
127) (b) 5 m
128) (a) 2D
129) (c) 9I and I
130) (b) 1.33
131) (b) 500 $\mathring{A}$
132) (a) $\sqrt{3}$
133) (b) get shifted upwards
134) (c) plane polarised
135) (d) polarisation
136) (a) 0.7 V
137) (c) The change in the crystal structure
138) (d) A closed switch in series with a small resistance and a battery
139) (c) 0^0–180^0
140) (d) Voltage regulator
141) (c) Photovoltaic action
142) (a) Recombination of charge carriers
143) (b) Saturated
144) (c) Signal phase reversal
145) (d) All the above
146) (a) 0100
147) (a) AND
148) (a) 

149) (c) NOR gate
150) (a) 101
151) (a) Sound
152) (c) In the channel
153) (b) Frequency modulation
154) (a) 75 kHz
155) (c) Sky wave propagation

12

12 PHYSICS

12th Standard

Physics

275 x 2 = 550

1) Calculate the number of electrons in one coulomb of negative charge.

2) A sample of HCl gas is placed in a uniform electric field of magnitude 3×10^4 NC^{-1}. The dipole moment of each HCl molecule is 3.4×10^{-30} Cm. Calculate the maximum torque experienced by each HCl molecule.

3) Four charges are arranged at the corners of the square PQRS of side an as shown in the figure.
(a) Find the work required to assemble these charges in the given configuration.
(b) Suppose a charge q is brought to the center of the square, by keeping the four charges fixed at the corners, how much extra work is required for this?

4) A water molecule has an electric dipole moment of 6.3×10^{-30} Cm. A sample contains 10^{22} water molecules, with all the dipole moments aligned parallel to the external electric field of magnitude 3×10^5 NC^{-1}. How much work is required to rotate all the water molecules from $\theta = 0°$ to 90°?

5) Dielectric strength of air is 3×10^6 V m^{-1}. Suppose the radius of a hollow sphere in the Van de Graff generator is R = 0.5 m, calculate the maximum potential difference created by this Van de Graaff generator.

6) What is meant by quantisation of charges?

7) Write down Coulomb's law in vector form and mention what each term represents.

8) Write a short note on superposition principle.

9) Define 'Electric field'.

10) What is mean by 'Electric field lines'?

11) The electric field lines never intersect Justify.

12) Define 'Electric dipole'. Give the expression for the magnitude of its electric dipole moment and the direction.

13) Write the general definition of electric dipole moment for a collection of point charge.

14) What is an equipotential surface?

15) What are the properties of an equipotential surface?

16) Give the relation between electric field and electric potential.

17) Define 'electrostatic potential energy '.

18) Define 'electric flux'.

19) What is meant by electrostatic energy density?

20) Write a short note on 'electrostatic shielding'.

21) What is Polarisation?

22) What is dielectric strength?

23) Define 'capacitance'. Give its unit.

24) What is corona discharge?

25) When two objects are rubbed with each other, approximately a charge of 50 nC can be produced in each object. Calculate the number of electrons that must be transferred to produce this charge.

26) Define 'electrostatic potential' .

27) Compute the current in the wire if a charge of 120 C is flowing through a copper wire in 1 minute.

28) Why current is a scalar?

29) State microscopic form of Ohm's law.

30) State macroscopic form of Ohm's law.

31) Define electrical resistivity

32) Define temperature coefficient of resistance.

33) Write a short note on super conductors?

34) What is electric power and electric energy?

35) Define current density.

36) If an electric field of magnitude 570 N C^{-1}, is applied in the copper wire, find the acceleration experienced by the electron.

37) A copper wire of cross-sectional area 0.5 mm^2 carries a current of 0.2 A. If the free electron density of copper is 8.4 x 10^{28} m^{-3} then compute the drift velocity of free electrons.

38) Determine the number of electrons flowing per second through a conductor, when a current of 32 A flows through it.

39) A potential difference across 24 Ω resistor is 12 V. What is the current through the resistor?

40) If the resistance of coil is 3 Ω at 20°C and α = 0.004/°C then determine its resistance at 100°C.

41) Resistance of a material at 20^0C and 40^0C are 45 Ω and 85 Ω respectively. Find its temperature coefficient of resistivity.

42) In a meter bridge experiment with a standard resistance of 15 Ω in the right gap, the ratio of balancing length is 3:2. Find the value of the other resistance.

43) In a meter bridge, the value of resistance in the resistance box connected in the right gap is 10 Ω. The balancing length is l_1 = 55 cm. Find the value of unknown resistance.

44) Find the heat energy produced in a resistance of 10 Ω when 5 A current flows through it for 5 minutes.

45) Derive the expression for power P = VI in electrical circuit.

46) State Kirchhoff's current rule.

47) State Kirchhoff 's voltage rule.

48) State the principle of potentiometer.

49) What do you mean by internal resistance of a cell?

50) State Joule's law of heating.

51) What is Seebeck effect?

52) What is Thomson effect?

53) What is Peltier effect?

54) The resistance of a nichrome wire at 0 °C is 10 Ω. If its temperature coefficient of resistance is 0.004/^{0}C, find its resistance at boiling point of water. Comment on the result.

55) The rod given in the figure is made up of two different materials.

Both have square cross sections of 3 mm side. The resistivity of the first material is 4 x 10^{-3} Ωm and it is 25 cm long while second material has resistivity of 5 x 10^{-3} Ω.m and is of 70 cm long. What is the resistivity of rod between its ends?

56) An electronics hobbyist is building a radio which requires 150 Ω in her circuit, but she has only 220 Ω, 79 Ω and 92 Ω resistors available. How can she connect the available resistors to get desired value of resistance?

57) A cell supplies a current of 0.9 A through a 2 Ω resistor and a current of 0.3 A through a 7 Ω resistor. Calculate the internal resistance of the cell.

58) A potentiometer wire has a length of 4 m and resistance of 20 Ω. It is connected in series with resistance of 2980 Ω and a cell of emf 4 V. Calculate the potential along the wire.

59) Four bulbs P, Q, R, S are connected in a circuit of unknown arrangement. When each bulb is removed one at a time and replaced, the following behavior is observed.

	P	Q	R	S
P removed	*	on	on	on
Q removed	on	*	on	off
R removed	off	off	*	off
S removed	on	off	on	*

Draw the circuit diagram for these bulbs.

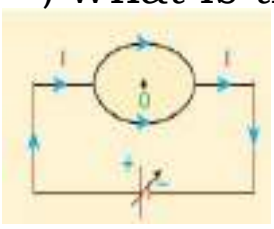
60) The horizontal component and vertical component of Earth's magnetic field at a place are 0.15 G and 0.26 G respectively. Calculate the angle of dip and resultant magnetic field. (G - gauss, cgs unit for magnetic field 1G = 10^{-4} T)

61) The repulsive force between two magnetic poles in air is 9 x 10^{-3} N. If the two poles are equal in strength and are separated by a distance of 10 cm, calculate the pole strength of each pole.

62) Using the relation $\vec{B} = \mu_\circ(\vec{H}+\vec{M})$ show that $x_m = \mu_r - 1$

63) Two materials X and Y are magnetised whose values of intensity of magnetisation are 500 A m^{-1} and 2000 A m^{-1} respectively. If the magnetising field is 1000 A m^{-1}, then which one among these materials can be easily magnetized?

64) What is the magnetic field at the centre of the loop shown in figure?



65) Compute the magnitude of the magnetic field of a long, straight wire carrying a current of 1 A at distance of 1m from it. Compare it with Earth's magnetic field.

66) Let E be the electric field of magnitude 6.0 x 10^6 N C^{-1} and B be the magnetic field magnitude 0.83 T. Suppose an electron is accelerated with a potential of 200 V, will it show zero deflection?. If not, at what potential will it show zero deflection.

67) Suppose a cyclotron is operated to accelerate protons with a magnetic field of strength 1 T. Calculate the frequency in which the electric field between two Dees could be reversed.

68) What is meant by magnetic induction?

69) Define magnetic flux.

70) Define magnetic dipole moment.

71) State Coulomb's inverse law.

72) What is magnetic susceptibility?

73) What is magnetic permeability?

74) State Ampere's circuital law.

75) Compare dia, para and ferro-magnetism.

76) What is meant by hysteresis?

77) Define ampere.

78) Define magnetic declination and inclination.

79) What is resonance condition in cyclotron?

80) State Fleming's left hand rule.

81) Is an ammeter connected in series or parallel in a circuit? Why?

82) Explain the concept of velocity selector.

83) Why is the path of a charged particle not a circle when its velocity is not perpendicular to the magnetic field?

84) What happens to the domains in a ferromagnetic material in the presence of external magnetic field?

85) A circular antenna of area 3 m^2 is installed at a place in Madurai. The plane of the area of antenna is inclined at 47º with the direction of Earth's magnetic field. If the magnitude of Earth's field at that place is 4.1 x 10^{-5} T find the magnetic flux linked with the antenna.

86) A cylindrical bar magnet is kept along the axis of a circular solenoid. If the magnet is rotated about its axis, find out whether an electric current is induced in the coil.

87) A straight conducting wire is dropped horizontally from a certain height with its length along east-west direction. Will an emf be induced in it? Justify your answer.

88) The current flowing in the first coil changes from 2 A to 10 A in 0.4 s. Find the mutual inductance between two coils if an emf of 60 mV is induced in the second coil. Also determine the magnitude of induced emf in the second coil if the current in the first coil is changed from 4 A to 16 A in 0.03 s. Consider only the magnitude of induced emf.

89) A 400 mH coil of negligible resistance is connected to an AC circuit in which an effective current of 6 mA is flowing.Find out the voltage across the coil if the frequency is 1000 Hz.

90) A capacitor of capacitance $\frac{10^2}{\pi}\mu F$ is connected across a 220 V, 50 Hz A.C. mains.

Calculate the capacitive reactance, RMS value of current and write down the equations of voltage and current.

91) What is meant by electromagnetic induction?

92) State Faraday's laws of electromagnetic induction.

93) State Lenz's law.

94) State Fleming's right hand rule.

95) How is Eddy current produced? How do they flow in a conductor?

96) Mention the ways of producing induced emf.

97) What for an inductor is used ? Give some examples.

98) What do you mean by self-induction?

99) What is meant by mutual induction?

100) Give the principle of AC generator.

101) List out the advantages of stationary armature-rotating field system of AC generator.

102) Define average value of an alternating current.

103) How will you define RMS value of an alternating current?

104) What are phasors?

105) Define electric resonance.

106) What do you mean by resonant frequency?

107) How will you define Q- factor?

108) What is meant by wattles current?

109) Give any one definition of power factor.

110) What are LC oscillations?

111) A square coil of side 30 cm with 500 turns is kept in a uniform magnetic field of 0.4 T. The plane of the coil is inclined at an angle of 30o to the field. Calculate the magnetic flux through the coil.

112) A straight metal wire crosses a magnetic field of flux 4 mWb in a time 0.4 s. Find the magnitude of the emf induced in the wire.

113) An induced current of 2.5 mA flows through a single conductor of resistance 100 Ω. Find out the rate at which the magnetic flux is cut by the conductor.

114) A fan of metal blades of length 0.4 m rotates normal to a magnetic field of 4 10^{-3} × T. If the induced emf between the centre and edge of the blade is 0.02 V, determine the rate of rotation of the blade.

115) A bicycle wheel with metal spokes of 1 m long rotates in Earth's magnetic field. The plane of the wheel is perpendicular to the horizontal component of Earth's field of 4×10^{-5}T. If the emf induced across the spokes is 31.4 mV, calculate the rate of revolution of the wheel

116) Determine the self-inductance of 4000 turn air-core solenoid of length 2m and diameter 0.04 m

117) A coil of 200 turns carries a current of 4 A. If the magnetic flux through the coil is 6×10^{-5} Wb, find the magnetic energy stored in the medium surrounding the coil.

118) Calculate the instantaneous value at 60º, average value and RMS value of an alternating current whose peak value is 20 A.

119) In series LC circuit, the voltages across L and C are 180° out of phase. Is it correct? Explain.

120) When does power factor of a series RLC circuit become maximum?

121) The relative magnetic permeability of the medium is 2.5 and the relative electrical permittivity of the medium is 2.25. Compute the refractive index of the medium.

122) Compute the speed of the electromagnetic wave in a medium if the amplitude of electric and magnetic fields are 3×10^{4} N C^{-1} and 2×10^{-4} T, respectively.

123) What is displacement current?

124) What are electromagnetic waves?

125) Write down the integral form of modified Ampere's circuital law.

126) A transmitter consists of LC circuit with an inductance of 1 μH and a capacitance of 1 μF. What is the wavelength of the electromagnetic waves it emits?

127) Write notes on Gauss' law in magnetism.

128) Write notes on Ampere-Maxwell law.

129) Why are e.m. waves non-mechanical?

130) What is angle of deviation due to refraction?

131) What is principle of reversibility?

132) What is relative refractive index?

133) Why do stars twinkle?

134) Explain the reason for glittering of diamond.

135) What are mirage and looming?

136) Write a short note on the prisms making use of total internal reflections.

137) What is Snell's window?

138) What are the Cartesian sign conventions for spherical mirrors?

139) What are primary focus and secondary focus of a lens?

140) What are the sign conventions followed for lenses?

141) What is power of a lens?

142) What is angle of minimum deviation?

143) What is dispersion?

144) How are rainbows formed?

145) Why does sky appear blue?

146) What is the reason for reddish appearance of sky during sunset and sunrise?

147) Why do clouds appear white?

148) What is Rayleigh's scattering?

149) Prove that when a reflecting surface of light is tilted by an angle θ, the reflected light will be tilted by an angle 2θ.

150) What is the height of the mirror needed to see the image of a person fully on the mirror?

151) One type of transparent glass has refractive index 1.5. What is the speed of light through this glass?

152) If the focal length is 150 cm for a glass lens, what is the power of the lens?

153) A monochromatic light is incident on an equilateral prism at an angle 30º and emerges at an angle of 75º. What is the angle of deviation produced by the prism?

154) The angle of minimum deviation for an equilateral prism is 37º . Find the refractive index of the material of the prism.

155) Find the dispersive power of flint glass if the refractive indices of flint glass for red, green and violet light are 1.613, 1.620 and 1.632 respectively.

156) Why are dish antennas curved?

157) What type of lens is formed by a bubble inside water?

158) State the laws of refraction

159) Why do metals have a large number of free electrons?

160) Define work function of a metal. Give its unit.

161) What is photoelectric effect?

162) How does photocurrent vary with the intensity of the incident light?

163) Give the definition of intensity of light according to quantum concept and its unit.

164) How will you define threshold frequency?

165) State de Broglie hypothesis.

166) Why we do not see the wave properties of a baseball?

167) A proton and an electron have same kinetic energy. Which one has greater de Broglie wavelength. Justify.

168) Write the relationship of de Broglie wavelength λ associated with a particle of mass m in terms of its kinetic energy K.

169) An electron and an alpha particle have same kinetic energy. How are the de Broglie wavelengths associated with them related?

170) How many photons per second emanate from a 50 mW laser of 640 nm?

171) Calculate the maximum kinetic energy and maximum velocity of the photoelectrons emitted when the stopping potential is 81 V for the photoelectric emission experiment.

172) A radiation of wavelength 300 nm is incident on a silver surface. Will photoelectrons be observed? [work function of silver = 4.7 eV]

173) Calculate the cut-off wavelength and cutoff frequency of x-rays from an x-ray tube of accelerating potential 20,000 V.

174) What is surface barrier?

175) Define stopping potential.

176) Mention the two features of x-ray spectra, not explained by classical electromagnetic theory.

177) What is Bremsstralung?

178) What are cathode rays?

179) What is meant by excitation energy?

180) Define the ionization energy and ionization potential.

181) Write down the draw backs of Bohr atom model.

182) What is distance of closest approach?

183) Define impact parameter.

184) Write a general notation of nucleus of element X. What does each term denote?
185) What is isotope? Give an example.
186) What is isotone? Give an example.
187) What is isobar? Give an example.
188) Define atomic mass unit u.
189) Show that nuclear density is almost constant for nuclei with Z > 10.
190) What is mass defect?
191) What is binding energy of a nucleus? Give its expression.
192) Calculate the energy equivalent of 1 atomic mass unit.
193) Give the physical meaning of binding energy per nucleon.
194) What is meant by radioactivity?
195) Give the symbolic representation of alpha decay, beta decay and gamma decay.
196) What is mean life of a radia active nucleus? Give the expression.
197) What is half-life of a radia active nucleus? Give the expression.
198) What is meant by activity or decay rate? Give its unit.
199) Define curie.
200) What are the constituent particles of neutron and proton?
201) Assuming that energy released by the fission of a single $^{235}_{92}U$ nucleus is 200MeV, calculate the number of fissions per second required to produce 1-watt power.
202) Show that the mass of radium $(^{226}_{88}Ra)$ with an activity of 1 curie is almost a gram. Given T1/2 = 1600 years.
203) Calculate the average atomic mass of chlorine if no distinction is made between its different isotopes?
204) Calculate the density of the nucleus with mass number A.
205) Give any two examples for “Nano” in nature.
206) Why steel is preferred in making Robots?
207) What are black holes?
208) What are sub atomic particles?
209) What are the salient features of corpuscular theory of light?
210) What is wave theory of light?
211) What is electromagnetic wave theory of light?
212) What is a wavefront?
213) What is Huygens’ principle?
214) What is interference of light?
215) What is phase of a wave?
216) What are coherent sources?
217) How does wavefront division provide coherent sources?
218) How do source and images behave as coherent sources?
219) What is bandwidth of interference pattern?
220) What is diffraction?
221) Discuss the special cases on first minimum in Fraunhofer diffraction.
222) What is a diffraction grating?
223) What is polarisation?
224) What is angle of polarisation and obtain the equation for angle of polarisation.
225) Discuss about pile of plates.
226) What is double refraction?
227) Mention the types of optically active crystals with example.

228) Discuss about Nicol prism.
229) How is polarisation of light obtained by scattering of light?
230) What are near point and normal focusing?
231) Why is oil immersed objective preferred in a microscope?
232) What is the use of an erecting lens in a terrestrial telescope?
233) What are the uses of spectrometer?
234) What is myopia? What is its remedy?
235) What is hypermetropia? What is its remedy?
236) What is presbyopia?
237) What is astigmatism?
238) Two light sources have intensity of light as I_0. What is the resultant intensity at a point where the two light waves have a phase difference of $\pi/3$?
239) The wavelength of a light is 450 nm. How much phase it will differ for a path of 3 mm?
240) Calculate the distance for which ray optics is good approximation for an aperture of 5 mm and wavelength 500 nm.
241) A monochromatic light of wavelength of 500 nm strikes a grating and produces fourth order maximum at an angle of 30°. Find the number of slits per centimeter.
242) The optical telescope in the Vainu Bappu Observatory at Kavalur has an objective lens of diameter 2.3 m. What is its angular resolution if the wavelength of light used is 589 nm?
243) What is the angle at which a glass plate of refractive index 1.65 is to be kept with respect to the horizontal surface so that an unpolarised light travelling horizontal after reflection from the glass plate is found to be plane polarised?
244) Calculate the power of the lens of the spectacles needed to rectify the defect of nearsightedness for a person who could see clearly up to a distance of 1.8 m.
245) A person has farsightedness with the far distance he could see clearly is 75 cm. Calculate the power of the lens of the spectacles needed to rectify the defect.
246) What is intensity division?
247) What is resolution?
248) What is Rayleigh's criterion?
249) What is the use of collimator?
250) Give the factors that are responsible for transmission impairments.
251) Explain centre frequency or resting frequency in frequency modulation.
252) What does RADAR stand for?
253) Define electron motion in a semiconductor.
254) What do you mean by doping?
255) A diode is called as a unidirectional device. Explain.
256) What do you mean by leakage current in a diode?
257) Draw the output waveform of a full wave rectifier.
258) Explain the current flow in a NPN transistor.
259) What is the phase relationship between the AC input and output voltages in a common emitter amplifier? What is the reason for the phase reversal?
260) Explain the need for a feedback circuit in a transistor oscillator.
261) State De Morgan's first and second theorems
262) What is rectification?
263) What is meant by biasing? Mention its types.
264) Define bandwidth of transmission system.
265) What do you mean by skip distance?
266) What is mobile communication?

267) Define forbidden energy gap.

268) Why is temperature co-efficient of resistance negative for semiconductor?

269) Give the Barkhausen conditions for sustained oscillations.

270) What are logic gates?

271) Write a short note on diffusion current across p - n junction.

272) Define barrier potential.

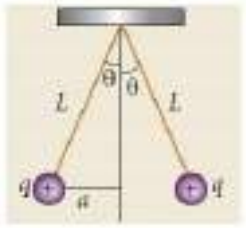
273) What is an integrated circuit?

274) What is modulation?

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

160 x 3 = 480

276) Two small-sized identical equally charged spheres, each having mass 1 g are hanging in equilibrium as shown in the figure. The length of each string is 10 cm and the angle θ is 30° with the vertical. Calculate the magnitude of the charge in each sphere. (Take g = 10 ms^{-2})



277) Calculate the electrostatic force and gravitational force between the proton and the electron in a hydrogen atom. They are separated by a distance of 5.3 x 10^{-11} m. The magnitude of charges on the electron and proton are 1.6 x 10^{-19} C. Mass of the electron is me = 9.1 x 10^{-31} kg and mass of proton is mp = 1.6 x 10^{-27} kg.

278) (a) Calculate the electric potential at points P and Q as shown in the figure below.
(b) Suppose the charge + 9μC is replaced by - 9 μC find the electrostatic potentials at points P and Q.

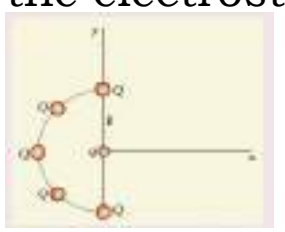
(c) Calculate the work done to bring a test charge +2 μC from infinity to the point Q. Assume the charge +9 μC is held fixed at origin and +2 μC is brought from infinity to P.

279) A parallel plate capacitor has square plates of side 5 cm and separated by a distance of 1 mm.
(a) Calculate the capacitance of this capacitor.
(b) If a 10 V battery is connected to the capacitor, what is the charge stored in any one of the plates? (The value of ε_o = 8.85 x 10^{-12} Nm^2 C^{-2})

280) A parallel plate capacitor filled with mica having ε_r = 5 is connected to a 10 V battery. The area of the parallel plate is 6 m^2 and separation distance is 6 mm.
(a) Find the capacitance and stored charge.
(b) After the capacitor is fully charged, the battery is disconnected and the dielectric is removed carefully.
Calculate the new values of capacitance, stored energy and charge.

281) What are the differences between Coulomb force and gravitational force?

282) Five identical charges Q are placed equidistant on a semicircle as shown in the figure. Another point charge q is kept at the center of the circle of radius R. Calculate the electrostatic force experienced by the charge q.



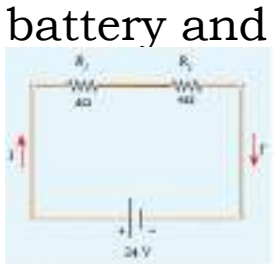
283) Suppose a charge +q on Earth's surface and another +q charge is placed on the surface of the Moon.
(a) Calculate the value of q required to balance the gravitational attraction between Earth and Moon.
(b) Suppose the distance between the Moon and Earth is halved, would the charge q change?
(Take $m_E = 5.9 \times 10^{24}$ kg, $m_M = 7.9 \times 10^{22}$ kg)

284) Distinguish between drift velocity and mobility.

285) What are ohmic and non ohmic devices?

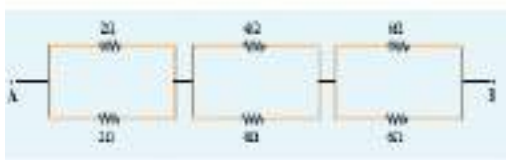
286) The resistance of a wire is 20 Ω. What will be new resistance, if it is stretched uniformly 8 times its original length?

287) Calculate the equivalent resistance for the circuit which is connected to 24 V battery and also find the potential difference across each resistors in the circuit.

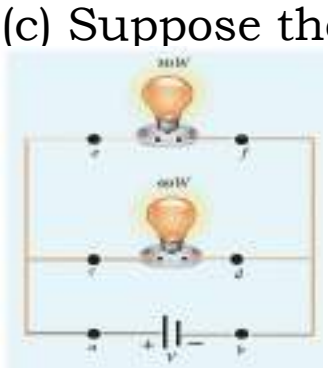


288) Two resistors when connected in series and parallel, their equivalent resistances are 15 Ω and $\frac{56}{15}$ Ω respectively. Find the individual resistances.

289) Calculate the equivalent resistance between A and B in the given circuit.

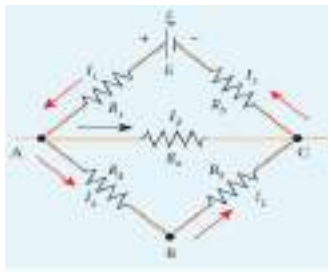


290) A battery of voltage V is connected to 30 W bulb and 60 W bulb as shown in the figure.
(a) Identify brightest bulb
(b) which bulb has greater resistance?
(c) Suppose the two bulbs are connected in series, which bulb will glow brighter?

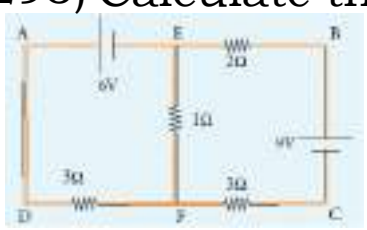


291) Two electric bulbs marked 20 W – 220 V and 100 W – 220 V are connected in series to 440 V supply. Which bulb will get fused?

292) The following figure shows a complex network of conductors which can be divided into two closed loops like EACE and ABCA. Apply Kirchoff's voltage rule(KVR)



293) Calculate the current that flows in the 1 Ω resistor in the following circuit.



294) In a Wheatstone's bridge P = 100 Ω, Q = 1000 Ω and R = 40 Ω. If the galvanometer shows zero deflection, determine the value of S.

295) An electric heater of resistance 10 Ω connected to 220 V power supply is immersed in the water of 1 kg. How long the electrical heater has to be switched on to increase its temperature from 30°C to 60°C. (The specific heat of water is s = 4200 J kg^{-1} K^{-1})

296) Write down the various forms of expression for power in electrical circuit.

297) State the applications of Seebeck effect.

298) A short bar magnet has a magnetic moment of 0.5 J T^{-1}. Calculate magnitude and direction of the magnetic field produced by the bar magnet which is kept at a distance of 0.1 m from the centre of the bar magnet along
(a) axial line of the bar magnet and
(b) normal bisector of the bar magnet.

299) Consider a magnetic dipole which on switching ON external magnetic field orient only in two possible ways i.e., one along the direction of the magnetic field (parallel to the field) and another anti-parallel to magnetic field. Compute the energy for the possible orientation.

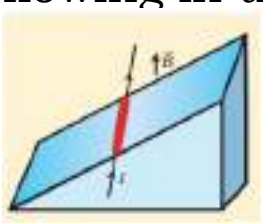
300) A coil of a tangent galvanometer of diameter 0.24 m has 100 turns. If the horizontal component of Earth's magnetic field is 25 x 10^{-6} T then, calculate the current which gives a deflection of 60° .

301) Compute the intensity of magnetisation of the bar magnet whose mass, magnetic moment and density are 200 g, 2 A m^2 and 8 g cm^{-3}, respectively.

302) Compute the work done and power delivered by the Lorentz force on the particle of charge q moving with velocity $\vec{v}$. Calculate the angle between Lorentz force and velocity of the charged particle and also interpret the result.

303) An electron moving perpendicular to a uniform magnetic field 0.500 T undergoes circular motion of radius 2.50 mm. What is the speed of electron?

304) A metallic rod of linear density is 0.25 kg m^{-1} is lying horizontally on a smooth inclined plane which makes an angle of 45° with the horizontal. The rod is not allowed to slide down by flowing a current through it when a magnetic field of strength 0.25 T is acting on it in the vertical direction. Calculate the electric current flowing in the rod to keep it stationary.

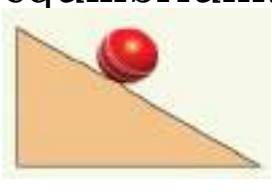


305) The coil of a moving coil galvanometer has 5 turns and each turn has an effective area of 2 x 10^{-2} m^2. It is suspended in a magnetic field whose strength is 4 x 10^{-2} Wb m^{-2}. If the torsional constant K of the suspension fibre is 4 x 10^{-9} N m deg^{-1}.
(a) Find its current sensitivity in division per microampere.
(b) Calculate the voltage sensitivity of the galvanometer for it to have full-scale deflection of 50 divisions for 25 mV.
(c) Compute the resistance of the galvanometer

306) State Biot - Savart's law.

307) A bar magnet is placed in a uniform magnetic field whose strength is 0.8 T. If the bar magnet is oriented at an angle 30° with the external field experiences a torque of 0.2 Nm. Calculate
(i) the magnetic moment of the magnet
(ii) the work done by the magnetic field in moving it from most stable configuration to the most unstable configuration and also compute the work done by the applied magnetic field in this case.

308) A non - conducting sphere has a mass of 100 g and radius 20 cm. A flat compact coil of wire with turns 5 is wrapped tightly around it with each turns concentric with the sphere. This sphere is placed on an inclined plane such that plane of coil is parallel to the inclined plane. A uniform magnetic field of 0.5 T exists in the region in vertically upward direction. Compute the current I required to rest the sphere in equilibrium.



309) How is a galvanometer converted into an ammeter

310) Give an account of magnetic Lorentz force.

311) Calculate the magnetic field at the centre of a square loop which carries a current of 1.5 A, length of each side being 50 cm.

312) A conducting rod of length 0.5 m falls freely from the top of a building of height 7.2 m at a place in Chennai where the horizontal component of Earth's magnetic field is 4.04×10^{-5} T. If the length of the rod is perpendicular to Earth's horizontal magnetic field, find the emf induced across the conductor when the rod is about to touch the ground. (Assume that the rod falls down with constant acceleration of 10 m s^{-2})

313) A solenoid of 500 turns is wound on an iron core of relative permeability 800. The length and radius of the solenoid are 40 cm and 3 cm respectively. Calculate the average emf induced in the solenoid if the current in it changes from 0 to 3 A in 0.4 second.

314) A circular metal of area 0.03 m^2 rotates in a uniform magnetic field of 0.4 T. The axis of rotation passes through the centre and perpendicular to its plane and is also parallel to the field. If the disc completes 20 revolutions in one second and the resistance of the disc is 4 Ω, calculate the induced emf between the axis and the rim and induced current flowing in the disc.

315) An ideal transformer has 460 and 40,000 turns in the primary and secondary coils respectively. Find the voltage developed per turn of the secondary if the transformer is connected to a 230 V AC mains. The secondary is given to a load of resistance 10^4 Ω. Calculate the power delivered to the load.

316) An inverter is common electrical device which we use in our homes. When there is no power in our house, inverter gives AC power to run a few electronic appliances like fan or light. An inverter has inbuilt step-up transformer which converts 12 V AC to 240 V AC. The primary coil has 100 turns and the inverter delivers 50 mA to the external circuit. Find the number of turns in the secondary and the primary current.

317) Write down the equation for a sinusoidal voltage of 50 Hz and its peak value is 20 V. Draw the corresponding voltage versus time graph.

318) The equation for an alternating current is given by i = 77 sin 314t. Find the peak current, frequency, time period and instantaneous value of current at t = 2 ms.

319) Find the impedance of a series RLC circuit if the inductive reactance, capacitive reactance and resistance are 184 Ω, 144 Ω and 30 Ω respectively. Also, calculate the phase angle between voltage and current.

320) A series RLC circuit which resonates at 400 kHz has 80 μH inductors, 2000 pF capacitor and 50 Ω resistor. Calculate
(i) Q-factor of the circuit
(ii) the new value of capacitance when the value of inductance is doubled and
(iii) the new Q-factor.

321) The current in an inductive circuit is given by 0.3 sin (200t – 40°) A. Write the equation for the voltage across it if the inductance is 40 mH.

322) A 500 μH inductor, $\frac{80}{\pi^2} pF$ capacitor and a 628 Ω resistor are connected to form a series RLC circuit. Calculate the resonant frequency and Q-factor of this circuit at resonance.

323) Find the instantaneous value of alternating voltage v = 10sin ($3\pi \times 10^4$ t) volt at
i) 0 s
ii) 50 μs
iii) 75 μs.

324) What are step-up and step-down transformers?

325) Obtain an expression for motional emf from Lorentz force.

326) A 50 cm long solenoid has 400 turns per cm. The diameter of the solenoid is 0.04 m. Find the magnetic flux linked with each turn when it carries a current of 1 A.

327) A coil of 200 turns carries a current of 0.4 A. If the magnetic flux of 4 mWb is linked with each turn of the coil, find the inductance of the coil.

328) Two air core solenoids have the same length of 80 cm and same cross-sectional area 5 cm^2 . Find the mutual inductance between them if the number of turns in the first coil is 1200 turns and that in the second coil is 400 turns.

329) A long solenoid having 400 turns per cm carries a current 2A. A 100 turn coil of cross-sectional area 4 cm^2 is placed co-axially inside the solenoid so that the coil is in the field produced by the solenoid. Find the emf induced in the coil if the current through the solenoid reverses its direction in 0.04 sec.

330) A 200 turn circular coil of radius 2 cm is placed co-axially within a long solenoid of 3 cm radius. If the turn density of the solenoid is 90 turns per cm, then calculate mutual inductance of the coil and the solenoid.

331) The solenoids S_1 and S_2 are wound on an iron-core of relative permeability 900. Their areas of their cross-section and their length are the same and are 4 cm^2 and 0.04 m respectively. If the number of turns in S_1 is 200 and that in S_2 is 800, calculate the mutual inductance between the solenoids. If the current in solenoid 1 is increased form 2A to 8A in 0.04 second, calculate the induced emf in solenoid 2.

332) A step-down transformer connected to main supply of 220 V is used to operate 11V, 88W lamp. Calculate
(i) Voltage transformation ratio and
(ii) Current in the primary.

333) A 200V/120V step-down transformer of 90% efficiency is connected to an induction stove of resistance 40 Ω. Find the current drawn by the primary of the transformer.

334) The 300 turn primary of a transformer has resistance 0.82 Ω and the resistance of its secondary of 1200 turns is 6.2 Ω. Find the voltage across the primary if the power output from the secondary at 1600V is 32 kW. Calculate the power losses in both coils when the transformer efficiency is 80%.

335) Consider a parallel plate capacitor which is connected to an 230 V RMS value and 50 Hz frequency. If the separation distance between the plates of the capacitor and area of the plates are 1 mm and 20 cm^2 respectively. Calculate the displacement current at t = 1 s.

336) A magnetron in a microwave oven emits electromagnetic waves (em waves) with frequency f = 2450 MHz. What magnetic field strength is required for electrons to move in circular paths with this frequency?.

337) A pulse of light of duration 10^{-6} s is absorbed completely by a small object initially at rest. If the power of the pulse is 60×10^{-3} W, calculate the final momentum of the object.

338) Let an electromagnetic wave propagate along the x-direction, the magnetic field oscillates at a frequency of 10^{10} Hz and has an amplitude of 10^{-5} T, acting along the y-direction. Then, compute the wavelength of the wave. Also write down the expression for electric field in this case.

339) If the relative permeability and relative permittivity of a medium are 1.0 and 2.25 respectively, find the speed of the electromagnetic wave in this medium.

340) Write down the properties of electromagnetic waves.

341) Give two uses each of
(i) IR radiation,
(ii) Microwaves and
(iii) UV radiation.

342) What are Fraunhofer lines? How are they useful in the identification of elements present in the Sun?

343) What is optical path? Obtain the equation for optical path of a medium of thickness d and refractive index n.

344) State the laws of reflection.
345) Obtain the equation for apparent depth.
346) What is critical angle and total internal reflection?
347) Obtain the equation for critical angle.
348) Give the characteristics of image formed by a plane mirror.
349) Derive the relation between f and R for a spherical mirror.
350) Arrive at lens equation from lens maker's formula.
351) Obtain the equation for lateral magnification of thin lens.
352) Derive the equation for effective focal length for lenses in contact.
353) What are resolution and resolving power?
354) Obtain lens maker's formula and mention its significance.
355) A compound microscope has a magnification of 30. The focal length of eye piece is 5 cm Assuming the final image to be at least distance of distinct vision, find the magnification produced by the objective.
356) A small bulb is placed at the bottom of a tank containing water to a depth of 80 cm, What is the area of the surface of water through which light from the bulb can emerge out? Refractive index of water is 1.33. (Consider the bulb to be a point source.)
357) A thin converging lens of refractive index 1.5 has a power of + 5.0 D. When this lens is immersed in a liquid of refractive index n, it acts as a divergent lens of focal length 100 cm. What must be the value of n?
358) If the distance D between an object and screen is greater than 4 times the focal length of a convex lens, then there are two positions of the lens for which images are formed on the screen. This method is called conjugate foci method. If d is the distance between the two positions of the lens, obtain the equation for focal length of the convex lens.
359) A thin rod of length f /3 is placed along the optical axis of a concave mirror of focal length f such that its image which is real and elongated just touches the rod. Calculate the longitudinal magnification.
360) Light travels from air in to glass slab of thickness 50 cm and refractive index 1.5.
(i) What is the speed of light in glass?
(ii) What is the time taken by the light to travel through the glass slab?
(iii) What is the optical path of the glass slab?
361) What is the radius of the illumination when seen above from inside a swimming pool from a depth of 10 m on a sunny day? What is the total angle of view? [Given, refractive index of water is 4/3]
362) The thickness of a glass slab is 0.25 m. it has a refractive index of 1.5. A ray of light is incident on the surface of the slab at an angle of 60o. Find the lateral displacement of the light when it emerges from the other side of the mirror.
363) A biconvex lens has radii of curvature 20 cm and 15 cm each. The refractive index of the material of the lens is 1.5. What is its focal length? Will the focal length change if the lens is flipped by the side?
364) What is the focal length of the combination if a lens of focal length –70 cm is brought in contact with a lens of focal length 150 cm? What is the power of the combination?
365) Light ray falls at normal incidence on the first face and emerges gracing the second face for an equilateral prism.
(a) What is the angle of deviation produced?
(b) What is the refractive index of the material of the prism?
366) It is possible for two lenses to produce zero power?
367) Why is yellow light preferred to during fog?

368) A beam of light of wavelength 600 nm from a distance source falls on a single slit 1.00 mm wide and the resulting diffraction pattern is observed on a screen 2 m away, what is the distance between the first dark fringes on either side of the central bright fringe?

369) What is a photo cell? Mention the different types of photocells.

370) A 150 W lamp emits light of mean wavelength of 5500 Å. If the efficiency is 12%, find out the number of photons emitted by the lamp in one second.

371) How many photons of frequency 10^{14} Hz will make up 19.86 J of energy?

372) What should be the velocity of the electron so that its momentum equals that of 4000 Å wavelength photon.

373) When a light of frequency 9×10^{14} Hz is incident on a metal surface, photoelectrons are emitted with a maximum speed of 8×10^{5} ms^{-1}. Determine the threshold frequency of the surface.

374) UV light of wavelength 1800 Å is incident on a lithium surface whose threshold wavelength is 4965 Å. Determine the maximum energy of the electron emitted.

375) Calculate the de Broglie wavelength of a proton whose kinetic energy is equal to 81.9×10^{-15} J. (Given: mass of proton is 1836 times that of electron).

376) Deutroa and an alpha particle alpha particle are accelerated with the same potential. Which one of the two has
i) greater value of de Broglie wavelength associated with it and
ii) less kinetic energy ? Explain.

377) An electron is accelerated through a potential difference of 81V. What is the de Broglie wavelength associated with it? To which part of electromagnetic spectrum does this wavelength correspond?

378) The ratio between the de Broglie wavelength associated with proton, accelerated through a potential of 512 V and that of alpha particle accelerated through a potential of X volts is found to be one. Find the value of X.

379) Light of wavelength 390 nm is directed at a metal electrode. To find the energy of electrons ejected, an opposing potential difference is established between it and another electrode. The current of photoelectrons from one to the other is stopped completely when the potential difference is 1.10 V. Determine i) the work function of the metal and ii) the maximum wavelength of light that can eject electrons from this metal.

380) Find the de Broglie wavelength associated with an alpha particle which is accelerated through a potential difference of 400 V. Given that the mass of the proton is 1.67×10^{-27} kg.

381) A proton and an electron have same de Broglie wavelength. Which of them moves faster and which possesses more kinetic energy? Justify your answer.

382) List out the laws of photoelectric effect.

383) Give the applications photocell.

384) Write the expression for the de Broglie wavelength associated with a charged particle of charge q and mass m, when it is accelerated through a potential V.

385) List out the characteristics of photons.

386) Write the properties of cathode rays.

387) Give the results of Rutherford alpha scattering experiment.

388) Write down the postulates of Bohr atom model.

389) (a) A hydrogen atom is excited by radiation of wavelength 97.5 nm. Find the principal quantum number of the excited state
(b) Show that the total number of lines in emission spectrum is $\frac{n(n-1)}{2}$ Compute the total number of possible lines in emission spectrum as given in(a).

390) Calculate the radius of the earth if the density of the earth is equal to the density of the nucleus.[mass of earth 5.97×10^{24} kg].

391) Calculate the mass defect and the binding energy per nucleon of the $^{108}_{47}Ag$ nucleus. [atomic mass of Ag = 107.905949]

392) Half lives of two radioactive elements A and B are 20 minutes and 40 minutes respectively. Initially, the samples have equal number of nuclei. Calculate the ratio of decayed numbers of A and B nuclei after 80 minutes.

393) On your birthday, you measure the activity of the sample 210Bi which has a half-life of 5.01 days. The initial activity that you measure is 1μCi.
(a) What is the approximate activity of the sample on your next birthday? Calculate
(b) the decay constant
(c) the mean life
(d) initial number of atoms.

394) Calculate the time required for 60% of a sample of radon undergo decay. Given $T_{1/2}$ of radon = 3.8 days.

395) (a) Show that the ratio of velocity of an electron in the first Bohr orbit to the speed of light c is a dimensionless number.
(b) Compute the velocity of electrons in ground state, first excited state and second excited state in Bohr atom model for hydrogen atom.

396) The Bohr atom model is derived with the assumption that the nucleus of the atom is stationary and only electrons revolve around the nucleus. Suppose the nucleus is also in motion, then calculate the energy of this new system.

397) Suppose the energy of an electron in hydrogen–like atom is given as $E_n = \frac{54.4}{n^2}$ where $n \in \mathbb{N}$. Calculate the following: (a) Sketch the energy levels for this atom and compute its atomic number. (b) If the atom is in ground state, compute its first excitation potential and also its ionization potential

398) A radioactive sample has 2 6. μg of pure $^{13}_{7}N$ which has a half-life of 10 minutes.
(a) How many nuclei are present initially?
(b) What is the activity initially?
(c) What is the activity after 2 hours? (d) Calculate mean life of this sample.

399) Distinguish between Nano science and Nanotechnology.

400) What is the difference between Nano materials and Bulk materials?

401) Mention any two advantages and disadvantages of Robotics.

402) Discuss the functions of key components in Robots?

403) Elaborate any two types of Robots with relevant examples.

404) Comment on the recent advancement in medical diagnosis and therapy.

405) Obtain the relation between phase difference and path difference.

406) Differentiate between Fresnel and Fraunhofer diffraction.

407) What is Fresnel's distance? Obtain the equation for Fresnel's distance.

408) Mention the differences between interference and diffraction.

409) Differentiate between polarised and unpolarised light.

410) Discuss polarisation by selective absorption.

411) What are polariser and analyser?

412) What are plane polarised, unpolarized and partially polarised light?

413) State and obtain Malus' law.

414) List the uses of polaroids.

415) State Brewster's law.

416) What are the advantages and disadvantages of a reflecting telescope?

417) Find the minimum thickness of a film of refractive index 1.25, which will strongly reflect the light of wavelength 589 nm. Also find the minimum thickness of the film to be anti-reflecting.

418) Light of wavelength 500 nm passes through a slit of 0.2 mm wide. The diffraction pattern is formed on a screen 60 cm away. Determine the,
(a) angular spread of central maximum
(b) the distance between the central maximum and the second minimum.

419) A man with a near point of 25 cm reads a book which has small print using a magnifying lens of focal length 5 cm.
(a) What are the closest and the farthest distances at which he should keep the lens from the book?
(b) What are the maximum and the minimum magnification possible?

420) A small telescope has an objective lens of focal length 125 cm and an eyepiece of focal length 2 cm.
(a) What is the magnification of the telescope?
(b) What is the separation between the objective and the eyepiece?
(c) What is the angular separation between two stars when viewed through this telescope if they subtend 1' for bare eye?

421) Obtain the equation for bandwidth in Young's double slit experiment.

422) What is the difference between resolution and magnification?

423) Light of wavelength of 5000 Å produces diffraction pattern of the single slit of width 2.5 μm. What is the maximum order of diffraction possible?

424) An unpolarised light of intensity 32 Wm^{-2} passes through three Polaroids such that the axes of the first and the last Polaroids are at 90°. What is the angle between the axes of the first and middle Polaroids so that the emerging light has an intensity of only 3 Wm^{-2}?

425) Distinguish between wireline and wireless communication? Specify the range of electromagnetic waves in which it is used.

426) What do you mean by Internet of Things?

427) Distinguish between intrinsic and extrinsic semiconductors.

428) How electron-hole pairs are created in a semiconductor material?

429) Distinguish between avalanche breakdown and Zener breakdown.

430) Discuss the biasing polarities in an NPN and PNP transistors

431) Write notes on photodiode.

432) State and prove De Morgan's first and second theorem.

433) Calculate the range of the variable capacitor that is to be used in a tuned-collector oscillator which has a fixed inductance of 150 μH. The frequency band is from 500 kHz to 1500 kHz.

434) List the applications of light emitting diode.

435) Give applications of RADAR.

140 x 5 = 700

436) Consider a point charge +q placed at the origin and another point charge -2q placed at a distance of 9 m from the charge +q. Determine the point between the two charges at which electric potential is zero.

437) Discuss the basic properties of electric charges.

438) Explain in detail Coulomb's law and its various aspects.

439) Define 'Electric field' and discuss its various aspects.

440) Calculate the electric field due to a dipole on its axial line and equatorial plane.

441) Derive an expression for the torque experienced by a dipole due to a uniform electric field.

442) Derive an expression for electrostatic potential due to a point charge.

443) Derive an expression for electrostatic potential due to an electric dipole.

444) Obtain an expression for potential energy due to a collection of three point charges which are separated by finite distances.

445) Derive an expression for electrostatic potential energy of the dipole in a uniform electric field.
446) Obtain Gauss law from Coulomb's law.
447) Obtain the expression for electric field due to an infinitely long charged wire.
448) Obtain the expression for electric field due to an charged infinite plane sheet.
449) Obtain the expression for electric field due to an uniformly charged spherical shell.
450) Discuss the various properties of conductors in electrostatic equilibrium.
451) Explain the process of electrostatic induction.
452) Explain dielectrics in detail and how an electric field is induced inside a dielectric.
453) Obtain the expression for capacitance for a parallel plate capacitor.
454) Obtain the expression for energy stored in the parallel plate capacitor.
455) Explain in detail the effect of a dielectric placed in a parallel plate capacitor.
456) Derive the expression for resultant capacitance, when capacitors are connected in series and in parallel.
457) Explain in detail how charges are distributed in a conductor, and the principle behind the lightning conductor.
458) Explain in detail the construction and working of a Van de Graaff generator.
459) Describe the microscopic model of current and obtain general form of Ohm's law.
460) Obtain the macroscopic form of Ohm's law from its microscopic form and discuss its limitation.
461) Explain the equivalent resistance of a series and parallel resistor network.
462) Explain the determination of the internal resistance of a cell using voltmeter.
463) State and explain Kirchhoff's rules.
464) Obtain the condition for bridge balance in Wheatstone's bridge.
465) Explain the determination of unknown resistance using meter bridge.
466) How the emf of two cells are compared using potentiometer?
467) Deduce the relation for the magnetic field at a point due to an infinitely long straight conductor carrying current.
468) Obtain a relation for the magnetic field at a point along the axis of a circular coil carrying current.
469) Compute the torque experienced by a magnetic needle in a uniform magnetic field.
470) Calculate the magnetic field at a point on the axial line of a bar magnet.
471) Obtain the magnetic field at a point on the equatorial line of a bar magnet.
472) Find the magnetic field due to a long straight conductor using Ampere's circuital law.
473) Discuss the working of cyclotron in detail.
474) What is tangent law? Discuss in detail.
475) Discuss the conversion of galvanometer into an ammeter and also a voltmeter.
476) Calculate the magnetic field inside and outside of the long solenoid using Ampere's circuital law.
477) Derive the expression for the torque on a current-carrying coil in a magnetic field.
478) Derive the expression for the force between two parallel, current - carrying conductors.
479) Compare the properties of soft and hard ferromagnetic materials.
480) Derive the expression for the force on a current-carrying conductor in a magnetic field.

481) Establish the fact that the relative motion between the coil and the magnet induces an emf in the coil of a closed circuit.

482) Give an illustration of determining direction of induced current by using Lenz's law.

483) Show that Lenz's law is in accordance with the law of conservation of energy.

484) Give the uses of Foucault current.

485) Define self-inductance of a coil interms of
(i) magnetic flux and
(ii) induced emf.

486) How will you define the unit of inductance?

487) What do you understand by self inductance of a coil? Give its physical significance.

488) Assuming that the length of the solenoid is large when compared to its diameter, find the equation for its inductance.

489) An inductor of inductance L carries an electric current i. How much energy is stored while establishing the current in it?

490) Show that the mutual inductance between a pair of coils is same ($M_{12} = M_{21}$).

491) How will you induce an emf by changing the area enclosed by the coil?

492) Show mathematically that the rotation of a coil in a magnetic field over one rotation induces an alternating emf of one cycle.

493) Elaborate the standard construction details of AC generator.

494) Explain the working of a single-phase AC generator with necessary diagram.

495) How are the three different emfs generated in a three-phase AC generator? Show the graphical representation of these three emfs.

496) Explain the construction and working of transformer.

497) Mention the various energy losses in a transformer.

498) Give the advantage of AC in long distance power transmission with an illustration.

499) Find out the phase relationship between voltage and current in a pure inductive circuit.

500) Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.

501) Define inductive and capacitive reactance. Give their units.

502) Prove that the total energy is conserved during LC oscillations.

503) Write down Maxwell equations in integral form.

504) Explain the Maxwell's modification of Ampere's circuital law.

505) Discuss the source of electromagnetic waves

506) Explain the types of emission spectrum.

507) Explain the types of absorption spectrum.

508) Discuss the Hertz experiment.

509) Explain the importance of Maxwell's correction.

510) Derive the mirror equation and the equation for lateral magnification.

511) Obtain the equation for radius of illumination (or) Snell's window.

512) Derive the equation for acceptance angle and numerical aperture of optical fibre.

513) Obtain the equation for lateral displacement of light passing through a glass slab.

514) Derive the equation for refraction at single spherical surface.

515) Derive the equation for angle of deviation produced by a prism and thus obtain the equation for refractive index of material of the prism.

516) Derive the equation for thin lens and obtain its magnification

517) What do you mean by electron emission? Explain briefly various methods of electron emission.
518) Briefly discuss the observations of Hertz, Hallwachs and Lenard.
519) Explain the effect of potential difference on photoelectric current.
520) Explain how frequency of incident light varies with stopping potential.
521) Explain why photoelectric effect cannot be explained on the basis of wave nature of light.
522) Explain the quantum concept of light.
523) Obtain Einstein's photoelectric equation with necessary explanation.
524) Explain experimentally observed facts of photoelectric effect with the help of Einstein's explanation.
525) Give the construction and working of photo emissive cell.
526) Derive an expression for de Broglie wavelength of electrons.
527) Briefly explain the principle and working of electron microscope.
528) How do we obtain characteristic x-ray spectra?
529) If the input to the NOT gate is A = 0011, its output is
a) 0100 b) 1000 c) 1100 d) 0011
530) Explain the J.J. Thomson experiment to determine the specific charge of electron.
531) Discuss the Millikan's oil drop experiment to determine the charge of an electron.
532) Derive the energy expression for an electron is the hydrogen atom using Bohr atom model.
533) Discuss the spectral series of hydrogen atom.
534) Explain the variation of average binding energy with the mass number using graph and discuss about its features.
535) Explain in detail the nuclear force.
536) Discuss the alpha decay process with example.
537) Discuss the beta decay process with examples.
538) Discuss the gamma emission process with example.
539) Obtain the law of radioactivity.
540) Discuss the properties of neutrino and its role in beta decay.
541) Discuss the process of nuclear fission and its properties.
542) Discuss the process of nuclear fusion and how energy is generated in stars?
543) Explain in detail the four fundamental forces.
544) Discuss the applications of Nanomaterials in various fields.
545) What are the possible harmful effects of usage of Nanoparticles? Why?
546) Prove laws of reflection using Huygens' principle.
547) Prove law of refraction using Huygens' principle.
548) Obtain the equation for resultant intensity due to interference of light.
549) Explain the Young's double slit experimental setup and obtain the equation for path difference.
550) Obtain the equations for constructive and destructive interference for transmitted and reflected waves in thin films.
551) Discuss the experiment to determine the wavelength of monochromatic light using diffraction grating.
552) Discuss the experiment to determine the wavelength of different colours using diffraction grating.
553) Obtain the equation for resolving power of optical instruments.
554) Discuss about simple microscope and obtain the equations for magnification for near point focusing and normal focusing.

555) Explain about compound microscope and obtain the equation for the magnification.
556) Discuss about astronomical telescope.
557) Explain the experimental determination of material of the prism using spectrometer.
558) Mention different parts of spectrometer and explain the preliminary adjustments.
559) Prove the laws of reflection using Huygen's principle.
560) What is modulation? Explain the types of modulation with necessary diagrams.
561) Elaborate on the basic elements of communication system with the necessary block diagram.
562) Explain the three modes of propagation of electromagnetic waves through space.
563) What do you know about GPS? Write a few applications of GPS.
564) Give the applications of lCT in mining and agriculture sectors.
565) Modulation helps to reduce the antenna size in wireless communication - Explain
566) Fiber optic communication is gaining popularity among the various transmission media -justify.
567) Elucidate the formation of a N -type and P-type semiconductors.
568) Explain the formation of PN junction diode. Discuss its V–I characteristics.
569) Draw the circuit diagram of a half-wave rectifier and explain its working.
570) Explain the construction and working of a full wave rectifier
571) What is an LED? Give the principle of its operation with a diagram.
572) Describe the function of a transistor as an amplifier with the neat circuit diagram. Sketch the input and output wave forms.
573) Transistor functions as a switch. Explain.
574) State Boolean laws. Elucidate how they are used to simplify Boolean expressions with suitable example.
575) Explain the working principle of a solar cell. Mention its applications

****