7

PRACTICE PAPER

Time allowed: 45 minutes **Maximum Marks: 200**

General Instructions: *Same as Practice Paper-1.*

Choose the correct option in the following questions.

1. **A body is positively charged. It has**
   (*a*) excess of positrons (*b*) excess of electrons
   (*c*) deficiency of electrons (*d*) deficiency of protons
2. **A point charge $+q$, is placed at a distance d from an isolated conducting plane. The field at a point P on the other side of the plane is**
   (*a*) directed perpendicular to the plane and away from the plane.
   (*b*) directed perpendicular to the plane but towards the plane.
   (*c*) directed radially away from the point charge.
   (*d*) directed radially towards the point charge.
3. **Which of the following statements is not true about Gauss's law?**
   (*a*) Gauss's law is true for any closed surface.
   (*b*) The term q on the right side of Gauss's law includes the sum of all charges enclosed by the surface.
   (*c*) Gauss's law is not much useful in calculating electrostatic field when the system has some symmetry.
   (*d*) Gauss's law is based on the inverse square dependence on distance contained in the Coulomb's law.
4. **The electrostatic potential on the surface of a charged conducting sphere is 100 V. Two statements are made in this regard:**
   S_1 : At any point inside the sphere, electric intensity is zero.
   S_2 : At any point inside the sphere, the electrostatic potential is 100 V.
   Which of the following is a correct statement?
   (*a*) S_1 is true but S_2 is false.
   (*b*) Both S_1 and S2 are false.
   (*c*) S_1 is true, S_2 is also true and S_1 is the cause of S_2.
   (*d*) S_1 is true, S_2 is also true but the statements are independent.
5. **Two identical metal plates, separated by a distance d form a parallel-plate capacitor. A metal sheet of thickness $d/2$ is inserted between the plates. The ratio of the capacitance after the insertion of the sheet to that before insertion is**
   (*a*) $\sqrt{2}$:1 (*b*) 2 : 1 (*c*) 1 : 1 (*d*) 1 : 2
6. **Electric field is always**
   (*a*) parallel to equipotential surface
   (*b*) perpendicular to equipotential surface
   (*c*) it can be perpendicular and parallel as well
   (*d*) it does not depends on distribution of charge

7. **An ellipsodial cavity is carved within a perfect → (c) conductor as shown in figure. A positive charge q is placed at the centre of the cavity. The points A and B are on the cavity surface.**

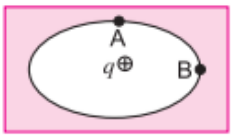
Which of the following statements is true?

I. Electric field near A in the cavity = electric field near B in the cavity

II. Charge density at A = charge density at B

III. Potential at A = potential at B.

IV. Total electric field flux through the surface of the cavity is $\frac{q}{\varepsilon_0}$.



(*a*) I and II only (*b*) I, II, and IV (*c*) III and IV only (*d*) none of these

8. **Temperature dependence of resistivity ρ(T) of semiconductors insulators and metals is significantly based on the following factors.**

(*a*) Number of charge carriers can change with temperature T.

(*b*) Time interval between two successive collision can depend on T.

(*c*) Length of material can be a function of T.

(*d*) Both (*a*) and (*b*)

9. **Kirchhoff's junction rule is a reflection of**

(*a*) conservation of current density vector.

(*b*) conservation of charge.

(*c*) the fact that there is no accumulation of charged at a junction.

(*d*) Both (*b*) and (*c*)

10. **The electric current in a conductor varies with time t as $I = 2t + 3t^2$, where I is in ampere and t in seconds. Electric charge flowing through a section of the conductor during $t = 2$ s to $t = 3$ s is**

(*a*) 10 C (*b*) 24 C (*c*) 33 C (*d*) 44 C

11. **Resistivity of a given conductor depends upon**

(*a*) temperature. (*b*) length of conductor.

(*c*) area of cross-section. (*d*) shape of the conductor.

12. **The electrical resistance of a conductor**

(*a*) varies directly proportional to its area of cross-section.

(*b*) decreases with increase in its temperature.

(*c*) decreases with increase in its conductivity.

(*d*) independent or its shape but depends only on its volume.

13. **Electrodynamic speaker can handle which type of audio power relative to permanent magnet type speaker?**

(*a*) Lower (*b*) Equal (*c*) Higher (*d*) Both (*a*) and (*b*)

14. **A horizontal wire 0.1 m long carries a current of 5 A. Find the magnitude and direction of the magnetic field, which can balance the weight of wire. Given the mass of the wire is 3×10^{-3} kg/m and $g = 10$ m/s^2.**

(*a*) 6×10^{-3} T, acting horizontally perpendicular to wire

(*b*) 6×10^{-3} T, acting vertically upwards

(*c*) 6×10^{-2} T, acting vertically downwards

(*d*) 6×10^{-2} T, acting horizontally perpendicular to wire

15. **A square current carrying loop is suspended in a uniform magnetic field acting in the plane of the loop. If the force on one arm of the loop is $\vec{F}$, the net force on the remaining three arms of the loop is**

(*a*) $\vec{F}$ (*b*) $-\vec{F}$ (*c*) $3\vec{F}$ (*d*) $-3\vec{F}$

16. **A charged particle goes undeflected in a region of velocity selector containing electric and magnetic field. It is possible that**

(*a*) $\vec{E}$ is not parallel to $\vec{B}$ and $\vec{v}$ (*b*) $\vec{E} \parallel \vec{B}, \vec{v} \parallel \vec{E}$

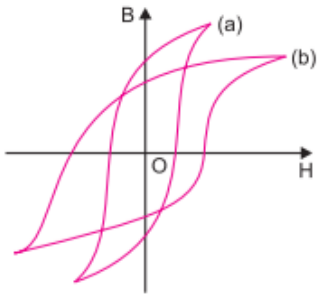
(*c*) $\vec{v} \parallel \vec{B}$ but $\vec{E}$ is not parallel to $\vec{E}$ (*d*) $\vec{E} \parallel \vec{B}$ but $\vec{v}$ is not parallel to $\vec{E}$

17. For which of the following substances, the magnetic susceptibility is independent of temperature

(*a*) diamagnetics only (*b*) paramagnetics only

(*c*) ferromagnetics only (*d*) diamagnetics and paramagnetics both

18. The B—H curves (a) and (b) shown in the figure are associated with



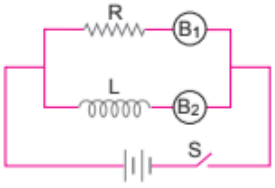
(*a*) a diamagnetic and a paramagnetic substance respectively

(*b*) a paramagnetic and a ferromagnetic substance respectively

(*c*) soft iron and steel respectively

(*d*) steel and soft iron respectively

19. Figure shows two bulbs B_1 and B_2, resistor R and inductor L. When the switch S is turned off



(*a*) both B_1 and B_2 dies out promptly (*b*) both B_1 and B_2 die out with some delay

(*c*) B_2 dies out promptly, but B_1 with some delay (*d*) B_1 dies out promptly, but B_2 with some delay

20. If L and R represent inductance and resistance respectively then the dimensions of L/R will be

(*a*) $M^0L^0T^{-1}$ (*b*) $M^0L^0T^{-2}$

(*c*) M^0L^0T (*d*) cannot be expressed in terms of M, L and T.

21. A copper ring is held horizontally and a magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet is

(*a*) equal to that due to gravity

(*b*) less than that due to gravity

(*c*) more than that due to gravity

(*d*) depends on the diameter of the ring and the length of the magnet

22. In an *ac* circuit the phase difference between current and emf is 45°. The circuit contains

(*a*) a pure inductance (*b*) a pure resistance

(*c*) a pure capacitance (*d*) a resistance, an inductance and a capacitance in series.

23. In an *ac* circuit containing resistance only, E and I are given by $E = 200 \sin (200)t$ volt and $I = 100 \sin (200)t$ mA. The power dissipated in the circuit is

(*a*) 10 watt (*b*) 200 watt (*c*) 100 watt (*d*) 400 watt

24. An alternating current is given by $i = i_1 \cos \omega t + i_2 \sin \omega t$. The rms current is given by:

(*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*) $\frac{i_1 i_2}{\sqrt{2}}$

25. A plane electromagnetic wave of energy U is reflected from the surface. Then the momentum transferred by electromagnetic wave to the surface is

(*a*) 0 (*b*) $\frac{U}{c}$ (*c*) $\frac{2U}{c}$ (*d*) $\frac{U}{2c}$

26. **A plane electromagnetic wave propagating along x direction can have which of the following pairs of E and B?**

(*a*) E_x, B_y (*b*) E_y, B_z (*c*) E_z, B_y (*d*) both (*b*) and (*c*)

27. **Match the corresponding entries of column 1 with column 2. [Where m is the magnification produced by the mirror]**

Column 1	Column 2
(A) $m = -2$	(*p*) Convex mirror
(B) $m = -\frac{1}{2}$	(*q*) Concave mirror
(C) $m = +2$	(*r*) Real image
(D) $m = +\frac{1}{2}$	(*s*) Virtual image

(*a*) A $\rightarrow$ *p* and *s*; B $\rightarrow$ *q* and *r*; C $\rightarrow$ *q* and *s*; D $\rightarrow$ *q* and *r*

(*b*) A $\rightarrow$ *r* and *s*; B $\rightarrow$ *q* and *s*; C $\rightarrow$ *q* and *r*; D $\rightarrow$ *p* and *s*

(*c*) A $\rightarrow$ *q* and *r*; B $\rightarrow$ *q* and *r*; C $\rightarrow$ *q* and *s*; D $\rightarrow$ *p* and *s*

(*d*) A $\rightarrow$ *p* and *r*; B $\rightarrow$ *p* and *s*; C $\rightarrow$ *p* and *q*; D $\rightarrow$ *r* and *s*

28. **How does the focal length of a convex lens changes if monochromatic red light is used instead of violet light?**

(*a*) Focal length is decreased when red light is used. (*b*) Focal length is increased when red light is used.

(*c*) Focal length remain same when red light is used. (*d*) Not depends on colour of light.

29. **The angle of a prism is 60^0 and the angle of minimum deviation for a ray of light refracted through it is 60^0. Then the refractive index of the material of the prism is**

(*a*) $\sqrt{2}$ (*b*) 2 (*c*) 3/2 (*d*) $\sqrt{3}$

30. **In order to increase the magnifying power of a microscope**

(*a*) the focal lengths of the objective and eye-piece should be small

(*b*) the focal length of objective should be decreased and that of eye-piece should be increased

(*c*) the focal length of objective and eye-piece should be increased

(*d*) the focal length of objective should be increased and that of eye-piece should be decreased

31. **The focal length of the lens in the human eye is maximum when it is looking at an object at**

(*a*) infinity (*b*) 25 cm from the eye

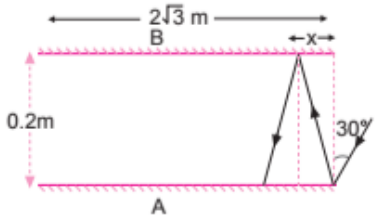
(*c*) 100 cm from the eye (*d*) a very small distance from the eye

32. **Astigmatism can be corrected by using**

(*a*) bifocal lenses (*b*) concave spherical lenses

(*c*) plano-convex lenses (*d*) cylindrical lenses

33. **Two plane mirrors *A* and *B* are aligned parallel to each other. A light ray is incident at an angle 30° at a point just inside one end of *A*. The plane of incidence coincides with the plane of fig. The maximum number of times the ray undergoes reflections (including the first one) before it emerges out is**



(*a*) 28 (*b*) 30 (*c*) 32 (*d*) 34

34. **A beam of light of wavelength 600 nm from a distant source falls on a single slit 1.0 mm wide and the resulting diffraction pattern is observed on a screen 2 m away. The distance between the first dark fringes on either side of the central bright fringe is**

(*a*) 1·2 cm (*b*) 1·2 mm (*c*) 2·4 cm (*d*) 2·4 mm

35. **A ray of light falls on a transparent glass plate. A part of it is reflected and a part is refracted. The reflected and refracted rays can be perpendicular to each other for**

(*a*) no angle of incidence (*b*) angle of incidence equal to 90°

(*c*) more than one angle of incidence (*d*) only one angle of incidence

36. **The relationship between brewster angle 'θ' and the speed of light '*v*' in the denser medium is**

(*a*) $v \tan \theta = c$ (*b*) $c \tan \theta = v$ (*c*) $v \sin \theta = c$ (*d*) $c \sin \theta = v$

37. **In a Fraunhoffer diffraction at single slit of width *d* with incident light of wavelength 5500 Å, the first minimum is observed at angle 30°. The first secondary maximum is observed at an angle θ =**

(*a*) $\sin^{-1}\frac{1}{\sqrt{2}}$ (*b*) $\sin^{-1}\frac{1}{4}$ (*c*) $\sin^{-1}\frac{3}{4}$ (*d*) $\sin^{-1}\frac{\sqrt{3}}{2}$

38. **Given below are two statements labelled as Statement P and Statement Q:**

Statement P : As work function of a material increases by some mechanism, it requires greater energy to excite the electrons from its surface.

Statement Q : A plot of stopping potential (V_s) versus frequency (ν) for different materials has greater slope for metals with greater work functions.

Select the most appropriate option:

(*a*) P is true, but Q is false (*b*) P is false, but Q is true

(*c*) Both P and Q are true (*d*) Both P and Q are false

39. **The de-Broglie wavelength of a netron in thermal equilibrium with heavy water at a temperature *T* (Kelvin) and mass *m*, is**

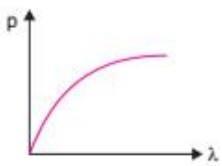
(*a*) $\frac{h}{\sqrt{mkT}}$ (*b*) $\frac{h}{\sqrt{3mkT}}$ (*c*) $\frac{2h}{\sqrt{3mkT}}$ (*d*) $\frac{2h}{\sqrt{mkT}}$

40. **Which of the following has the longest de Broglie wavelength if they are moving with the same velocity?**

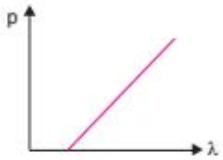
(*a*) Neutron (*b*) Proton (*c*) α-particle (*d*) β-particle

41. **The graph showing the correct variation of linear momentum (*p*) of a charge particle with its de-Broglie wavelength (λ) is —**

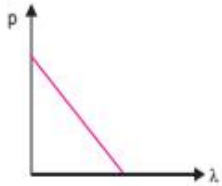
(*a*)



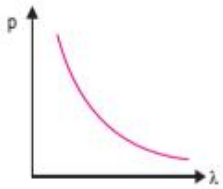
(*b*)



(*c*)



(*d*)



42. **Consider a beam of electrons (each electrons with energy E_0) incident on a metal surface kept in an evacuated chamber then**

(*a*) electrons can be emitted with any energy, with a maximum of E_0

(*b*) electrons can be emitted with any energy, with a maximum of $E_0 - \phi$, (ϕ is the work function)

(*c*) electrons can be emitted but all with an energy, E_0

(*d*) no electrons will be emitted as only photons can emit electrons

43. **In which of the following orbits will the electron of a hydrogen atom have maximum energy?**

(*a*) First (*b*) Second (*c*) Third (*d*) Completely detached

44. **The radius of the innermost electron orbit of a hydrogen atom is r_1. What is the ratio of radii of the $n = 2$ and $n = 3$ orbits?**

(*a*) $\frac{4}{9}$ (*b*) $\frac{2}{5}$ (*c*) $\frac{9}{4}$ (*d*) $\frac{9}{4}$

45. **In nuclear reaction:**

$$_4Be^9 + {}_2He^4 \rightarrow {}_6C^x + {}_0n^1; x =$$

(*a*) 10 (*b*) 12 (*c*) 16 (*d*) 14

46. **Which statement about alpha, beta and gamma radiation is correct?**

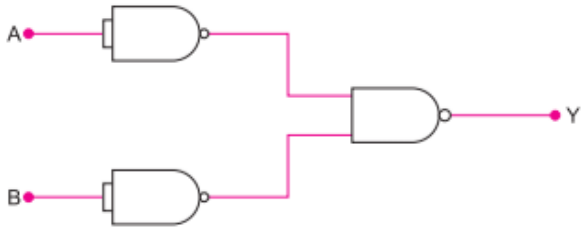
(*a*) Alpha radiation has the greatest ionizing power.

(*b*) Beta radiation has the greatest ionizing power.

(*c*) Gamma radiation has the greatest ionizing power.

(*d*) Alpha, beta and gamma radiation have nearly equal ionizing powers.

47. **The combination of logic gates represented in figure serve the purpose of**



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

48. **For a transistor amplifier, the voltage gain**

(*a*) remains constant for all frequencies

(*b*) is high at high and low frequencies and constant in the middle frequency range

(*c*) decrease from high to low frequencies steadily

(*d*) is low at high and low frequencies and constant in the middle frequency range.

49. **The logic behind NOR gate is that it gives**

(*a*) low output when both inputs are low (*b*) high output when both inputs are low

(*c*) high output when both inputs are high (*d*) none of these.

50. **In frequency modulation the frequency of modulated wave**

(*a*) remains constant (*b*) varies with that of signal

(*c*) varies with that of carrier (*d*) is zero

ANSWERS

PRACTICE PAPER – 7

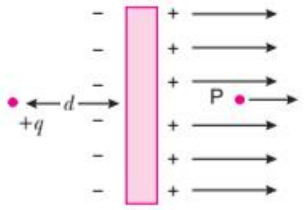
1. (*c*)	**2.** (*a*)	**3.** (*c*)	**4.** (*c*)	**5.** (*b*)	**6.** (*b*)	**7.** (*c*)
8. (*d*)	**9.** (*d*)	**10.** (*b*)	**11.** (*a*)	**12.** (*c*)	**13.** (*c*)	**14.** (*a*)
15. (*b*)	**16.** (*b*)	**17.** (*a*)	**18.** (*c*)	**19.** (*d*)	**20.** (*c*)	**21.** (*b*)
22. (*d*)	**23.** (*a*)	**24.** (*c*)	**25.** (*c*)	**26.** (*d*)	**27.** (*c*)	**28.** (*b*)
29. (*d*)	**30.** (*a*)	**31.** (*a*)	**32.** (*d*)	**33.** (*b*)	**34.** (*d*)	**35.** (*d*)
36. (*a*)	**37.** (*c*)	**38.** (*a*)	**39.** (*b*)	**40.** (*d*)	**41.** (*d*)	**42.** (*a*)
43. (*d*)	**44.** (*a*)	**45.** (*b*)	**46.** (*a*)	**47.** (*a*)	**48.** (*d*)	**49.** (*b*)
50. (*b*)						

SOLUTIONS

PRACTICE PAPER–7

1. (*c*) A body can be charged negatively or positively by giving or taking out the electrons respectively. Positive charge indicates that some electrons are taken out and the body has deficiency of electrons.

2. (*a*) When a point charge $+q$ is placed at a distance d from an isolated conducting plane, due to induction by $+q$ charge, the other side (RHS) of the plane acquire positive charge, so, field lines will emerge perpendicular to the plane and away from the plane.



3. (*c*) Gauss's law is often useful towards a much easier calculating of electrostatic field when the system has some symmetry. This helps to choose suitable gaussian surface.

4. (*c*) $E = -\frac{dV}{dr} \Rightarrow E = 0$ then, $\frac{dV}{dr} = 0$

$\Rightarrow V =$ constant

Thus, $E = 0$ inside the charged conducting sphere causes, the same electrostatic potential 100 V at any point inside the sphere.

5. (*b*) $C = \frac{\varepsilon_0 A}{d}$, $C' = \frac{\varepsilon_0 A}{d - t\left(1 - \frac{1}{K}\right)} = \frac{\varepsilon_0 A}{d - \frac{d}{2}\left(1 - \frac{1}{\infty}\right)}$

$= \frac{2\varepsilon_0 A}{d}$

$\Rightarrow C' = 2C \Rightarrow \frac{C'}{C} = \frac{2}{1} = 2:1$

6. (*b*) As work done to move a charge on equipotential surface is zero.

8. (*d*) $\rho = \frac{m}{ne^2\tau}$, when temperature increases, than successive collision between electrons will be increases and relaxation time (τ) will be decreases.

9. (*d*) Kirchhoff's junction rule states that algebraic sum of current flowing towards any point in an electric network is zero, *i.e.*, charges are conserved in electric network.

so, it is a reflection of conservation of charge.

10. (*b*) $I = \frac{dq}{dt} \Rightarrow q = \int_2^3 I\,dt = \int_2^3 (2t + 3t^2)\,dt$

$= \left[\frac{2t^2}{2} + \frac{3t^3}{3}\right]_2^3 = [t^2 + t^3]_2^3$

$= [(3)^2 + (3)^3] - [(2)^2 + (2)^3] = 24$ C

12. (*c*) $R = \frac{\rho L}{A} = \frac{L}{\sigma A}$

$R \propto \frac{1}{\sigma}$

13. (*c*) It is a type of higher audio power relative to permanent magnet type speaker.

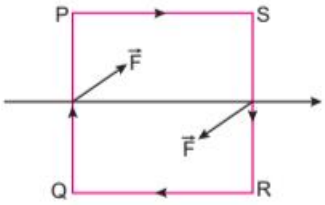
14. (*a*) Here, mass of wire, $m = 0.1 \times (3 \times 10^{-3})$ kg

In equilibrium position, $F = IlB = mg$

$\Rightarrow \quad B = \frac{mg}{Il} = \frac{(0.1 \times 3 \times 10^{-3}) \times 10}{5 \times 0.1} = 6 \times 10^{-3}$ T

The weight is wire be supported by force F if it acts vertically upwards. It will be so if the direction of $\vec{B}$ is horizontal and perpendicular to wire carrying current.

15. (*b*) As clear from figure, force on arm PS and arm RQ is zero. If $\vec{F}$ is force on arm RS, the force on arm PQ is $-\vec{F}$. Therefore, net force on the remaining three arms of the loop $= -\vec{F}$.



16. (*b*) A charged particle will go undeflected in an electric field if the direction of force on particle due to electric field only acts in the direction of motion of the particle *i.e.*, the charged particle moves parallel to the electric field. A moving charged particle cannot be deflected while passing through a region if the force on it due to electric field is equal and opposite to the force due to magnetic field. It will be so if magnetic field is perpendicular to electric field and is perpendicular to the direction of motion of charged particle.

18. (*c*) The retentivity of soft iron is greater than steel while coercivity of soft iron is less than steel. Hence area of (B–H) loop for soft iron is smaller than that of steel.

19. (*d*) When switch S is turned off, the current in resistor branch becomes zero immediately, while current in inductor branch takes some time to become zero.

20. (*c*) Time constant, $\tau = L/R$

21. (*b*) Due to Lenz's law, copper ring opposes the motion of bar magnet due to flux changes inside it. Hence acceleration of the falling magnet is less than g as $a_{net} = g - a$

22. (*d*) Because ϕ between current and emf is 45° in case of *LCR* circuit.

23. (*a*) $P_{av} = \frac{1}{2} V_0 i_0 = \frac{1}{2} \times 100 \times 200 \times 10^{-3} = 10$ W

24. (*c*) $i_{rms}^2 = (i^2)_{mean} = \frac{\int_0^T (i_1 \cos \omega t + i_2 \sin \omega t)^2}{T}$

$= \int_0^T i_1^2 \cos^2 \omega t + \int_0^T i_2^2 \sin^2 \omega t + \int_0^T 2 i_1 i_2 \sin \omega t \cos \omega t$

$= i_1^2 \times \frac{1}{2} + i_2^2 \times \frac{1}{2} + 0$

$i_{rms} = \sqrt{\frac{i_1^2 + i_2^2}{2}}$

25. (*c*) Energy of a photon, $U = h\nu$

Momentum of a photon, $\frac{h\nu}{c} = \frac{U}{c}$

When wave is reflected completely, change in momentum $\Delta p = 2p = \frac{2U}{c}$

$\therefore \quad \Delta p = \frac{2U}{c}$.

26. (*d*) The electric and magnetic field vectors $\vec{E}$ and $\vec{B}$ are perpendicular to each other as well as perpendicular to the direction of propagation of electromagnetic wave.

28. (*b*) We know, $\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

$f \propto \frac{1}{(n-1)}$ and $n_v > n_R$

The decrease in refractive index would result increase of focal length of lens.

Hence, we can say by replacing violet light with red, the focal length is increased.

29. (*d*) For minimum deviation,

$n = \frac{\sin\left(\frac{A + \delta_m}{2}\right)}{\sin \frac{A}{2}} \quad \Rightarrow \quad n = \frac{\sin 60°}{\sin 30°}$

$= \frac{\sqrt{3}}{2} \times 2 = \sqrt{3}$

30. (*a*) Magnifying power of compound microscope;

$M = \frac{-L}{f_o}\left(1 + \frac{D}{f_e}\right)$

So, to increase the magnifying power of a compound microscope, the focal lengths of objective and eye - piece both should be decreased.

31. (*a*) At infinity, lens of eye is adjusted at largest aperture without any strain.

32. (*d*) Cylindrical lenses focus the light into a line instead of a point.

33. (*b*) Distance for one reflection is $x = 0{\cdot}2 \tan 30°$

Number of reflections,

$N = \frac{l}{x} = \frac{2\sqrt{3}}{0{\cdot}2 \tan 30°} = 30$

34. (*d*) Angular half-width of central maximum,

$\theta = \frac{\lambda}{a} = \frac{600 \times 10^{-9}}{1 \times 10^{-3}} = 6 \times 10^{-4}$ m

Linear half-width,

$y = D\theta = 2 \times 6 \times 10^{-4}$ m $= 12 \times 10^{-4}$ m

$= 1.2$ mm

Total width $= 2y = 2{\cdot}4$ mm

35. (*d*) Brewster's Law states that at any particular angle of incidence, reflected ray is completely, polarized and the angle between reflected and refracted ray is 90°.

36. (*a*) According to Brewster's law

$\tan\theta = n$

And, $n = \frac{c}{v}$

Then, $\tan\theta = \frac{c}{v} \quad \Rightarrow \quad v \tan\theta = c$

37. (*c*) For first minimum,

$a \sin\theta = \lambda$

$a \sin 30° = 5500$ Å

$a = \frac{5500}{0.5}$ Å $= 11000$ Å

For first secondary maximum,

$a \sin\theta' = \frac{3\lambda}{2}$

$\sin\theta' = \frac{3 \times 5500}{2 \times 11000} = \frac{3}{4}$

$\therefore \quad \theta' = \sin^{-1}\frac{3}{4}$

39. (*b*) At thermal equilibrium,

$\frac{1}{2} m v^2 = \frac{3}{2} kT$

$\therefore \quad m^2 v^2 = 3mkT$

$\Rightarrow \quad p^2 = 3mkT$

From de-Broglie wavelength,

$\lambda = \frac{h}{p} = \frac{h}{\sqrt{3mkT}}$

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40. (*d*) From de Broglie wavelength,

$$\lambda = \frac{h}{mv} \Rightarrow \lambda \propto \frac{1}{m}$$

Now, $m_\alpha > m_n > m_p > m_\beta$

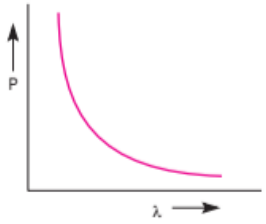
$\Rightarrow \quad \lambda_\alpha > \lambda_n > \lambda_p > \lambda_\beta$

$\therefore$ β-particle has the longest wavelength

41. (*d*) de Broglie wavelength

$$\lambda = \frac{h}{p}$$

$$p = \frac{h}{\lambda}$$



42. (*d*) When a beam of electrons of energy E_0 of each electron is incident on a metal surface kept in vacuum, then due to elastic collision with electrons on surface, energy of incident electrons will be transferred to the emitted electrons. To emit the electrons below the surface, a part of E_0 of incident electrons is consumed against work function. So, energy of emitted electrons becomes less than E_0. So, the maximum energy of emitted electrons can be E_0.

43. (*d*) Energy increases as we move to higher orbits.

44. (*a*) Radius of nth orbit,

$$r_n = 0 \cdot 53 \frac{n^2}{Z} \text{Å}$$

$$r \propto n^2$$

$$\frac{r_2}{r_3} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$$

45. (*b*) Here, $x + 1 = 9 + 4 = 13 \Rightarrow x = 12$

46. (*a*) α-particles are heavier, they move slowly, so possess large momentum. Due to this property they come in contact with large number of particle, so they possess high ionizing power.

47. (*a*) Output of gate $G_1 = \overline{A}$

Output of gate $G_2 = \overline{B}$

Output of gate $G_3 = \overline{\overline{A}\ \overline{B}} = \overline{\overline{A}} + \overline{\overline{B}} = A + B$ (OR gate)

48. (*d*) Voltage gain of transistor amplifier is constant at mid frequency range and falls at low and high frequency range.

49. (*b*) NOR gate can be used to realise the basic logic function; OR, AND and NOT. So it gives high output when both inputs are low.

50. (*b*) In frequency modulation, the frequency rather than the amplitude of the carrier ware is made to vary in proportion to the varying amplitude of the modulating signal.