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PHYSICS (054)

SECTION-A

● **Choose the correct option : (1 mark each)**

(1) What is the ratio of magnitude of forces acting on two charges 1μC and 5μC ?

(A) 1 : 5 (B) 5 : 1

(C) 1 : 25 (D) 1 : 1

(2) When two spheres having 2Q and -Q charge are placed at a certain distance, the force acting between them is F. Now they are connected by a conducting wire and again separated from each other. How much force will act between them if the separation now is same as before, the force acting between them will be

(A) + F (B) +F/2

(C) +F/4 (D) + F/8

(3) One point electric charge Q is placed at P. A closed surface is placed near the point P. The electrical total flux passing through a surface of the sphere will be :

(A) $Q \in_0$ (B) $\in_0 / Q$

(C) $Q / \in_0$ (D) Zero

(4) The charge Q is placed on (n-1) corners of a polygon of sides n. The distance of each corner from the centre of the polygon is r. The electric field at its center is :

(A) KQ/r^2 (B) $(n-1)\frac{KQ}{r^2}$

(C) $\left(\frac{n-1}{n}\right)\frac{KQ}{r^2}$ (D) $\left(\frac{n}{n-1}\right)\frac{KQ}{r^2}$

(5) An electric dipole is placed at the center of a sphere. The flux passing through the surface of the sphere is _____

(A) infinity (B) Zero

(C) $2q / \in_0$ (D) cannot be found

(6) The linear charge density on the circumference of a circle of radia 'a' varies as $\lambda_0 = \lambda_0 \cos\theta$ The total charge on it, is :

(A) zero (B) infinite

(C) $\pi a\lambda_0$ (D) $2\pi a$

(7) Two point charges 10μC and 40μC are kept 30 cm apart. At a distance _____, on the straight line joining them, the intensity of electric field is zero.

(A) 20 cm from 40μC (B) 7.5 cm from 10μC

(C) 15 cm from 40μC (D) 5 cm from 10μC

(8) Two spheres carrying charge q are hanging from a same point of suspension with the help of threads of length 2m, in a space free from gravity. The distance between them will be :

(A) 2m (B) 4m

(C) 1m (D) undetermined

(9) The dimensions of permittivity [ε_0] are _____ Take Q as the dimensions of charge.

(A) $M^1L^{-2}T^{-2}Q^{-2}$ (B) $M^{-1}L^2T^{-3}Q^{-1}$

(C) $M^{-1}L^{-3}T^2Q^2$ (D) $M^1L^3T^{-2}Q^{-2}$

(10) E_0 intensity of an electric field is present along the X-axis. If the electric potential at point x = 0 is zero, then the value of the electric potential at point x = +x will be _____

(A) $V(x) = xE_0$ (B) $V(x) = -xE_0$

(C) $V(x) = x^2E_0$ (D) $V(x) = -x^2E_0$

(11) A point electrical charge 3C is at the center of a circle of radius r. The line integration of the electric field of charge 3C along the circumference of the circle will be .....

(A) $\frac{1}{4\pi \in_0} \cdot \frac{3}{r}$ (B) zero

(C) $\frac{6\pi}{4\pi \in_0} \cdot \frac{1}{r^2}$ (D) $6\pi r$

(12) A metal of negligible thickness is introduced between the two plates of the capacitor. The value of capacitance will be .....

(A) doubled (B) increased by 3 times

(C) halved (D) unchanged

(13) An object having mass *m* and charge *q* is initially kept stationary in a uniform electric field E. It is then freed. Calculate the kinetic energy of the particle, when it travels a distance *d*.

(A) $q E^2 d$ (B) $q E d$

(C) $q^2 E d$ (D) $q E d^2$

(14) The potential energy of the system in which one electron is brought close to another electron will .....

(A) increase (B) decrease

(C) not change (D) become zero

(15) One variable capacitor is connected to 100 V battery. If the capacitance is increased from $2\mu F$ to $10\mu F$, the change in energy in the above system will be :

(A) 2×10^{-2} J (B) 4×10^{-2} J

(C) 25×10^{-2} J (D) 16.5×10^{-2} J

(16) The unit of volt is equivalent to which of the following units .....

(A) J / A (B) $NC^{-1}m^{-2}$

(C) J / C (D) erg / cm

(17) The energy of a charged capacitor is U. Another identical capacitor is connected parallel to the first capacitor, after disconnecting the battery. The energy of each of the capacitors will be .....

(A) U (B) 3U/2

(C) U/4 (D) U/2

(18) The maximum amount of current can be drawn from the battery, whose emf is equal to 12 V and having 0.4Ω internal resistance will be equal to .....

(A) 30 A (B) 4.8 A

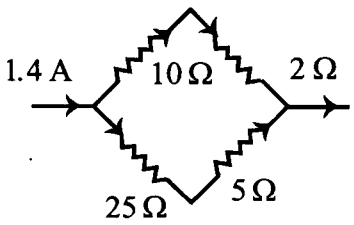
(C) 48 A (D) 24 A

(19) If $5\times10^{4}\Omega$ is the resistance of a person's wet hand, then _____ potential difference will generate a fatal current of 1.0 mA

(A) 50,000 mV (B) 50,000μV

(C) 230 mV (D) 230μV

(20) _____ A current flows through the $2\,\Omega$ branch of resistance.



(A) 1.4 (B) 1.0

(C) 0.4 (D) 1.2

(21) If n number of cells each of which have emf ε are connected in parallel, the resultant emf will be equal to _____

(A) $n\varepsilon$ (B) $n^2\varepsilon$

(C) ε / n (D) None of the three option

(22) A copper wire having resistance R is divided into ten equal parts. Five of these are connected in series and other five are connected in parallel and finally both of them are connected with each other. Calculate the resultant resistance of such an arrangement.

(A) R (B) R/4

(C) R/5 (D) R/52

(23) The resistance of a 10 meter long potentiometer wire is $20\,\Omega$ It is connected in series with a 3 V battery and $10\,\Omega$ resistor. The potential difference between two points separated by distance 30 cm is equal to

(A) 0.06V (B) 0.02V

(C) 0.1V (D) 1.2V

(24) An electrician has two resistive coils. He can obtain the resistances of 3Ω, 4Ω, 12Ω and $16\,\Omega$ on connecting them independently, in series and parallel respectively. So, resistances of these two coils are . ..... Ω and..... Ω

(A) 6 and 10 (B) 7 and 9

(C) 4 and 16 (D) 4 and 12

(25) Which of the wire will be used as shunt if l represents length and d represents diameter ? (Out of the given options)

(A) l, d (B) $2l$, d

(C) $l/2$, $2d$ (D) $2l$, $d/2$

(26) To obtain more thermo e.m.f. the metals of _____ in thermoelectric series must be used.

(A) closer to each other (B) costly

(C) any order (D) None of the three options

(27) To deposit 1 gm. equivalent of substance on cathode in an experiment of electrolysis is _____C.

(A) 1.6×10^{-9} (B) 96,500

(C) 95,600 (D) 4.8×10^{-8}

(28) When a heater of large wattage is switched on, a bulb lighting in our house becomes dim for a moment because .....

(A) current passing through the bulb decreases

(B) p.d. between two ends of the bulb increases

(C) resistance of the heater adds in series.

(D) None of the three option

(29) Temperature of a conductor increases by 5^0 C on passing electric current for some time. The increase in its temperature when double current is passed through the same conductor for the same time is ..... ^{0} C.

(A) 20 (B) 16

(C) 12 (D) 10

(30) Neutral temperature of a thermocouple is 270^0 C. and temperature of the cold junction is 15^0 C. then the temperature of inversion is ..... ^{0} C.

(A) 255 (B) 285

(C) 525 (D) 575

(31) If p.d. across a conductor is constant and resistivity of its material is ρ, the Joule heat produced in 1s is proportional to .....

(A) $1/\rho$ (B) $1/\sqrt{\rho}$

(C) ρ (D) ρ^2

(32) Two bulbs rated P_1 Watt, V volt and P_2 watt, V volts are connected in series and applied across V volts, The total power (in watts) will be .....

(A) $P_1 \cdot P_2$ (B) $P_1 + P_2$

(C) $\frac{P_1 + P_2}{P_1 P_2}$ (D) $\frac{P_1 P_2}{P_1 + P_2}$

(33) Resistance of two bulbs of 200 W and 100 W are R_1 and R_2 respectively and they can be used with a supply of same voltage, then .....

(A) $R_1 = 6R_2$ (B) $R_2 = 2R_1$

(C) $R_2 = 4R_1$ (D) $R_1 = 4R_2$

(34) For thermocouple, thermo emf. .....

(A) is always positive (B) is always negative

(C) can be positive, negative or zero (D) is always zero

(35) The current through a lamp is decreased by 5 %, then power consumption approximately .....

(A) increases by 5% (B) decreases by 5%

(C) increases by 10% (D) decreases by 10%

(36) If temperature of a metal increases, then its work function .....

(A) increases (B) decreases

(C) does not change (D) cannot be predicted

(37) When current is passed through a circular wire prepared from a long conducting wire, magnetic field produced at its centre is B. Now a loop having two turns is prepared from the same wire and the same current is passed through it. The magnetic field at its center will be

(A) $B/4$ (B) $B/2$

(C) 4B (D) 2B

(38) Kinetic energy of a charged particle moving in a magnetic field

(A) remains constant (B) increases

(C) decreases (D) becomes zero

(39) Two particles of mass m and charge q are attached with two ends, one with each end, of a rod of length $2r$. The rod is rotated with angular speed ω about its mid point. The ratio of magnetic moment produced and total angular momentum of these particles is

(A) q/m (B) $q/2m$

(C) $2q/m$ (D) $q/\pi m$

(40) Speed of a particle moving through a magnetic field is increased then the radius of curvature of its trajectory will .....

(A) increase (B) decrease

(C) become half (D) not change

(41) In the middle of the solenoid, magnetic field lines are .....

(A) circular (B) perpendicular to the axis

(C) parallel to the axis (D) None of the three options

(42) A Proton and an α particle enter the magnetic field with equal velocity, then which one of these particles experiences more force ?

(A) Proton (B) α particle

(C) both experiences equal force (D) cannot be predicted

(43) What is the shape of an ideal toroid ?

(A) Triangle (B) Square

(C) Cylindrical (D) Circular

(44) 1 tesla = ... gauss.

(A) 10^{-4} (B) 10^{-2}

(C) 10^{-1} (D) 10^{4}

(45) In a magnetic field, a diamagnetic substance

(A) goes from the region of strong magnetic field to the region of weak magnetic field.

(B) adjusts perpendicular to the magnetic field

(C) goes from the region of weak magnetic field to the region of strong magnetic field.

(D) none of the above three happens

(46) A bar magnet with length L and with magnetic moment M is split into two equal pieces, then the magnetic moment of each piece is

(A) M (B) M/4

(C) M/2 (D) $\sqrt{2}M$

(47) Which of the following substances cannot be ferromagnetic in character ?

(A) Solids (B) Gases

(C) Alloys (D) None of the above

(48) Magnetic properties of which of the following materials are affected by temperature ?

(A) Diamagnetic (B) Ferromagnetic

(C) Paramagnetic (D) All

(49) The direction of magnetic dipole moment .....

(A) is from the north pole to the south pole (B) is from the south pole to the north pole

(C) is scalar quantity (D) can be in any direction

(50) The earth's magnetic field in a closed iron box is ..... then the magnetic field outside the box.

(A) more (B) less

(C) equal (D) zero

(51) Relative permeability of one substance is 0.050; its magnetic susceptibility is

(A) 0.950 (B) 0.925

(C) -0.925 (D) -0.950

(52) State the angle of dip at a place where horizontal component of earth's magnetic field is equal to the vertical component.

(A) 90^0 (B) 0^0

(C) 30^0 (D) 45^0

(53) For vacuum magnetic susceptibility .....

(A) $Xm = 0$ (B) $Xm > 1$

(C) $Xm < 1$ (D) $Xm = 1$

(54) In ferromagnetic substance, domain are approximately of the order of ..... in size.

(A) 1 cm (B) 1 meter

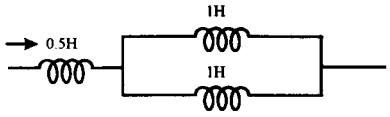
(C) 10^{-3} m (D) 10^{-2} m

(55) Magnetic flux linked with a coil is $\phi = 7t^2 + 2t - 3$ where t is in seconds and ϕ is in Wb. At t=1 s, the induced emf = ... V

(A) 16 (B) 1.6

(C) 14 (D) 6

(56) Equivalent inductance of the circuit shown in the figure is



(A) 2.5 H (B) 1H

(C) 1.5 H (D) none of these

(57) A square-conducting coil of area 10^{-2} m^2 is placed normally inside a uniform magnetic field of 10^3 Wbm^{-2}. The magnetic flux linked with the coil is ..... Wb.

(A) 10^5 (B) 10^{-5}

(C) 10 (D) 0

(58) The self-inductance of a coil of 600 turns and some radius is 108 mH. Then the self-inductance of an inductance of an identical coil having 500 turns will be ..... mH.

(A) 90 (B) 130

(C) 155 (D) 75

(59) A conducting rod of 1 m length is moving with a velocity $10ms^{-1}$ in a direction parallel to the magnetic field of intensity 1 T. Then, induced emf in the rod will be .....

(A) 10V (B) 0.1V

(C) 1V (D) 0

(60) 900 mJ energy is required to induce 3A current in a coil, then the self-inductance of the coil will be .....

(A) 0.2 H (B) 2 H

(C) 0.2 mH (D) None of these

(61) The self-inductance of a straight conducting wire is .....

(A) zero (B) infinite

(C) very small (D) not predicted

(62) The value of the Q factor is an L-C-R series circuit is .....

(A) Dependent on the frequency of the a.c. source.

(B) Dependent on the values of all the three components L,R and C.

(C) Dependent only on the values of L and C

(D) It may or may not depend on the power factor.

(63) V and I are given by the following equation in an a.c. circuit. V = 100 sin (100t) V, I = $100 \sin\left(100t + \frac{\pi}{3}\right)$ mA The power in the circuit is equal to ..... W

(A) 10^2 (B) 10^4

(C) 2.5 (D) 25

(64) The power in an a.c. circuit is given as $P = V_{rms} \cdot I_{rms} \cos\theta$ The power factor at the resonance frequency of a series L-C-R circuit will be .....

(A) 1 (B) zero

(C) $1/2$ (D) $1/\sqrt{2}$

(65) An alternating current is given by the formula : $I = I_1 \sin(\omega t) + I_2 \cos(\omega t)$ The rms value of the current will be equal to .....

(A) $\frac{I_1 + I_2}{\sqrt{2}}$ (B) $\frac{I_1 - I_2}{\sqrt{2}}$

(C) $\sqrt{\frac{I_1^2 + I_2^2}{2}}$ (D) $\sqrt{\frac{I_1^2 - I_2^2}{2}}$

(66) An A.C. voltage source has 220 V and 50 Hz frequency, the average value of the voltage in a time interval 0.01 is equal to V

(A) zero (B) 22,000

(C) $\frac{220 \times 2}{\pi}$ (D) None of the option

(67) On connecting a pure inductor with the source, 20 Ω reactance is obtained. How much times will the reactance be if frequency of source is made three times ?

(A) 20 (B) 10

(C) 3 (D) 9

(68) In an A.C. circuit, value of reactance of an inductor is same as that of its resistance. What will be the phase difference between the current flowing in this inductor and voltage ?

(A) 45^0 (B) 90^0

(C) 30^0 (D) 60^0

(69) In an A.C. L - C - R series circuit, at resonance .....

(A) $X_L > X_C$ (B) $X_L < X_C$

(C) $X_L = X_C$ (D) none of these

(70) Power dissipation in an A.C. L - C - R series circuit is directly proportional to .....

(A) Z (B) R

(C) L (D) C

(71) In an ideal transformer, an alternating current of 2A is flowing in primary coil. The number of turns in primary and secondary coil are 100 and 20 respectively. Then current flowing in secondary coil is .....

(A) 0.4 A (B) 5 A

(C) 0.08 A (D) 10 A

(72) If V_g, V_x and V_m are the velocity of the γ-rays, X-rays and microwave respectively in space then

(A) $V_g < V_x < V_m$ (B) $V_g > V_x > V_m$

(C) $V_g = V_x = V_m$ (D) $V_g > V_x < V_m$

(73) If the relative permeability and dielectric constant of a given medium are equal to μ_r and K respectively, then the refractive index of the medium is equal to .....

(A) $\sqrt{\mu_r \epsilon_0}$ (B) $\sqrt{\mu_r k}$

(C) $\sqrt{\mu_0 \epsilon_0}$ (D) $\frac{1}{\sqrt{\mu_r k}}$

(74) The maximum value of $\vec{E}$ in an electromagnetic wave is equal to $18 Vm^{-1}$ then the maximum value of $\vec{B}$ will be equal to .....T.

(A) 9×10^{-9} (B) 10×10^{-11}

(C) 6×8^{-8} (D) 4×10^{-6}

(75) An electromagnetic wave passing through space is given by the following equations $E = E_0 \sin(\omega t - kx)$ $B = B_0 \sin(\omega t - kx)$ which of the following options are true ?

(A) $E_0 B_0 = \omega k$ (B) $E_0 \omega = B_0 K^0$

(C) $E_0 K = B_0 \omega$ (D) None of the above option.

(76) ..... rays are known as Heat rays.

(A) Infrared (B) Ultraviolet

(C) X (D) Visible light

(77) Jagdishchandra Bose generated electromagnetic waves, having wavelength in the range of ..... mm to ..... mm in his laboratory.

(A) 10 to 20 (B) 20 to 30

(C) 5 to 25 (D) 25 to 50

(78) In order to produce electromagnetic waves of wavelength 300 m, frequency of oscillations of electric charge will be ..... Hz.

(A) 10^5 (B) 10^6

(C) 10^3 (D) 10^2

(79) According to Maxwell, a changing electric field produces .....

(A) emf (B) electric field

(C) magnetic field (D) radiation pressure

(80) A liquid of refractive index n is filled in a tank. A plane mirror is kept at the bottom of tank. A point like object P is kept at height h from the mirror. An observer observes P and image obtained of P from the top vertically upward direction. What will be the distance observed by the observer.

(A) 2nh (B) $\frac{n}{2h}$

(C) $\frac{2h}{n}$ (D) $\frac{2n}{n-1}$

(81) A ray of light is traveling from a denser medium to rarer medium. For these media critical angle is C. So, maximum possible deviation of the ray is .....

(A) $\pi - 2C$ (B) $\pi - C$

(C) 2C (D) $\pi/2 + C$

(82) Focal length of a thin lens made of the material of refractive index 1.5, is 15 cm. It's focal length when it is kept in a medium of refractive index 4/3 would be .....

(A) 45 cm (B) 30 cm

(C) 75 cm (D) 60 cm

(83) A ray of light is incident normally on the surface of an equilateral prism made of material of refractive index 1.5 So, angle of deviation is .....

(A) 45^0 (B) 60^0

(C) 75^0 (D) 30^0

(84) When a ray of light travels from one medium to the other, then the physical quantity which changes is :.....

(A) frequency (B) refractive index.

(C) wavelength (D) none of the above

(85) Radii of curvature of both the sides of a convex lens are 15 cm if the refractive index of the material of the lens is 1.5, it's focal length in air is .....

(A) 10 cm (B) 20 cm

(C) 15 cm (D) 30 cm

(86) Forcal length of the lens of the eye is changed by .....

(A) Retina (B) Ciliary muscle

(C) Cornea (D) Crystalline lens

(87) An image of an object obtained by convex mirror is n times smaller than the object, if focal length of lens is f , object distance would be .....

(A) $(n-1)f$ (B) nf

(C) $f/n-1$ (D) f/n

(88) If refractive index of a medium with respect to air is $(2/\sqrt{3})$, critical angle of the medium with respect to air is .....

(A) 60^0 (B) 45^0

(C) 30^0 (D) none of these

(89) If image of an object is formed on the principal focus of a convex lens, then the position of the object is .....

(A) at infinite distance (B) on the principal focus F

(C) on the centre of curvature C (D) between F and C

(90) For which one of the following colour, the focal length of convex lens is minimum ?

(A) Red (B) Green

(C) Blue (D) Yellow

(91) The power of two lenses placed in contact with each other are -15 D and +5D. Then equivalent focal length of combination of lenses will be ..... cm.

(A) -10cm (B) +10cm

(C) +20cm (D) -20cm

(92) The distance between two slits in young's experiment is 0.2 mm. If the wavelength of light used is 5000 A^0. the angular position of 3rd bright fringe from central bright fringe is .....rad.

(A) 0.075 (B) 0.75

(C) 0.0075 (D) 0.057

(93) In young's experiment if a transparent sheet is placed, the width of the fringes

(A) decreases (B) increases

(C) remains the same (D) get irregular

(94) Detailed information can be obtained by the oil immersion objective of a microscope, because such objective has .....

(A) more resolution (B) more magnification

(C) greater diameter (D) none of the above

(95) A plate of thickness d and refractive index 1.5 is placed in the passage of one ray in Young's experiment. If the central fringe is bright, the minimum thickness of the plate is .....

(A) λ (B) $2\lambda/3$

(C) $\lambda/3$ (D) 2λ

(96) To decide the position of point like object precisely ..... light should be used.

(A) short wavelength (B) long wavelength

(C) polarized (D) intense

(97) The resultant intensity, obtained due to superposition of two waves of intensity I_1 and I_2 and having phase difference of $\pi/2$ is .....

(A) $I_1 + I_2$ (B) $I_1^2 + I_2^2$

(C) $\left[I_1^2 + I_2^2 + 2I_1 I_2\right]$ (D) none of these

(98) In a Fraunhoffer diffraction formed by single slit, if wavelength of incident light is λ and width of slit is 2λ then value of angle of diffraction is .....

(A) $\pi/2$ (B) $\pi/6$

(C) $\pi/3$ (D) $\pi/4$

(99) The resolving power of telescope depends on .....

(A) focal length of objective lens (B) focal length of eye-piece

(C) diameter of objective lens (D) length of telescope

(100) The diameter of the lens of a telescope is 1.22 m. Wavelength of light is $5000A^0$ the resolution power of the telescope is .....

(A) 2×10^5 (B) 2×10^6

(C) 2×10^3 (D) 2×10^1

(101) Photo electric effect represents that,.....

(A) electron has a wave nature (B) light has a particle nature

(C) (a) and (b) both (D) none of the above

(102) De Broglie wavelength of a particle moving with velocity 2.25×10^8 ms^{-1} is same as the wavelength of photon. The ratio of kinetic energy of the particle to the energy of photon is ..... Velocity of light 3×10^8 ms^{-1}

(A) $\frac{3}{8}$ (B) $\frac{8}{3}$

(C) $\frac{7}{8}$ (D) $8/7$

(103) Energy of photon is $E = hf$ and its momentum is $P = h/\lambda$, where λ is the wavelength of photon. With this assumption speed of light wave is .....

(A) 3×10^8 ms^{-1} (B) EP

(C) E/P (D) $(E/p)^2$

(104) Wavelength of an electron having energy 10 KeV is ..... A^0

(A) 0.12 (B) 12

(C) 1.2 (D) 120

(105) If the momentum of an electron is required to be same as that of wave of 5200 A^0 wave length. Its velocity should be ..... ms^{-1}

(A) 10^3 (B) 1.2×10^3

(C) 2.8×10^3 (D) 1.4×10^3

(106) Mass of proton in motion is .....

(A) hf/c^2 (B) hf

(C) h/λ (D) c/hf

(107) A proton and electron are lying in a box having unpenetrable walls, the ratio of uncertainity in their velocities are .....

m_e = mass of electron and m_p = mass of proton.

(A) $m_e \cdot m_p$ (B) $\frac{m_e}{m_p}$

(C) $\sqrt{m_e\, m_p}$ (D) $\sqrt{\frac{m_e}{m_p}}$

(108) From Davisson - Germer experiment, it is proved that .....

(A) light has wave nature (B) light has particle nature

(C) material particle has particle nature (D) material particle has wave nature

(109) Dimensional formula of Planck's constant (h) is .....

(A) $M^1 L^2 T^{-2}$ (B) $M^1 L^0 T^{-2}$

(C) $M^1 L^2 T^{-1}$ (D) $M^0 L^0 T^0$

(110) If a piece of sodium or potassium is kept in sunlight, then .....

(A) it becomes negatively charged (B) it becomes positively charged

(C) it remains neutral (D) nothing can be said

(111) The ionization potential of hydrogen atom is 13.6 V. The energy required to liberate the electron from it's second state is .....

(A) 6.8 eV (B) 27.2 eV

(C) 13.6 eV (D) 13.4 eV

(112) The ratio of energies of electron in the first excited state to it's second excited state is .....

(A) 1 : 4 (B) 4 : 1

(C) 4 : 9 (D) 9 : 4

(113) The operating voltage in a Coolidge tube is 10^5 V. The speed of X-rays produced is ..... ms^{-1}

(A) 10^5 (B) 2×10^5

(C) 3×10^8 (D) information is incomplete

(114) The wavelength of the first line of Lyman series is λ The wavelength of the first line in Balmer series is .....

(A) $\frac{5}{27}\lambda$ (B) $\frac{27}{5}\lambda$

(C) $\frac{9}{2}\lambda$ (D) $\frac{2}{9}\lambda$

(115) For the first orbit of hydrogen atom the minimum excitation potential is ..... V. Energy of electron in its ground state is 13.6 eV.

(A) 13.5 (B) 10.2

(C) 3.6 (D) 3.4

(116) An α- particle of 10 MeV is moving forward for a head-on-collision. What will be the distance of closest approach from the nucleus of atomic number Z=50 ?

(A) 1.44×10^{-14} m (B) 2.88×10^{-14} m

(C) 0.53×10^{-10} m (D) $\frac{0.53\times10^{-10}}{50}$ m

(117) The wavelength of K_α spectral line is λ for an element of atomic number is 43. The wavelength of K_α spectral line for an element of atomic number 29 is .....λ

(A) $\frac{9}{4}$ (B) $\frac{42}{28}$

(C) $\frac{43}{29}$ (D) $\frac{4}{9}$

(118) For hydrogen atom, energy and radius of an electron in the n^{th} orbit are E_n and r_n respectively, then .....

(A) $\frac{E_n}{r_n}$ = constant (B) $E_n \cdot r_n$ = constant

(C) $E_n \cdot r_n = 0$ (D) none of these

(119) In an ordinary excited state, the electrons can stay for about ..... s

(A) 10^{-10} (B) 10^{-9}

(C) 10^{-8} (D) 10^{-5}

(120) What is to be done to increase the penetrating power of X-rays ?

(A) Filament current should be increased

(B) Filament current should be decreased

(C) P.d. between cathode and anode should be decreased

(D) P.d. between cathode and anode should be increased.

(121) Which of the following is used as a moderator in nuclear reactor ?

(A) Uranium (B) Plutonium

(C) Cadmium (D) Heavy water

(122) The activity of a radioactive element at t=0 is 9750 decay/min and at t=5 min the activity recorded is 975 decay/min. The decay constant of this element is nearly .....min-[1]

(A) 0.69 (B) 0.461

(C) 0.230 (D) 0.922

(123) Half life of a radioactive element is 5 min. In 15 min, the ..... of the substance will remain undecayed.

(A) 87.5% (B) 12.5%

(C) 25% (D) None of the above

(124) Complete the reaction : ${}_6C^{11} \rightarrow {}_5B^{11} + \beta^+ +$ .....

(A) electron (B) neutrino

(C) proton (D) neutron

(125) The half lives of α and β decays for a radioactive substance are 4 yr. and 12 yr. respectively. After 12 yr. it's activity will be ..... %

(A) 50 (B) 12.5

(C) 6.25 (D) 25

(126) In the ${}_{92}U^{238}$ nucleus, there are .....

(A) 92 protons and 92 neutrons

(B) 92 protons and 146 neutrons

(C) 92 protons and 92 electrons

(D) 146 neutrons and 92 electrons

(127) A series of radioaqctive elements are produced in the decay of ${}_{94}P_U^{241}$. The series stops after the emission of total 8 α particle and 5 β particle. The stable element produced at the end of this series is .....

(A) ${}_{83}Bi^{209}$ (B) ${}_{82}Pb^{209}$

(C) ${}_{82}Se^{205}$ (D) ${}_{82}Mg^{201}$

(128) The energy of thermal neutron is approximately ..... eV.

(A) 0.4 (B) 0.04

(C) 4 (D) 40

(129) In time equal to the mean life time ..... % of radioactive element will decay.

(A) 63% (B) 37%

(C) 100% (D) none of these

(130) When a radioactive nucleus emits α-particles, the atomic mass number of the parent element.

(A) increase by 2 (B) increases by 4

(C) decreases by 2 (D) decreases by 4

(131) The density of electron and holes in an intrinsic semiconductors is n_e and n_h respectively Which of the following options are true ?

(A) $n_e > n_n$ (B) $n_e = n_h$

(C) $n_h > n_e$ (D) $n_h >> n_h$

(132) When will the conductivity of a Ge semiconductor decrease ?

(A) on adding donor impurity (B) on making UV light incident

(C) on decreasing the temperature (D) on adding acceptor impurity

(133) Which type of semiconductor device does not need any bias voltage ?

(A) photo diode (B) Transistor

(C) varactor diode (D) solar cell

(134) The frequency of the output signal becomes ..... by doubling the value of the capacitance in the LC oscillator circuit.

(A) $\frac{1}{\sqrt{2}}$ increases (B) $\frac{1}{\sqrt{2}}$ decreases

(C) $\sqrt{2}$ increases (D) 2 times increases

(135) $\alpha = 0.99$ for a CE transistor amplifier circuit. The input resistance is equal to 1 kΩ and the load resistance is equal to 10 kΩ The voltage gain of the circuit is .....

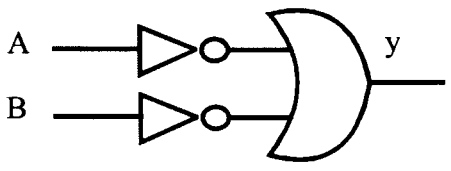
(A) 99 (B) 990

(C) 9900 (D) 99000

(136) The logic circuit shown in the equivalent diagram of which logic gate ?

(A) OR gate (B) AND gate

(C) NAND gate (D) NOR gate



(137) In the reverse bias condition of P-N junction diode, potential barrier .....

(A) increases (B) decreases

(C) remains constant (D) nothing can be said

(138) In the semiconductors, what is the order of forbidden gap between valence band and conduction band ?

(A) 1 MeV (B) 5 eV

(C) 1 eV (D) 0.1 MeV

(139) For a common base circuit, α dc .....

(A) > 1 (B) < 1

(C) $= 0$ (D) none of these

(140) Transconductance gm means

(A) $\frac{\Delta I_C}{\Delta V_{BE}}$ (B) $\frac{\Delta I_C}{\Delta I_B}$

(C) $\frac{\Delta V_{BE}}{\Delta I_B}$ (D) $\frac{\Delta V_{CE}}{\Delta I_C}$

(141) $y = A + B$ is the Boolean equation of which gate ?

(A) NAND gate (B) OR gate

(C) NOR gate (D) NOT gate

(142) The Boolean equation of NOT gate is .....

(A) $y = \overline{A}$ (B) $y = A + B$

(C) $y = A\text{-}B$ (D) $y = A \cdot B$

(143) I C means ..... (Full form)

(A) integrated circuit (B) internal circuit

(C) international circuit (D) none of these

(144) Which of the following is not a transmission channel ?

(A) Optical fibre (B) Co-oxial Cable

(C) Fax (D) Transmission Line

(145) The propagation of UHF band is via

(A) Space wave (B) Ground Wave

(C) Opticalfibre (D) Sky Wawe

(146) Which condition is to be satisfied in an AM detection circuit so that the signal corresponds to an envelope of the carrier wave ?

(A) $T_C << RC$ (B) $T_C >> RC$

(C) $f_C << RC$ (D) $\frac{1}{fm} << RC$

(147) In order to cover a circular region of radius 16 km, by a TV transmitter, what must be the height of the transmitting antenna ? (Radius of the earth = 6.4×10^6 m)

(A) 0.1 Km (B) 0.02 Km

(C) 2 Km (D) 0.2 Km

(148) The transmitted power by an antenna of a given length is .....

(A) directly proportional to λ^2 (B) inversely proportional to λ^2

(C) directly proportional to λ (D) inversely proportional to λ

(149) If the height of antenna is increased by four times, then how much times line of sight distance will be?

(A) 4 (B) 16

(C) 2 (D) 8

(150) In communication satellites, there are ..... transponders approximately.

(A) 8 to 12 (B) 12 to 24

(C) 12 to 32 (D) 6 to 12

(151) Which band frequency is used to determine the earth's surface temperature ?

(A) X-rays (B) Visible light

(C) FM (D) Thermal infrared

(152) What should be the height of an antenna for efficient transmission of 3 MH_2 frequency wave ?

(A) 75 (B) 50

(C) 10 (D) 25

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SECTION - B

• **Answer the following questions in very short (One Mark Each)** **(16)**

(1) Which fact is known as quantization of electric charge ?

(2) What will be the electric charge on the nucleus of the atom ${}_8O^{16}$?

(3) Write Coulomb's inverse square law.

(4) Write Gauss's theorem in static electricity.

(5) Which physical quantity has the SI Unit Vm ?

(6) Which physical quantity has the dimensional formula $M^{-1}\ C^{-3}\ A^2\ T^4$?

(7) Write the principle of superposition for the force acting between more than two electric charges.

(8) What is surface charge density ?

(9) On which two factors does the intensity of electric field depend ?

(10) What is electric dipolemoment ?

(11) Two field lines never intersect each other. Why ?

(12) Write the formula for the electric field intensity at a distance r $(r >> a)$ from the mid point of a dipole having dipolemoment P, on the axis of a dipole.

(13) What is electric flux ?

(14) How does the electric field vary with respect to distance due to linear charge distribution of infinite length ?

(15) What will be the intensity of electric field at a point situated at a distance of 30 cm from a 20μc stationary point charge ?

(16) How many electrons are there in 10μc negative electric charge ?

(17) Define electrostatic potential.

(18) Define capacitance.

(19) What is electric potential energy of a system of electric charges ?

(20) Which fact is more general in the case of metallic conductors placed in electric field ?

(21) 1 μμF = ... F

(22) 1 C electric charge cannot be induced on a metallic sphere of radius 0.01m. Why ?

(23) What is polar dielectric ?

(24) What is electric susceptibility ?

(25) What is polarization ?

(26) Which physical quantity has the dimensional formula $M^{-1}\ C^{-2}\ T^4\ A^2$?

(27) If 5 PF capacitors are charged upto 1000 V, What will be the stored energy ?

(28) What is emf of a battery ?

(29) Define electric current density.

(30) What is mobility of a charged conductor ?

(31) Write Kirchhoff's first law.

(32) What is Meissner effect ?

(33) The value of resistance of a resistor is $4.7\,\Omega + 5\%$. Then give its colour code.

(34) Which physical quantity has the unit Ampere - Second ?

(35) What is super conductivity ?

(36) Which physical quantity has the unit Am^{-2} ?

(37) What is shunt ?

(38) Write the principle of potentiometer.

(39) Define Electric potential gradient.

(40) The voltage capacity of a voltmeter having $100\,\Omega$ resistance is 20 V. Then, what will be its current capacity ?

(41) Draw the figure of a pivoted moving coil galvanometer.

(42) The resistance of an ammeter is $G\,\Omega$ If its current capacity is to be made 'n' times, find the value of shunt.

(43) State Joule's Law.

(44) What is drift velocity ?

(45) What is Ohmic loss ?

(46) Why water acts as a good solvent ?

(47) Write Faraday's lst law.

(48) Write the principle of electro chemical cell.

(49) What is depolarizing phenomenon in Lechlanche cell ?

(50) Of which combined effect is Seebeck effect ?

(51) Of which reverse effect is Peltier effect ?

(52) What is Peltier emf ?

(53) What is Thomson emf ?

(54) Write the electrolyte in lead storage cell.

(55) Which physical quantity has the unit JC^{-1} ?

(56) Write the statement of Biot-Savart's Law.

(57) Write Ampere Circuital's law.

(58) What is toroid ?

(59) Write the principle of cyclotron.

(60) Write the use of galvanometer.

(61) Write the use of Cyclotron.

(62) What is gyromagnetic ratio ?

(63) Write the formula of Lorentz force.

(64) Write the importance of small soft iron cylinder in a moving coil galvanometer.

(65) _____ field can be obtained with the help of magnetic field varying with time.

(66) Write Lenz's Law.

(67) Write Faraday's law of electromagnetic induction.

(68) What is motional emf ?

(69) What are eddy currents ?

(70) Draw the symbol of in doctor.

(71) Write any one definition of mutual inductance ?

(72) When is the resonance said to occur in series L-C-R circuit ?

(73) Which are the two factors on which Q-factor depends ?

(74) What are oscillations in L-C circuit ?

(75) Write the principle of transformer.

(76) Draw the circuit symbol of step-down transformer.

(77) What is transformation ratio ?

(78) If W^2 LC = 1 in L-C-R circuit, what will be the power factor ?

(79) Will the current lead or lag the voltage in an A.C. circuit containing onlyinductor ? By how much factor ?

(80) Out of voltage and current, which would lead in phase in A.C. circuit containing only capacitor ? By how much factor ?

(81) Maxwell completed the differential equations of electro magnetic waves with the help of physical quantity .....

(82) The wavelength of electromagnetic radiation having frequency 3 x 10^9 H_z is_____A^0.

(83) Define intensity of radiation.

(84) What are inductive components ?

(85) What are emitted components ?

(86) Write the full form of LASER

(87) All the electro magnetic waves having wave length less than _____A^0 are absorbed in the ozone layer.

(88) Define energy density for electro magnetic waves and write its unit.

(89) Write the dimensional formula of $\sqrt{\mu_r \varepsilon_r}$

(90) Define focal plane.

(91) Define aperture of a spherical mirror.

(92) Write the dimensional formula of focal length.

(93) Write the principle of optical fibres.

(94) Define optic centre for a concave lens.

(95) What is a thin lens ?

(96) If the height of object and the height of image is the same for a thin lens of focal length 16 cm, what will be the object distance ?

(97) What is Mie-Scattering ?

(98) Write Rayleigh's criteria for the amount of scattering of light.

(99) The power of two lens are 2.5 D and 1.5 D respectively. What will be power of the combination lens ?

(100) fo + fe is the _____ of telescope.

(101) Define critical angle.

(102) Write Snell's Law.

(103) Define plane of polarization.

(104) What is bound current ?

(105) What is Curie temperature ?

(106) What is magnetization intensity ? On which factor does it depend ?

(107) What is "Angle of dip" ?

(108) What is soft ferromagnetic substance ?

(109) Write Hugen's Principle.

(110) What are coherent sources ?

(111) Write the condition for destructive interference in terms of path difference.

(112) Write the precise definition of diffraction.

(113) On which factor does the amount of diffraction depend ?

(114) Write Rayleigh's criterion for resolution.

(115) Write the formula for angular resolution and resolving power of a telescope.

(116) Define unpolarized and plane polarized light.

(117) What is optic axis ?

(118) Write Malus's law.

(119) Write Brewster's Law.

(120) What is meant by interference term. ?

(121) Which light was used by Young in his historical experiment ?

(122) The distance between two slits in Young's experiment is 4 mm. If it is illuminated by light of 6000 A^0, find the width of fringes obtained on the screen kept at a distance of 2 m, from the slit.

(123) The angle of polarization of glass is 57.17^0, then find the refractive index of glass.

(124) What are σ and π components ?

(125) Write Plank's hypothesis.

(126) Write Plank's revolutionary idea for microscopic oscillators.

(127) What is work function of a metal.

(128) What is field emission of electron ?

(129) Write principle of Photocell.

(130) Write De-Broglie's hypothesis.

(131) Write Heisenberg's uncertainty principle.

(132) What is threshold frequency ?

(133) The slope of the graph of Voe $\rightarrow$ f gives the quantityknown as _____

(134) On which factor does the max. energy of the emitted photoelectron depend in Photoelectric Effect?

(135) Write 'Bohr's first hypothesis.

(136) Write Bohr's second hypothesis.

(137) When is an electron said to be in it's ground state ?

(138) Write the name of spectral series in U.V. region in the spectrum of hydrogen atom.

(139) Of which substance is the anode made from, in Coolidge tube ?

(140) What is metastable state ?

(141) What is optical pumping ?

(142) What is population inversion ?

(143) _____ is a pair of isomers.

(144) In 92 U^{235}, there are _____ nucleons.

(145) The radius of $_1H^1$ is..... fm.

(146) Define 1 eV.

(147) I Ci = ... Becquerel.

(148) 1μci .....disintegration $second^{-1}$.

(149) $1^{P^1} \rightarrow o^{n^1} + ... + v$ (Fill in the blank)

(150) $_7N^{14} + _2He^4 \rightarrow _8O^{17} + ... + Q$ (Fill in the blank)

(151) What is multiplication factor ?

(152) What is the slope of the graph of $\tau_{1/2} \rightarrow \frac{1}{\lambda}$?

(153) Which particle did Pauli hypothesize in the emision of β - particles for the law of conservation of angular momentum to hold good ?

(154) What is thermal neutron ?

(155) Which law of conservation is obeyed in nuclear reaction ?

(156) Write the half life of a nucleus having decay constant 0.693 S^{-1}

(157) 1 n Ci = ... Bq (Fill in the blank)

(158) Write the principle of nuclear reactor.

(159) How much forbidden gap is for insulators ?

(160) What is depletion barrier ?

(161) Write the use of PN function diode.

(162) Draw circuit diagrams of half-wave and full-wave rectifier.

(163) Draw the circuit symbol of Zener diode.

(164) What is doping ?

(165) Write the full form of BJT.

(166) Write the Boolean equation of AND gate.

(167) Of which logic gate is the Boolean equation $Y = \overline{A}$?

(168) Draw the circuit symbol of OR gate.

(169) What is FDX transmission ?

(170) The power transmitted from an antenna of given length is _____ proportional to the wavelength λ.

(171) What is modulation ?

(172) What is space wave ?

(173) Of what is ionosphere made up ?

(174) What is critical frequency ?

(175) Write the function of transducer.

(176) Write the 2 types of communication channel.

(177) What is transponder ?

(178) What is Amplitude modulation (AM) ?

(179) What is 'space current' ?

(180) Write the full form of APD .

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Section-C

● **Answer the following questions in short. (2 marks each)**

(1) What is electric charge ? Give its explanation

(2) Explain quantizationof electric charges.

(3) In how many ways can electric charge be induced on a substance ? Explain the method of charging a substance without making any physical contact with another charged substance, with the necessary diagram.

(4) Write Coulomb's Law and explain it in vector form.

(5) Define linear density and volume density of electric charge. Write their units.

(6) Explain electric field intensity in brief.

(7) Write the formula of electric field intensity at a point r (x,y,z) of a dipole. Hence, obtain the equation of electric field intensity at a point y=y on the equator.

(8) Explain the behaviour of an electric dipole in a non uniform electric field.

(9) Explain electric flux. $\phi = \int \vec{E} \cdot d\vec{a}$

(10) Obtain the formula of electric field intensity for a point lying outside the thin spherical shell due to the electric charge, using Gauss's theorem.

(11) Define and explain in short electrostatic potential. Write its unit.

(12) Obtain the formula for electric potential at a point in the electric field due to point electric charge.

(13) What is equipotential surface in an electric field ? Show that the electric field intensity vector at any point is always perpendicular to the equipotential surface passing through the point.

(14) Obtain the relation between electric field (E) and electric potential (V).

(15) Derive the formula of potential energy of electric dipole placed in a uniform electric field.

(16) Discuss the various situations taking place inside as well as outside a conductor placed in an electric field.

(17) What is dielectric ? State its types and give two examples of each.

(18) Obtain the formula of equivalent capacitance in the case of parallel connection of capacitors, with the help of circuit diagram explaining it.

(19) If dielectric medium having dielectric constant K is introduced between the two plates of a capacitor, the capacitance of the capacitor becomes K times the original capacitance. Explain.

(20) Discuss the principle of Van-de-graff generator.

(21) Obtain the formula of electric current density on the cross-sectional area of a conductor.

(22) Write Ohm's Law and discuss it. State its limitation.

(23) Explain the drift velocity of an electron in a metal in the presence of external electric field, drawing the necessary figure.

(24) Explain colour code for carbon resistors.

(25) Using $J = \sigma E$, obtain the formula of resistivity $\rho = \frac{m}{ne^2\tau}$ for a conductor.

(26) Explain in short, super conductor and super conductivity.

(27) Derive Kirchhoff's second Law, accepting the single valuedness of electric potential in a closed network.

(28) Write two points of difference between Series and parallel connections of resistors.

(29) Why should be the resistance of a voltmeter very large ? Explain.

(30) Obtain the formula of current passing through each cell in the case of parallel connection of two cells having different emf and different internal resistance.

(31) Obtain the formula to compare the emfs of the two cells using potentiometer, drawing the necessary circuit diagram.

(32) Define Joule Heat. Obtain its formula and write Joule's law.

(33) What is Ohmicloss ? Give its two examples and write two general uses of Joule heat.

(34) What is electroplating ? Write the important inference drawn from this process.

(35) Write the mathematical forms of Faraday's Laws (both) of electrolysis. Show that e/z = contant for all elements.

(36) What is Voltaic Cell ? Explain electrical conduction in it with the help of a figure.

(37) When is secondary cell said to Charged or discharged ? Obtain the formula for its charging current, drawing the necessary circuit diagram.

(38) Draw the graph of thermo emf $\rightarrow$ temperature and hence obtain the formula of thermoelectric power. On which factors does the thermoelectric power depend ?

(39) Write the points showing that Peltier effect and Joule effect is not the same.

(40) Explaining Thomson effect, define Thomson emf,and write its unit.

(41) Write Biot-Savart's Law and explain it in short.

(42) Write formula of magnetic field intensity at a point on the axis of a circular ring of N turns carrying electric current. Hence, explain the equations of magnetic field intensities on the centre of the coil and at a point far away from the centre of the coil.

(43) Write Ampere's circuital Law and explain it.

(44) What is toroid ? Obtain the formula of magnetic field produced inside toroid due to electric current, using Ampere's circuital law.

(45) Obtain the formula of magnetic force when a positive electric charge q moves with velocity $\vec{V}_d$ $\vec{B}$ in a uniform magnetic field $\vec{B}$. Hence, obtain Lorentz force.

(46) Write the uses of Cyclotron.

(47) Obtain the formula of torque acting on a rectangular coil, carrying unidirectional electric current and suspended in a uniform magnetic field, assuming the value of forces BIl on the vertical sides.

(48) Explain the principle and working of a galvanometer.

(49) Derive the formula of orbital magnetic moment of an electron revolving in an orbit of an atom.

(50) Explain how does a bar magnet produce magnetic field, how can it be prepared ?

(51) Obtain the pole strength of a solenoid $m_s = MB\theta$ from the equivalence between a bar magnet and a solenoid.

(52) Write the points of comparision between magnetic dipole and electric dipole.

(53) Assuming the expressionfor the torque $\tau = -MB\theta$ acting on a magnetic dipole placed in a uniform magnetic field, obtain the expression for periodic time of its oscillations.

(54) What is magnetic declination ? Explain how can it be determined at any place.

(55) Explain horizontal component and vertical component of earth's magnetic field with the help of a figure. Show all the magnetic parameters of the earth in the same figure.

(56) Discussing the effective magnetic induction in a substance obtained when I_f current passes through a toroidal winding, obtain the resultant magnetic field equation $\beta = \mu_0 [i_f + i_b]$.

(57) Write the characteristics of diamagnetic substance.

(58) Draw the figure of hysterisis cycle and show (i) Retentivity (ii) coercivity.

(59) Explain Faraday's experiment of two bar magnets and write its observation and conclusion.

(60) Explain the cause of induced emf between the two ends of a conducting rod moving perpendicular to the magnetic field.

(61) Explain how Eddy currents are produced and write its use.

(62) Derive the formula of self inductance of a Solenoid.

(63) Write a note on mutual inductance.

(64) Write the principle and construction of A.C. dynamo or generator and derive the expression of the flux linked with the coil at time t.

(65) Write the differential equation of electric charge Q in L-C-R series A.C. circuit.Hence, obtain the expression for complex current i.

(66) Write the formula of impedance in L-C-R series A.C. circuit and name the different terms. Show complex impedance in complex plane and write the formula of $|Z|$

(67) Write the formula of impedance when C and R are connected in series in L-C-R series A.C. Circuit. Using phase diagram, obtain the formula of current and phase difference.

(68) Obtain the r.m.s. value of A.C. voltage $V = Vm \cos \omega t$.

(69) Draw the graphs of $Irms \rightarrow \omega$ $(R_1 > R_2)$ in L-C-R A.C. series circuit. Define Q-factor and obtain its formula.

(70) Write the differential equationof L-C circuit and give its solution. Hence, obtain the expression for current.

(71) Write the need of transformer. Explain its principle, drawing the necessary diagram.

(72) Explain in short, the generation of oscillating electromagnetic fields in Hertz's experiment of E.M. waves.

(73) Write points of Maxwell's theory for E.M. waves.

(74) Explain emitted and inductive components of E.M. radiation, drawing the necessary figure.

(75) Mention any four characteristics of E.M. waves.

(76) Write the formula of velocity of E.M. wave in a medium having dielectric constant K. Hence, obtain the refractive index of the medium in terms of K.

(77) Define intensity of E.M. wave and obtain its necessary formula.

(78) Obtain Gauss's equation for a concave mirror.

(79) Defining the absolute refractive index, obtain the generalised form of Snell's law.

(80) The phenomenon of rising of the Sun at any place is seen two minutes earlier than it really rises. Explain.

(81) Explain total internal reflection, drawing the necessary diagram.

(82) Write the principle, construction and use of optical fibres.

(83) Obtain the equation $-\frac{n_1}{u}+\frac{n_2}{V}=\frac{n_2-n_1}{R}$ showing the relation between U,V,R, n_1 and n_2 for a convex spherical surface.

(84) Write the generalised equation for a thin lens. Hence, obtain Lens-maker's formula.

(85) Prove that $i+e=A+\delta$ where symbols have their usual meanings, drawing the necessary diagram,showing the refraction of light due to a prism.

(86) Why is the sky seen blue and clouds white in colour ? Explain on the basis of scattering.

(87) Draw the diagram of compound microscope and derive the formula of magnification of its image.

(88) Describe the construction and working of reflecting telescope.

(89) Explain refraction of light according to Huygen's theory.

(90) What is interference ? Obtain the expression for the resultant displacement due to two waves superposing at a point, which are emitted from a point source.

(91) Write the formula of interference term. Hence, explain non-coherent and coherent sources.

(92) Obtain the formula for the path difference between two waves emtted from two coherent sources, incident on a screen. (in terms of θ as well as x)

(93) A person standing behind the door can be heard, but cannot be seen. Explain on the basis of diffraction.

(94) Discuss Fraunhoffer diffraction through a single slit and obtain the condition for the first minimum.

(95) Explain resolving power of a microscope.

(96) Obtain Malus's Law, $I = Io\ Cos^2\theta$ in the case of polarization.

(97) State and prove Brewster's Law.

(98) Explain polarization due to reflection.

(99) What is work function of a metal ? On which factors does its value depend ? State any two methods to bring out an electron from the metals.

(100) Why does the wave theory fail in explaining photoelectric effect ?

(101) Give Einstein's explanation of photoelectric effect.

(102) Write four characteristics of photon.

(103) Write De-Broglie's hypothesis and obtain the formula $\lambda = \frac{h}{mv}$

(104) Explain the arrangement of Davisson - Germer's experiment, drawing the necessary diagram.

(105) Draw the graph of the number of α-particles scattered in Geiger-Marsden's experiment versus diffraction angle. Explain it and define impact parameter.

(106) Write the names of the different spectral series obtained in the spectrum of hydrogen atom. Write the formulae to calculate their wave number.

(107) Explain the quantization of linear momentum and energy of a free electron, kept in a one dimensional box of length L and having non-penetrating walls.

(108) Show the radius of the electron in the nth orbit is directly proportional to square of the principal quantum number, on the basis of Bohr model.

(109) Write a note on emission spectrum.

(110) Explain X-ray spectrum and obtain the formula of λ min.

(111) Write the importance of Moseley's experimental work from scientific point of view.

(112) Write the full form of LASER. Draw the schematic diagram of He-Ne gas LASER and explain its construction.

(113) Mention any four uses of LASER light.

(114) Explain the stability of nucleus.

(115) Define the units of mass and energy in nuclear physics and obtain the relation between amu and eV.

(116) What is natural radioactivity ? Explain that it is a nuclear phenomenon.

(117) Obtain the exponential law of radioactive disintegration.

(118) Write emission of α - particles with an example and give two important points of this phenomenon.

(119) Draw the graph of no. of β- particles emitted from a radioactive element versus energy of β- particles. Write the difficulties arising from this graph.

(120) Explain the phenomenon of artificial radioactive disintegration with anyone example.

(121) Write the necessary precautions for a successful nuclear chain reaction.

(122) Explain thermonuclear fusion in sun and other stars giving the necessary equations.

(123) Explain the concept of hole in pure semiconductors.

(124) Explain how N- type semiconductor can be prepared, drawing the necessary diagram.

(125) Explain electrical conduction in P-type semiconductors on the basis of band theory.

(126) What is P-N Junction diode ? Giving the explanation of P-N junction, explain depletion layer.

(127) Explain how P-N junction diode can function as a varactor diode.

(128) Discuss the forward bias characteristics of P-N junction diode, drawing the circuit diagram.

(129) What is Zener diode ? Draw its circuit symbol and write its two characteristics.

(130) Explain the use of P-N junction diode as a full wave rectifier with the necessary circuit diagram and graph.

(131) What is transistor ? Give its types and draw its symbol. Name its electrodes.

(132) Draw the input and output characteristics of a transistor. Hence, define (i) input resistance (ii) output resistance.

(133) Distinguish between analog and digital signal with the necessary diagram. State where digital signal is used.

(134) Draw the electric circuit of AND gate and explain its working.

(135) Draw the logic circuit of NOR gate. Also, draw its symbol, truth table and write its Boolean equation.

(136) What is 'Noise' ? Explain its types giving an example.

(137) Explain amplitude modulation with the necessary figure.

(138) Write a short note on Ground wave Sky wave.

(139) Write the formula for refractive index of ionosphere. Hence, explain how radio waves are reflected by ionosphere.

(140) What is remote sensing ? Explain and give its importance.

(141) Obtain the relation $d = \sqrt{2hr}$ between the height of a transmitter antenna (h) and communication range (d).

(142) What is geo-stationary satellite ? Explain communication through it.

(143) Write the advantages of optical fibre communication.

(144) What is ionosphere ? Explain how can it be used for the propagation of radiowaves.

(145) What is modulation ? Write its necessity in communication.

• • •

Section-D

● **Solve the following (Each question carries 3 marks)**

(1) Q amount of charge is uniformly distributed over some body. How should the body be divided in the into two parts, so that the forces acting between the two parts is maximum for a given separation between them ?

(2) A particle having mass 5×10^{-9} kg is held at some distance from a very large uniformly charged plane. The surface charge density on the plane is 4×10^{-6} c / m^2 What should be the charge on the particle, so that the particle remains stationary even after releasing it ? ($\varepsilon_0 = 8.85 \times 10^{-12}$ C^2 $N^{-1}m^{-2}$ $g = 9.8 m^{-2}$)

(3) Two sphefres of copper, weighing 1 g. each are kept 1 m. apart. The number of electrons in them are 1 % less than the number of protons. Find electrical force acting between them. Atomic weight of copper is 63.54 $g.mol^{-1}$, atomic number is 29, Avogadro's number N_A = 6.023 x $10^{23} mol^{-1}$, k=9 x 10^9 SI. (Ans. 1.74 x 10^{15} N)

(4) Three charges q, q and -q are placed on the vertices of an equilateral triangle. Show that the vector sum of resultant forces acting on all of them is zero.

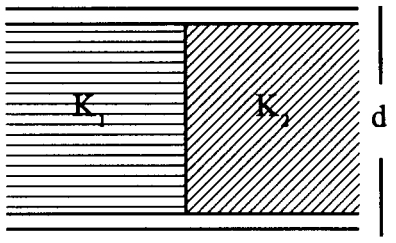
(5) An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $(\vec{E})$ The dipole is rotated through a very small angle θ from equilibrium and is released. Prove that it executes simple harmonic oscillations with frequency $f = \frac{1}{2\pi}\sqrt{\frac{PE}{I}}$ where I = moment of intertia of the dipole.

(6) The surface charge density of a very large surface is equal to -2.0 x 10^{-6} Cm^{-2}. From what distance should an electron of 150 eV energy be projected towards the plane so that its velocity becomes zero on reaching the plane ? ε_0 = 9 x 10^{-12} C^2N^{-1} m^{-2} and 1 eV = 1.6 x 10^{-19} J.

(7) The coordinates of two electric charges, $q_A = 2.5 \times 16^{-7} c$ and $q_B = -2.5 \times 16^{-7} c$ are (0, 0, –15) cm and (0, 0, 15) cm then calculate the total electric charge and dipole moment of this system.

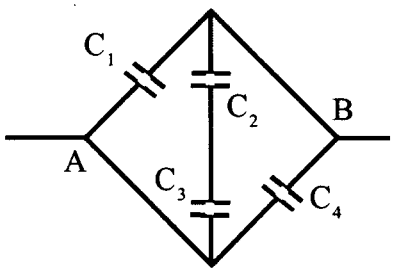
(8) A charge of 40 μc is kept on the origin of a coordinate system. Calculate the electric potential at a point (0.5, 0.8, 0.6)m k - 9 x 10^0 Sl.

(9) Two slabs of dielectric constants K_1 and K_2 are placed between the parallel plates of a capacitors as shown in figure. Area of the plates is A and the distance between them is d. Find capacitance of this system.



(10) Electric field in certain region is given by $\vec{E} = Ax\hat{i}$ where A = 20 Vm^{-2} Let us consider electric potential at point (10,20) m to be zero. What will be the electric potential at the origin point ?

(11) Calculate the equivalent capacitance of the given network between pointsA and B.



$C_1 = C_4 = 1\mu F \quad C_2 = C_3 = 2\mu F$

(12) The resistance of the tungsten filament of a bulb is 18 Ω at 20° temperature. A steady current of 0.185 A flows through the bulb on connecting it with a battery of 30.0 V. If, for tungsten, $\alpha = 4.5 \times 10^{-3}\ K^{-1}$ find the temperature of the filament. Assume the validity of Ohm's law here.$(\theta = 2.1 \times 10^3 K)$

(13) There are 30 divisions in dial of a galvanometer. 20 μA causes a deflection of 1 division in the galvanometer. Its resistance is equal to 25 Ω How will you convert the above galvanometer into an ammeter, which can measure upto 1 Ampere ?

$(S = 0.015\,\Omega)$

(14) When the electron is moving on a circular path of radius 5.0×10^{-11} m with a constant speed $6.28 \times 10^6\ ms^{-1}$. Calculate its frequency and the electric current constituted by it.

$(f = 2 \times 10^{18}$ rotations., $I = 3.6 \times 10^{-1}$ A)

(15) Two dissimilar conducting wires P and Q are taken off 1 m length. The length of the P wire is stretch and its length is doubled. Let the modified wire be called R. If the resistance of the R wire and Q wires are same, calculate the length of P and Q wires.

$(r_1 = 0.2m, r_2 = 0.8m)$

(16) The resistance of the ammeter is equal to 0.01 Ω The ammeter shows 4 ampere current where it is connected with the battery. The current is reduced by 3 ampere when a 1.5 Ω resistor is connected in series. Calculate the emf of the battery and its internal resistor.

$(r = 0.49\,\Omega, \varepsilon = 2V)$

(17) A copper wire is stretched which results in 2 % increase in its length. Calculate the % change in the resistance of the wire.

(18) The resistance of the wire made of silver at 27° C temperature is equal to 2.1 Ω while at 100° C it is 2.7 Ω Calculate the temperature coefficient of the resistivity of the silver. Take the reference temperature is equal to 20° C.

(19) A D.C. motor draws 10 A current when it works on a 30 V supply. Find resistance of its winding if its efficiencyis 40 %

$(R = 1.8\,\Omega)$

(20) A thin layer of 0.001 cm. of copper is to be deposited ona plate of copper of 10 cm^2 through electrolysis. Calculate the amount of energy used if a battery of 12 V is connected. Density of copper = 9 gm cm^{-3} electrochemical equivalent of copper = 0.0003 $g.mol^{-1}$.

(U = 7200J Ans.)

(21) An electric kettle has two heating coils. When one of the coils is switched on, a given quantity of water in the kettle starts boiling in 10 min. When the other coil only is switched on, then the same amount of water starts boiling in 15 min. If the two coils are switched on in parallel, how much time will the same amount of water take to boil ? Each time the voltage applied is the same.

(22) Two wires which are made of the same material are having same cross-sectional area A, but are of different lengths l_1 and l_2 Prove that if they are used as fuse wires, they will melt for the same value of the current flowing through them, in the same time.

(23) For a thermocouple $\alpha = 14\mu V\ ^0C^{-1}$ and $\beta = -0.07\mu V\ (^0C^{-1})$ Find the neutral and the inversion temperatures.

$(tn = 200^0C,\ ti = 400^0C)$

(24) On passing some current through a silver voltameter for 10^3 s. 1.118 g. silver collects on its cathode. An ammeter connected in series shows 0.9 A. If the electrochemical equivalent of silver is 1.118×10^{-6} kgC^{-1} find the error in the ammeter.

(25) A current of 0.3 A is passed through an electrochemical cell containing $AgNO_3$ solution, for 15 min. The amount of silver deposited on the cathode is 3.02×10^{-4} kg Find out the atomic weight of silver Faraday constant = 96500 C mol^{-1} valency of silver = 1.

(atomic weight = 108 g / mol)

(26) A circular loop is prepared from a wire of uniform cross section. A battery is connected between any to points on its circumference. Show that magnetic induction at the center of the loop is zero.

(27) A solenoid of length 0.4 m and diameter 0.6 m has only one layer of winding, containing 1000 turns. If current passing through the solenoid is 5.0×10^{-3} A, find magnetic induction at the end of the axis

$(B = 6.28 \times 10^{-6}\ T)$

(28) Write the equation of magnetic force acting on a particle moving through a magnetic field. Using it obtain Newton's equation of motion and show that kinetic energy of the particle remains constant with time.

(29) Distance between two very long parallel wires is 0.18 meter. The currents of 8 amp and 12 amp are flowing in the same direction in the two wires respectively. Find a point on a perpendicular line joining the wires, where the field intensity is zero.

(30) A charge Q is uniformly spread over a disc of radius R, made from a non-conducting material. This disc is now rotated about its geometrical axis with frequency *f*. Find the magnetic field generated at the center of the disc.

(31) A very long wire is placed perpendicular to the direction of the horizontal component of earth's magnetic field. Find the value of current to be passed through the wire so that the resultant magnetic field is zero at a point which is at a distance of 5 cm. from the wire. What will be the magnetic field at a point at a distance of 5 cm. from the wire on the opposite side ?

$(H = 0.36 \times 10^{-4}\ T)$

(32) A rectangular coil having 60 turns and an area of 5.0×10^{-4} met^2 is suspended in a radial magnetic field of strength 90×10^{-4} T. If a current of 0.2 mA through the coil gives it a deflection of 18^0, find the effective torsional constant for the spring system holding the coil.

(33) An electron in an atom is revolving round the nucleus in a circular orbit with a speed of 10^7 ms^{-1}. If the radius of the orbit is 10^{-9} meter, find the resulting magnetic field at the center.

$(e = 1.6 \times 16^{-16} c \quad \mu = 4\pi \times 10^{-7} T\, MA^{-1})$

(34) Two very long linear wires carrying currents are placed parallel to each other with a distance of 2 meter between them. If currents of 40 amp. and 60 amp. are flowing in the same direction respectively through them, find the attractive force per unit length.

$\mu = 4\pi \times 10^{-7} SI$

(35) A 3 Coulomb charge passes with a velocity of $50\hat{j}$ ms^{-1} through a region having a uniform magnetic field $2\hat{k}$ T and some uniform electric field. If the Lorentz force acting on it is $330\hat{i}$ N, find the electric field in this region.

(36) A magnetic needle is hung by an untwisted wire, so that it can rotate freely in the magnetic meridian. In order to keepit in the horizontal position a weight of 100 mg. is kept on one end of the needle. If the magnetic pole strength of this nedle is 10 Am, find the value of the vertical component of the earth's magnetic field g = 9.8 m/s^2.

(37) 2.0 A current is passing through the winding of a Rowland ring. The number of turns of the ring is 400 and the average circumference of the ring is 40 cm. In this situation the magnetic field produced in the material inside the ring is 10 T. Find (1) magnetic intensity (2) magnetization intensity(3) magnetic susceptibility. H = 2000 Am^{-1} and = 12.57×10^{-7} TmA^{-1}

(38) The region inside a current carrying toroidal winding is filled with tungsten of susceptibility 6.8×10^{-5} What is the percentage increase in the magnetic field in presence of the material with respect to the magnetic field without it ?

(39) A toroidal core with 3000 turns has inner and outer radii of 11 cm and 12 cm. respectively. When a current of 0.07 A is passed, then the magnetic field produced in the core is 2.5 T.Find the relative permeabilityof the core. $(\mu_0 = 4\pi \times 10^{-7}\ TmA^{-1})$

(40) Two small and similar bar magnets dipole moment 1.0 Am^2 each. These are kept in a plane in such a way that their axes are perpendicular to one another. The distance between their centers is 2 m. Find the magnetic field at the midpoint of the line segment joining their centers.

(41) The Work for rotating a magnet with diple momentM, by 90^0 from its mangnetic meridian is n times' the work to rotate in by 60^0. Find the value of n.

(42) A steamer would like to move in the direction making an angle of 10^0 south with the west. The magnetic declination at the place is 17^0 west from the north. In which direction should the steamer move ?

(43) A magnet makes an angle of 45^0 with the horizontal in a plane making an angle of 30^0 with the magnetic meridian. Find the true value of the dip angle at the place.

(44) Find the value of the self inductance of a very long solenoid of length l having total number of turns equal to N, and cross sectional area A.

$$\left(L = \frac{\mu_0 N^2 A}{l}\right)$$

(45) A conducting lop of radius r is placed concentric with another loop of a much larger radius R so that both the loops are coplanar. Find the mutual inductance of the system of the two loops. Take R >>> r.

(46) Find equivalent inductance of two inductors connected in parallel with the help of an appropriate D.C. circuit.

(47) A coil having 200 turns has a surface area 0.12 m^2 A magnetic field of strength 0.10 weber/ m^2 linked perpendicular to this area changes to 0.5 weber/m^2 in 0.2 sec. Find the emf induced in the circuit.

(48) A conducting bar of 4 m length is allowed to fall freely from a 50 m high tower keeping it aligned along the east-west direction.Find the emf induced in the rod when it is 20 m below the top of the tower. Earth's magnetic field is 0.7 x 10^{-4} T.g = 10 m/s^2. The angle of dip = 60^0.

(49) A U. Shaped conducting frame is placed in a uniform magnetic field B in such a way that the plane of the frame is perpendicular to the field lines. A conducting rod is supported on the parallel arms of U. perpendicular to them, and is given a velocity v at time t = 0 Prove that the velocity of the rod at time t will be given by

$$V_t = V_0 \exp\left(\frac{-B^2 l^2}{mR} \cdot t\right)$$

(50) The flux linked per each turn of a coil of N turns changes from ϕ_1 to ϕ_2 If the total resistance of the circuit including the coil is R, prove that the charge Q induced is given by $Q = \frac{N(\phi_2 - \phi_1)}{R}$

(Q induced electric charge)

(51) There are 1.5 x 10^4 turns in the winding of a toroidal ring. The radius of circular axis of the ring is 10 cm. The radius of cross-section of ring is 2.0 cm. Find inductance of the ring. (0.57H)

(52) A resistor$R = 10\,\Omega$ and capacitor $C = 12.5\,\mu F$ are connected in series circuit with an A.C. source of 100 V and 500 Hz frequency. Calculate the voltage developed between the two ends of the resistor.

(V_{rms} = 100V)

(53) 100 W power is consumed in a coil, 1.0 A current flows through the coil. An A.C. source of 110 V and 50 Hz frequency is connected with the above coil. Calculate the inductance and resistance of the coil.

$(Z = 110\,\Omega, L = 0.146H)$

(54) An inductor of 0.5 H and a resistance of $100\,\Omega$ are connected in series with a A.C. source of 240 V and 50 Hz. Then, find the maximum curent in the inductor.

(55) A 5H inductor, $80\mu F$ capacitor and a $40\,\Omega$ resistance are connected in series witha A.C. source of 230 V. Find (1) frequency of resonance (ii) the value of impedance of the circuit and the value current under resonance.

(56) Input voltage of a step up transformer is 220 V.A.C. The current trhrough the secondary coil is 5A. If the ratio of the number of turns of prmary to secondary coils is 1 : 20, find the (i) output voltage (ii) current through the primary coil and (iii) output and input power.

(57) L and R connected in series with an A.C. voltage. The maximum voltage of the source is 220 V calculate the power and the power consumed in circuit factor. Reactance of the coil is 40Ω and R = 30Ω.

$(\cos\theta = 0.6,\ P = 290.4w)$

(58) Prove that if voltage obtained from an A.C. source is given by $V = V_m \sin\omega t$. its average value is $\frac{2Vm}{\pi} = 0.637\ V_m$ Obtain the average over a half cycle of the period.

(59) In an A.C. circuit L-C-R are connected in a series. The inductance is of 10 H, ω = 100 $rads^{-1}$. The resistance $R = 100\Omega\ rads^{-1}$ Power factor is 0.5 Find the value of the capacitance.

$(C = 12\mu F)$

(60) An A.C. supply of V_m = 100 V and 159.2 Hz frequency is connected to an inductance of 1 H Obtain the equation for the current in the circuit. The applied voltage V = Vm Cosωt)

$\left(I = 0.1\cos\left(1000t - \frac{\pi}{2}\right)A\right)$

(61) Prove that the unit of $\frac{1}{\sqrt{\mu_0\,\epsilon_0}}$ is that of velocity, using the unit of μ_0 and ϵ_0

(62) A 1000 W bulb is kept at the centre of a spherical surface and is at a distance of 10 m from the surface. Calculate ε_0, Bo (the maximum electric and magnetic field strengths) and I (the intensity of the waves). Take the working efficiency of the bulb 2.5 % and consider it as a point source.

ε_0 = 8.85 x 10^{-12} SI and c = 3.0 x 10^8 ms^{-1}

(63) An electromagnetic plane wave is traveling along the X-direction. The electric field vector at any arbitrary point and time is given by $\vec{E} = 6.3\hat{j}\ Vm^{-1}$ Calculate the magnetic field at that position and time. $\left(\vec{B} = 2.1\times10^{-8}\hat{k}T\right)$

(64) The magnetic field of an electromagnetic plane wave traveling along the X-direction is given by B_y = 2 x 10^{-7} sin (0.5 x 10^3x + 1.5 x $10^{11}t$) T Calculate (1) wavelength and frequency of the wave (2) Write the equation of the electric field.

$\left(\lambda = 1.26cm,\ f = 23.9GH_z,\ E_z = -60\sin\left(0.5\times10^3x + 1.5\times10^{11}t\right)Vm^{-1}\right)$

(65) 5 % of the total energy of a 100W bulb is converted into visible light. Calculate the average intensity at a spherical surface which is at a distance 1 m from the bulb. Consider the bulb as a point source and the medium isotropic. ($0.4 Wm^{-2}$)

(66) Derive the formula for lateral magnification, $m = {}^{f}/_{f-u}$ for spherical mirrors, where f = focal length and u = object distance.

(67) A swimmer is diving in a swimming pool vertically with a velocity of 2 m/s. What will be the velocity as seen by a stationary fish at the bottom of the pool, right below the driver ? Refractive index of water is 1.33.

(68) A fish is at some depth in a lake. It is at horizontal distance R = 1.5 m from the edge of the lake. If it is just able to see a tree on the edge of the lake what is it's depth ? Refractive index of water = 1.33 (D =1.3 m)

(69) For a thin lens prove that when the heights of the object and the image are equal, object distance and image distance are equal to $2f$.

(70) For a prism, angle of prism is 60^0 and it's refractive index is 1.5, find (1) angle of incidence corresponding to the angle of minimum deviationand (2) angle of emergence for angle of maximum deviation. $\left(\text{Ans}: i = 48^0\ 35^1, e = 27.9^0\right)$

(71) An object is moving towards the concave mirror along it's principal axis with uniform velocity v_0 Prove that when the object is at distance u from the concave mirror, velocity of the image is $vi = -\left(\frac{R}{2U - R_1}\right)^2 v_0$ R is the radius of curvature of the mirror.

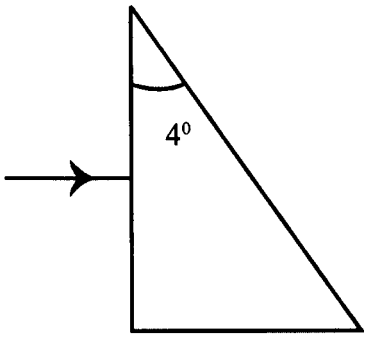
(72) A narrow beam of light is incident at 53^o angle made with the normal on a glass plate of refractive index 1.6. If the thickness of the plate is 20 mm. Caculate lateral shift of the beam when it emerges out from the plate. $\sin 53^0 = 0.8$

(73) Depth of a well is 5.5 metre and refractive index of water 1.33. If viewed from the top, by how much height would the bottom of the well appear to be shifted up ? $(d = 1.37m)$

(74) For a thin lens object distance is 24 cm and image distance is 51 cm. If image is formed on the outer side of the lens, find (1) Focallength of the lens. (2) Type of the lens (3) Type of image (4) Lateral magnification. (Ans: 16.32 cm ,convex inverted and real, 2.1)

(75) Focal length of a convex lens in air is 27 Calculate it's focal length in water refractive index of water is 1.33 and the refractive index of the material of the lens is 1.5.(Ans : 78.2 cm)

(76) A horizontal ray is incident on a prism with angle of prism 4^0 and refractive index 1.5 as shown in figure.Calculate angle of emergence.



(77) In Youngs experiment width of one slit is 3 times that of another. If we assume that the intensity of light is proportional to the width of the slit, find the ratio of maximum to minimum intensity.

$$\left(\frac{I\max}{I\min}=\frac{2+\sqrt{3}}{2-\sqrt{3}}\right)$$

(78) A light of 5000 A^0 is incident normally on a slit of width 0.01 cm. Obtain width of central maximum in the Fraunhofer diffraction pattern. Screen is placed at a distance of 100 cm.

(79) Plane polarized light is normally incident on a Polaroid. The Polaroid is rotated with the angular speed 10 rad s^{-1} about this ray of light. If the incident light energy is one second is 4 mJ, What will be the light energy emerging out of the Polaroid during one rotation ?

$$\text{Hint}:\left[\int_0^T \cos^2 \omega t\, dt=\frac{\pi}{\omega}\right]$$

(80) The ratio of intensities of rays emitted from two different coherent sources is $\propto$ For the interference pattern formed by them prove that $\frac{I\max+I\min}{I\max-I\min}=\frac{1+\alpha}{2\sqrt{\alpha}}$ where 1_{max} = maximum intensity in the interference fringes I_{min} = minimum intensity in the interference fringes.

(81) In Young's experiment, the distance betweentwo slits is 0.05 cm. and the distance between the screen and the slits is 100 cm. Find the distance between third bright and the fifth dark fringe. Wavelength of light is 5000 A^0.

(82) In Young's experience fifth bright fringe produced by light of wavelength 4000 A^0 superposes over the fourth bright of an unknown wavelength. Find this wavelength. $(\lambda = 5000A^0)$

(83) In Young's experiment the distance between two slits is 1 mm and the distance between two consecutive bright fringes are 0.03 cm. Now, on displacing the screen by 50 cm. away from the slits the distance between two consecutive dark fringes is doubled. Find the wavelength of light. $(\lambda = 6000A^0)$

(84) If the difference of the time taken by two waves emitted from coherent sources to reach a point is an integral multiple of the period of the wave, show that constructive interference will occur at that point.

(85) In Young's double slit experiment, if the distance between two slits is double than the wavelength of light used, prove that a maximum of 5 bright fringes will be obtained on the screen.

(86) In Fraunhoffer diffraction, the wavelength of light incident normally on the slit is $d/2$ where d is the width of the slit. What will be the number of bright fringes (maximum) formed on an infinitely extended screen placed at any distance from the slit ?

(87) Light of 5000 A^0 is incident on a slit of width 2 mm in Fraunhoffer diffraction. Find the width of second maximum on the screen placed at the focal plane of the ens of focal length 100 cm. The lens is placed close to the slit.

(88) In the Fraunhoffer diffraction by a single slit a position where first order minimum is formed by the wave length of 6000 A^0, first order maximum is formed due to an unkbnown wavelength λ^1. Find λ^1 (4000A^0)

(89) 11 x 10^{11} photons are incident on a surface in 10 s. These photons correspond to a wavelength of 10 A^0 If the surface area of the given suface is 0.01 m^2 find the intensity of given radiations. Velocity of light is 3 x 10^8 ms^{-1} h = 6.6 x 10^{-34} Joule-sec.

(90) U.V light of wavelength 200 nm is incident on polished surface of Fe. Work function of the surface is 4.7 eV. Find (1) stopping potential (2) maximum kinetic energy of photo-electrons (3) maximum speed of photo electrons.

$h = 6.625 \times 10^{-34}\,Js,\ c = 3 \times 10^8\,ms^{-1},\quad 1eV = 1.6 \times 10^{-14}\,J,\quad m = 9.11 \times 10^{-31}\,kg$

$\left(Vo = 1.5V,\ \frac{1}{2} mv\,max = 2.42 \times 10^{-19}\,J\ \ V\,max = 7.3 \times 10^5\ ms^{-1} \right)$

(91) An electron is at a distance 10 m front from a charge of 10 C. Its total energy is 15.6 x 10^{-10} J. Find its de Broglie wavelength at this point.

$h = 6.6 \times 10^{-34}\,Js,\ m_e = 9.1 \times 10^{-31}\,kg\ \ \frac{1}{4\pi\varepsilon_0} = 9 \times 10^9\,SI\ \ e = 1.6 \times 10^{-19}\,C$

$\left(\lambda = 8.93 \times 10^{-15}\,m \right)$

(92) Wavelength of light incident on a photosensitive surface is reduced from 4000 A^0 to 360 nm. Find the change in stopping potential.

$h = 6.625 \times 10^{-34}\,Js\ \ e = 1.6 \times 10^{-19}\,C\ \ c = 3 \times 10^8\ ms^2 \qquad \left(34.5 \times 10^2\,V \right)$

(93) An electric bulb of 100 W converts 3 % of electrical energy into light energy. If the wavelength of light emitted is 6625 A^0 find the number of photons emitted in 1 s.

$h = 6.625 \times 10^{-34}\,Js\ \ c = 3 \times 10^8\,ms^{-1}\ \left(n = 10^{19} \right)$

(94) When a radiation of wavelength 3000 A^0 is incident on a metal stoppng potential is found to 1.85 V and on making radiation of 4000 A^0 incident on it, the stopping potential is found to be 0.82 V. Find (1) Planck's constant (2) Work function of the metal (3) threshold wavelength of the metal.

$\left(h = 6.592 \times 10^{-34}\,Js,\ 2.27eV, 5445\,A^0 \right)$

(95) Power produced by Sun is 4 x 10^{26} W. If the average wavelength of the emitted radiations is considered to be 500 nm, find the number of photon's emitted in 1 s.

$\left(n = 1.0 \times 10^{45}\ Photons/s \right)$

(96) Fnd the de Broglie wavelength of an atom of nitrogen gas at 300 K. Mass of nitrogen atom is 4.7 x 10^{-26} kg.and it is at 1 atm. pressure. Consider it as an ideal gas.

$\left(\lambda = 0.273 \times 10^{-10}\,m \right)$

(97) In potassium photo electric effect can be produced with maximum wavelength 564 nm. Find its work function in eV

$1eV = 1.6 \times 10^{-19}\,J\ \ h = 6.63 \times 10^{-34}\,Js\ \ c = 3 \times 10^8\,ms^{-1} \qquad \left(\phi = 2.20\,eV \right)$

(98) Find the ground state energy of an electron inside a one dimensional box of length 1.2 x 10^{-15} m. Mass of an electron = $m_e = 9.1 \times 10^{-31}\,kg$ $h = 6.62 \times 10^{-34}\,Js$ $\left(0.26 \times 10^6\,MeV \right)$

(99) Show that in a hydrogen atom angular speed of an electron is given by $\omega = \frac{\pi m e^4}{2 \varepsilon_0^2 n^3 h^3}$.

(100) Calculate the quantum number for which the radius of the orbit of electron in Be^{3+} would be equal to that for the ground state of electron in a hydrogen atom. Also, compare the energy of the two states. $\left(n = 2, E_{Be}^{3+} = 4EH\right)$

(101) Calculate the maximum wavelength of Balmer series in the hydrogen spectrum. Calculate the corresponding wave number. $\left(\text{Rydbergcons tan t } R = 1.097 \times 10^7 m^{-1}\right)$

$(\lambda = 6563A^0 \;\; n = 1.52 \times 10^2 m^{-1})$

(102) The H_α line in the Balmer series of the hydrogen spectrum has a wavelength of 6563 A^0 From this calculate the wavelength for the first line of the Lyman series. (Ly- α)

$\left(\lambda = 1215A^0\right)$

(103) If the energy of electron in a one dimensional box is to be equal to the energy of hydrogen in it's ground stagte, what should be length of the box ? $m_e = 9.1 \times 10^{-31} kg$, $h = 6.62 \times 10^{-34} Js$

(104) Calculate the binding energy per nucleon of $_{26}Fe^{56}$ nucleus from the data provided here. m_p = 1.007825 u ,m_n = 1.008665 u

$\left(8.79 \frac{MeV}{nucleon}\right)$

(105) A patient has been given a dose of radioactive material. Initially a counter broght near to him records 16,000 counts per minute. Under similar conditions, the counter records 500 counts per minute after a lapse of 4 hours. Find the half life of the radioactive material. $\left(\tau_{\frac{1}{2}} = 48 \text{ min}\right)$

(106) What fraction of a radioactive substance will decay in time $\frac{1}{\lambda}$? λ is the decay constant.

(107) Half life of Ra^{226} is 4.98 x 10^{10} s. Find the activity of 1 g. of its sample. Take Avogadro number 6.02 x 10^{23} mol^{-1}

$(I = 1.0 Ci)$

(108) Mass of a $_{17}Cl^{35}$ nucleus is 34.9800u If mass of a proton is 1.00783 u and neutron is 1.00866u Find the binding energy of $_{17}Cl^{35}$ nucleus. Take $(I u = 931 MeV)$ $(BE = 287.66 MeV)$

(109) A nucleus has an average radius of 6.6 fm. If the average mass of the nucleus is 1.0088 u, calculate it's density, R_0 = 1.1 fm, 1 u = 1.66 x 10^{-27} kg. $\left(\rho = 3 \times 10^{17} kgm^{-3}\right)$

(110) At a specific time, the rate of radioactive decay of a substance is 8000 decay s^{-1}. At that time, the undecayed number of nuclei is 8 x 10^7. Find the decay constant and the half life.

$(\lambda = 10^{-4} s^{-1}, \tau_{1/2} = 6930 \text{ seconds})$

(111) Half life of a radioactive element is 0.693 s. How much time will it take for decay of 80 % of this substance ?

$(t = 1.61 s)$

(112) The current gain of a comon base circuit is equal to α and the current gain of a common emitter (CE) circuit is equal to β. Find the relationship between α and β.

$\left(\alpha = \frac{\beta}{1+\beta}\right)$

(113) A change of 0.02 V takes place between the base and emitter when a input signal is connected to the CE transistor amplifier. As a result, 20μA change takes place in the base current and a change of 2mA takes place in the collector current. Calculate the following quantities : (1) r_i (2) A_i and (3) g_m. $(1k\,\Omega, 100, 0.1\,\text{mho})$

(114) A electron hole pairs are formed when 6000 A^0 wavelength light is incident on the semiconductor. What will be the band gap energy of the semiconductor ?

$(h = 6.62 \times 10^{-34}\,Js)$ $(E_g = 2.07\,eV)$

(115) The voltage gains of a NPN common emitter amplifier is equal to 200. It's load resistance is 10kΩ. Calculate the value of the transconductance. If the input resistance is replaced by 1kΩ, what will be the value of the a.c. current gain ?

$(gm = 0.02\,\text{mho}, Ai = 20)$

(116) The base current changes by 200μA when a 200 mV signal is applied at the input of a CE amplifier. Find input resistance. If the output voltage is equal to 2 volt, what is the voltage gain ?

$(ri = 1000\,\Omega \quad Av = 10)$

(117) The collector current changes by 10 mA when the input voltage of the NPN common emitter amplifier changes by 100 mV. The A.C. current gain of this circuit is equal to 150. If we have to obtain a power gain of 4500, what should be the value of the load resistance ?

$(R_L = 300\,\Omega)$

(118) The A.C. current gain of a PNP common emitter circuit is equal to 100. The value of the input resistance is equal to 1 kΩ. What should be the value of the load resistance R_L in order to obtain power gain of 2000 ?

$(R_L = 200\,\Omega)$

(119) Height of a TV tower is 100 m. If the average population density is 1000 / km^2, how many people can observe the programmes of this station ? (Radius of the earth : 6.4 x 10^6 m)

(120) The maximum value of electron density in the ionosphere, in the morning is 10 x 10^9 m^{-3}. At noon, it increases to 20 x 10^9 m^{-3}. Find the ratio of critical frequency at noon to the critical frequency in the morning.

(121) What must be the height of a TV antenna, so that people in a circular region of 3140 km^2 can enjoy the program of a FM radio station ? (R_e = 6400 km).

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