16 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. Consider a region inside in which there are various types of charges but the total charge is zero. At points outside the region

(*a*) the electric field is necessarily zero.

(*b*) the electric field is due to the dipole moment of the charge distribution only.

(*c*) the work done to move a charged particle along a closed path, away from the region, will be zero.

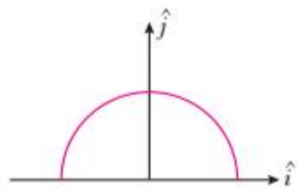
(*d*) None of these

2. The minimum value of charge on any charged body may be

(*a*) 1.6×10^{-19} coulomb (*b*) 1 coulomb

(*c*) 1μC (*d*) 4.8×10^{-12} coulomb

3. A thin semicircular ring of radius r has a positive charge 'q' uniformly distributed over it. The net electric field $\vec{E}$ at centre O is



(*a*) $\frac{q}{2\pi^2\varepsilon_0 r^2}\hat{j}$ (*b*) $\frac{q}{4\pi^2\varepsilon_0 r^2}\hat{i}$ (*c*) $-\frac{q}{4\pi^2\varepsilon_0 r^2}\hat{i}$ (*d*) $\frac{-q}{2\pi^2\varepsilon_0 r^2}\hat{j}$

4. If the net electric flux through a closed surface is zero, then we can infer

(*a*) no net charge is enclosed by the surface.

(*b*) uniform electric field exists within the surface.

(*c*) electric potential varies from point to point inside the surface.

(*d*) charge is present inside the surface.

5. In a Van de Graaff type generator, a spherical metal shell is to be 15×10^6 V electrode. The dielectric strength of the gas surrounding the electrode is 5×10^7 Vm^{-1}. The minimum radius of the spherical shell required will be

(*a*) 1 m (*b*) 2 m (*c*) 1.5 m (*d*) 3 m

6. A positive charge Q' is moved around another positive charge Q on circular path. If the radius of the circular path is r, the work done on the charge Q' in making one complete revolution is

(*a*) $\frac{Q}{4\pi\varepsilon r}$ (*b*) $\frac{QQ'}{4\pi\varepsilon r}$ (*c*) zero (*d*) $\frac{Q'}{4\pi\varepsilon r}$

7. **In case of a Van de Graaff generator, the breakdown field of air will be**
(*a*) 2×10^8 Vm^{-1} (*b*) 3×10^6 Vm^{-1}
(*c*) 3×10^4 Vm^{-1} (*d*) 2×10^{-8} Vm^{-1}

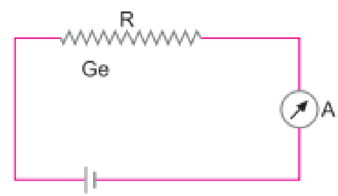
8. **A parallel plates capacitor is charged by connecting a battery across its plates. If the battery remains connected and a dielectric material is inserted in between the plates of the capacitor, then**
(*a*) potential difference across the capacitor increases (*b*) electric field remains the same
(*c*) capacitance increases (*d*) all the above

9. **A wire of uniform area of cross-section *A*, length *l* and resistance *R* is cut at the middle into two equal parts of length *l*/2 each. Then the resistivity of each piece compared to that of the original becomes**
(*a*) half (*b*) double (*c*) unchanged (*d*) unpredictable

10. **A potentiometer wire is 100 cm long and a constant potential difference is maintained across it. Two cells are connected in series first to support one another and then in opposite direction. The balance points are obtained at 50 cm and 10 cm from the positive end of the wire in the two cases. The ratio of emf's is**
(*a*) 3 : 4 (*b*) 3 : 2 (*c*) 5 : 1 (*d*) 5 : 4

11. **A wire of length 100 cm is connected to a cell of emf 2 V and negligible internal resistance. The resistance of the wire is 3 Ω. The additional resistance required to produce a potential drop of 1 millivolt per cm is**
(*a*) 60 Ω (*b*) 47 Ω (*c*) 57 Ω (*d*) 55 Ω

12. **A current is passed by a battery of constant voltage through the germanium wire at room temperature. Now the temperature of germanium wire is decreased. The reading of ammeter will**



(*a*) increase (*b*) decrease
(*c*) remain unchanged (*d*) increase and decrease alternatively

13. **The sensitivity of a moving coil galvanometer increases with the decrease in**
(*a*) number of turns (*b*) area of coil
(*c*) magnetic field (*d*) torsional rigidity

14. **A strong magnetic field is applied to a proton at rest. Then**
(*a*) the particle moves in opposite direction of the applied field.
(*b*) the particle moves in the direction of the applied field.
(*c*) the particle continues to be at rest (consider the proton as a charged particle only).
(*d*) the particle executes circular motion in magnetic field.

15. **A straight current carrying conductor is placed inside a uniform magnetic field. The force per unit length acting on the conductor is**
(*a*) maximum when the conductor is perpendicular to the direction of magnetic field.
(*b*) maximum when the conductor is along the direction of magnetic field.
(*c*) minimum when the conductor is perpendicular to the direction of magnetic field.
(*d*) minimum when the conductor makes an angle of 45° with the direction of magnetic field.

16. **The line on the earth's surface joining the points where the field is horizontal is called**
(*a*) magnetic meridian (*b*) magnetic axis
(*c*) magnetic line (*d*) magnetic equator

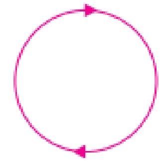
17. **The magnetic field of earth can be modelled by that of a point dipole placed at the centre of the earth. The dipole axis makes an angle of 11.3° with the axis of earth. At Mumbai, declination is nearly zero. Then,**
(*a*) the declination varies between 11.3° W to 11.3° E
(*b*) the least declination is 0°
(*c*) the plane defined by dipole axis and earth axis passes through Greenwich
(*d*) declination averaged over earth must be always negative

18. **In a plane perpendicular to the magnetic meridian, the dip needle will be**
(*a*) vertical (*b*) horizontal
(*c*) inclined equal to the angle of dip at that place (*d*) pointing in any direction

19. Earth's magnetic field always has a horizontal component except at

(*a*) equator
(*b*) magnetic pole
(*c*) at latitude 60°
(*d*) at latitude 30°

20. In the given diagram, a line of force of a particular force field is shown. Out of the following options, it can never represent:



(*a*) an electrostatic field
(*b*) a magnetostatic field
(*c*) a gravitational field of a mass at rest
(*d*) both (*a*) and (*c*)

21. A rectangular, a square, a circular and an elliptical loop, all in the *x*-*y* plane are moving out of the uniform magnetic field with a constant velocity $\vec{v} = v\,\hat{i}$. The magnetic field is directed along the negative *z*-direction. The induced emf during the passage of these loops, out of the field region will not remain constant for:

(*a*) the circular and the elliptical loops
(*b*) only the elliptical loop
(*c*) any of the four loops
(*d*) the rectangular, circular and elliptical loops

22. When an *ac* voltage of 220 V is applied to the capacitor C

(*a*) the maximum voltage between plates is 220 V.
(*b*) power delivered to the capacitor is zero.
(*c*) the charge on the plates is in phase with the applied voltage.
(*d*) both (*b*) and (*c*)

23. In a series LR-circuit, the inductive reactance is equal to the resistance R of the circuit. An emf $E = E_0\cos(\omega t)$ is applied to the circuit. The power consumed in the circuit is

(*a*) $\frac{E_0^2}{4R}$
(*b*) $\frac{E_0^2}{8R}$
(*c*) $\frac{E_0^2}{R}$
(*d*) $\frac{E_0^2}{2R}$

24. High voltage transmission line is preferred as

(*a*) its appliances are less costly
(*b*) thin power cables are required
(*c*) idle current very low
(*d*) power loss is very less

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

(*a*) visible region
(*b*) infrared region
(*c*) ultraviolet region
(*d*) microwave region

26. The amplitudes of electric and magnetic fields are related to each other by the relation

(*a*) $E_0 = B_0c$
(*b*) $B_0 = E_0c$
(*c*) $E_0B_0 = c^2$
(*d*) $E_0B_0 = c$

27. In electromagnetic wave if u_e and u_m are mean electric and magnetic energy densities, then

(*a*) $u_e = u_m$
(*b*) $u_e > u_m$
(*c*) $u_e < u_m$
(*d*) $u_e^2 = \frac{1}{2}u_m^2$

28. Monochromatic light of wavelength 600 nm enters from air into a glass medium of refractive index 1.5. The wavelength of refracted light inside the glass is

(*a*) 400 nm
(*b*) 600 nm
(*c*) 700 nm
(*d*) 900 nm

29. The focal length of a lens depends on

(*a*) radii of curvature of its surfaces only
(*b*) refractive index of its material only
(*c*) refractive index of the medium surrounding the lens only
(*d*) all the above factors

30. The refractive index of the material of an equilateral prism is $\sqrt{2}$. What will be the angle of minimum deviation for a light ray passing through it?

(*a*) 45°
(*b*) 60°
(*c*) 30°
(*d*) 90°

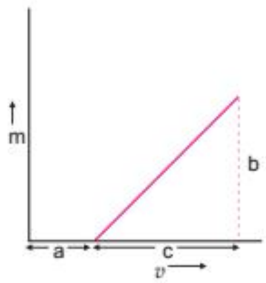
31. The refractive index of glass is 1.5. A sphere of this glass is immersed in water having refractive index 4/3. The critical angle for light rays originating within the sphere is

(*a*) $\sin^{-1}\frac{3}{2}$
(*b*) $\sin^{-1}\frac{9}{8}$
(*c*) $\sin^{-1}\frac{8}{9}$
(*d*) $\sin^{-1}\frac{6}{5}$

32. **In case of dispersion of white light through a prism, the emergent violet ray of the spectrum remains**

(*a*) at the middle of the spectrum
(*b*) towards the upper side of the spectrum.
(*c*) towards the lower side of the spectrum
(*d*) invisible

33. **The graph shows the variations of magnification m produced by a convex lens with image distance v, the focal length of the lens used is**



(*a*) $\frac{b}{c}$ (*b*) $\frac{b}{ca}$ (*c*) $\frac{bc}{a}$ (*d*) $\frac{c}{b}$

34. **When unpolarised light is incident on a parallel glass plate at Brewster's (polarising) angle; then which of the following statements is correct?**

(*a*) Reflected and refracted rays are completely polarised with their planes of polarisation parallel to each other.

(*b*) Reflected and refracted rays are completely polarised with their planes of polarisation perpendicular to each other.

(*c*) The reflected light is plane polarised but transmitted light is partially polarised.

(*d*) The reflected light is partially polarised but refracted light is plane polarised.

35. **Consider Fraunhofer diffraction pattern obtained with a single slit at normal incidence. At the angular position of the first diffraction minimum, the phase difference (in radians) between the wavelets from the opposite edges of the slit is**

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

36. **The intensity ratio of the maxima and minima in an interference pattern produced by two coherent sources of light is 9 : 1. The intensities of the used light sources are in ratio**

(*a*) 3 : 1 (*b*) 4 : 1 (*c*) 9 : 1 (*d*) 10 : 1

37. **Both, light and sound waves produce diffraction. It is more difficult to observe diffraction with light waves because**

(*a*) light waves do not require medium
(*b*) wavelength of light waves is too small
(*c*) light waves are transverse in nature
(*d*) speed of light is far greater

38. **Monochromatic light of wavelength 667 nm is produced by a helium neon laser. The power emitted is 9 mW. The number of photons arriving per second on the average at a target irradiated by this beam is:**

(*a*) 3×10^{16} (*b*) 9×10^{15} (*c*) 3×10^{19} (*d*) 9×10^{17}

39. **Electrons are emitted from a given metal surface by the use of green light but not emitted by the use of yellow light. Then electrons can be emitted from that surface if one uses**

(*a*) blue light (*b*) red light (*c*) infrared rays (*d*) heat waves

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

Statement P : An electron microscope is based on de Broglie hypothesis.

Statement Q : A beam of electrons behaves as a wave which can be converged by electric and magnetic lenses.

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

41. Which spectral series of hydrogen lie in UV region?

(*a*) Paschen (*b*) Lyman (*c*) Brackett (*d*) Balmer

42. The angular momentum of the electron in the n^{th} allowed orbit is

(*a*) $\frac{2h}{\pi}$ (*b*) $\frac{nh}{2\pi}$ (*c*) $\frac{ph}{2\pi}$ (*d*) $\frac{h}{2\pi}$

43. The minimum energy required to knock an electron completely out of the atom is called as

(*a*) ionisation energy (*b*) potential energy (*c*) kinetic energy (*d*) excitation energy

44. The half life of a radioactive nucleus is 50 days. The time interval $(t_2 - t_1)$ between the time t_2 when $\frac{2}{3}$ of it has decayed and the time t_1 when $\frac{1}{3}$ of it had decayed is

(*a*) 30 days (*b*) 50 days (*c*) 60 days (*d*) 15 days

45. A nuclide A (with mass number m and atomic number n) disintegrates emitting an alpha and one beta particle. The resulting nuclide B has mass number and atomic number respectively equal to

(*a*) $m - 4$ and $n - 2$ (*b*) $m - 2$ and n (*c*) $m + 4$ and $n + 1$ (*d*) $m - 4$ and $n - 1$

46. In a β-decay:

(*a*) The parent and the daughter nuclei have the same number of protons.
(*b*) The daughter nucleus has one proton less than the parent nucleus.
(*c*) The daughter nucleus has one proton more than the parent nucleus.
(*d*) The daughter nucleus has one neutron more than the parent nucleus.

47. In the forward bias arrangement of a *p-n*-junction diode

(*a*) the *n*-end is connected to the positive terminal of the battery
(*b*) the *p*-end is connected to the positive terminal of the battery
(*c*) the direction of current is from *n*-end to *p*-end in the diode
(*d*) the *p*-end is connected to the negative terminal of battery

48. Match the following type of semiconductors in Column A with their properties in Column B.

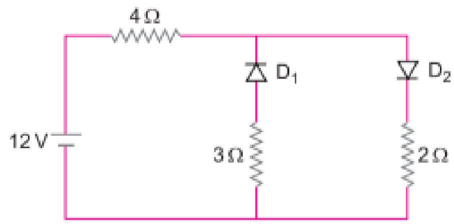
Column A		Column B	
(*i*)	Zener diode	(*p*)	Detects optical signals
(*ii*)	Photo-diode	(*q*)	Works in forward biasing
(*iii*)	LED	(*r*)	Converts electrical energy into optical energy
		(*s*)	Acts as voltage regulator

(*a*) (*i*)–(*s*), (*ii*)–(*p*), (*iii*)–(*q*), (*r*) (*b*) (*i*)–(*p*), (*ii*)–(*s*), (*iii*)–(*r*)
(*c*) (*i*)–(*s*), (*ii*)–(*p*), (*iii*)–(*q*) (*d*) (*i*)–(*q*), (*r*), (*ii*)–(*p*), (*iii*)–(*s*)

49. A transistor oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produce oscillations of frequency f. If L is doubled and C is changed to $4C$, the frequency will be

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

50. The circuit has two oppositely connected ideal diodes in parallel. What is the current flowing in the circuit?



(*a*) 1.71 A (*b*) 2.00 A (*c*) 2.31 A (*d*) 1.33 A

ANSWERS

PRACTICE PAPER – 16

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

SOLUTIONS

PRACTICE PAPER—16

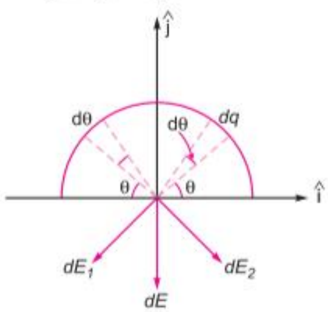
1. (*c*) The electric field at points outside the origin is due to all individual charges and their distribution over the region. As the total charge is zero, then region can be supposed to contains a number of dipoles. For a point outside the region, the dominant electric field is due to dipole, *i.e.*, $E \propto \frac{1}{r^3}$ for large r. Also as the electric field is conservative field. Hence the work done to move a charged particle along a close path is zero.

2. (*a*) The smallest charge is charge on electron

$= 1.6 \times 10^{-19}$ C.

3. (*d*) By symmetry, the net electric field is in negative *y*-axis and is given by

$$\vec{E} = -\int dE_1 \sin\theta\ \hat{j}$$



$$= -\int \frac{dq}{4\pi\varepsilon_0 r^2}\sin\theta.\ \hat{j}$$

But $d\theta = \frac{q}{\pi r}.r\,d\theta = \frac{q}{\pi}d\theta$

$$\vec{E} = \int_0^{\pi} \frac{(q/\pi)d\theta}{4\pi\varepsilon_0 r^2}\sin\theta\ \hat{j}$$

$$= \frac{q}{4\pi^2\varepsilon_0 r^2}\int_0^{\pi}\sin\theta\,d\theta\ \hat{j} = \frac{q}{4\pi^2\varepsilon_0 r^2}[-\cos\theta]_0^{\pi}\hat{j}$$

$$= \frac{q}{4\pi^2\varepsilon_0 r^2}(-2)\ \hat{j} = \frac{-q}{2\pi^2\varepsilon_0 r^2}\ \hat{j}$$

4. (*a*) no net charge is enclosed by the surface.

5. (*d*) Here, $V = 15 \times 10^6$ V

Dielectric strength $= 5 \times 10^7$ V m^{-1}

Maximum electric field, $E = (5 \times 10^7) \times \frac{10}{100}$

$= 5 \times 10^6$ V m^{-1}.

As, $E = \frac{V}{r}$

$$r = \frac{V}{E} = \frac{15\times10^6}{5\times10^7} = 3\text{m}.$$

6. (*c*) As the charge returned to the initial position.

7. (*b*) Although air is normally on insulator but at a sufficient high voltage, it ionises and become partially conducting. The electric field at which it occurs is called breakdown field of air and is near by about to 3×10^6 V m^{-1}.

9. (*c*) Resistivity depends on material only

10. (*b*) Suppose two cells have emfs ε_1 and ε_2 (also $\varepsilon_1 > \varepsilon_2$).

Potential difference per unit length of the potentiometer wire = k (say)

When ε_1 and ε_2 are in series and support each other then

$$\varepsilon_1 + \varepsilon_2 = 50 \times k \quad \ldots(i)$$

When ε_1 and ε_2 are in opposite direction

$$\varepsilon_1 - \varepsilon_2 = 10 \times k$$

On adding eqn. (*i*) and eqn. (*ii*)

$2\varepsilon_1 = 60k \Rightarrow \varepsilon_1 = 30k$ and $\varepsilon_2 = 50k - 30k = 20k$

$$\therefore \quad \frac{\varepsilon_1}{\varepsilon_2} = \frac{30k}{20k} = \frac{3}{2}$$

11. (*c*) For the full length of wire, total drop required

$$= \frac{1\text{ mV}}{1\text{ cm}} \times 100\text{ cm} = 100\text{ mV}$$

$$I = \frac{100}{3}\text{mA} = \frac{1}{30}\text{A}$$

$V = 2$ V

$$R = \frac{V}{I} = \frac{2}{\frac{1}{30}} = 60\ \Omega$$

Now required resistance = $60 - 3 = 57\ \Omega$

12. (*b*) On cooling resistance of semiconductor Ge increases, so current $I = \frac{V}{R}$ decreases.

13. (*d*) Sensitivity, $S = \frac{NBA}{K}$, where K = torsional rigidity

Hence, S increases when K is decreases.

15. (*a*) As we know, $\vec{F} = i\vec{l} \times \vec{B}$

$\therefore\ |\vec{F}| = ilB\sin\theta$

If $\theta = 90° \Rightarrow F_{max} = ilB$

Hence when current carrying conductor placed perpendicular to magnetic field. It experiences maximum force.

16. (*d*) The line on the earth's surface joining the points where the field is horizontal is magnetic equator.

17. (*a*) The axis of dipole makes an angle of 11.3° with the axis of the earth and the declination varies between 11.3° W to 11.3° E depending upon the point of observation.

18. (*a*) In a plane perpendicular to the magnetic meridian, the dip needle will be vertical.

19. (*b*) At magnetic poles, the horizontal component of Earth's Magnetic field is zero.

20. (*d*) In electrostatic field and gravitational field, the field lines cannot originate and terminate at the same point.

21. (*a*) The area coming out per second from the magnetic field is not constant as well as flux does not changes constantly for elliptical and circular loops. So induced emf, during the passes of these loop, out of the field region will not remains constant.

22. (*d*) The plate with positive charge will be at higher potential and the plate with negative charge will be at lower potential. So, we can say that the charge is in phase with applied voltage.

23. (*a*) Power consumed: $P = E_{\text{rms}} i_{\text{rms}} \cos\phi$

$$P = E_{rms}\left(\frac{E_{rms}}{Z}\right)\frac{R}{Z}$$

$$\left[\because\ i_{rms} = \frac{E_{rms}}{Z} \text{ and } \cos\phi = \frac{R}{Z}\right]$$

$$E_{rms} = \frac{E_0}{\sqrt{2}}, \text{ then } P = \frac{E_0^2}{4R}$$

24. (*d*) Weak current flows through the transmission line, hence low power loss (I^2R).

25. (*c*) Given, energy required to dissociate a carbon monoxide molecule into carbon and oxygen atoms, $E = 11$ eV.

i.e., $E = h\nu$ where, $h = 6.62 \times 10^{-34}$ Js

$$\nu = \frac{E}{h} = \frac{11\times1.6\times10^{-19}}{6.62\times10^{-34}}$$

$$= 2.65 \times 10^{-15} \text{ Hz}$$

This frequency radiation belongs to UV region.

28. (*a*) Frequency does not changes in refraction *i.e.*, $\nu_c = \nu_m = \nu$

$$\therefore \quad n = \frac{c}{v} = \frac{\lambda_c \nu}{\lambda_m \nu} = \frac{\lambda_c}{\lambda_m}$$

$$1\cdot5 = \frac{600}{\lambda_m} \quad\Rightarrow\quad \lambda_m = \frac{600}{1.5} = 400\text{ nm}$$

29. (*d*) According to lens maker's formula,

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

f depends upon, n and radii curvature of its surface.

30. (*c*) For minimum deviation,

$$n = \frac{\sin\frac{A+\delta_m}{2}}{\sin\frac{A}{2}} \quad \text{Given } n \Rightarrow \sqrt{2}, \quad A = 60°$$

$$\sqrt{2} = \frac{\sin\frac{60°+\delta_m}{2}}{\sin 30°} \Rightarrow \sqrt{2}\times\frac{1}{2} = \sin\frac{60°+\delta_m}{2}$$

$$\frac{1}{\sqrt{2}} = \sin\frac{60°+\delta_m}{2} \Rightarrow \sin 45° = \sin\frac{60°+\delta_m}{2}$$

$$45° = 30° + \frac{\delta_m}{2} \quad\Rightarrow\quad \delta_m = 30°$$

31. (*c*) Refraction at critical angle (i_c),

$$n_{gw} = \frac{1}{\sin i_c}$$

$$\frac{n_g}{n_w} = \frac{1}{\sin i_c} \Rightarrow \frac{1.5}{\frac{4}{3}} = \frac{1}{\sin i_c} = \frac{9}{8}$$

$$\Rightarrow \sin i_c = \frac{8}{9}$$

$$i_c = \sin^{-1}\frac{8}{9}$$

32. (*c*) Violet light being of shortest wavelength is most deviated from the path.

33. (*d*) Magnification, $M = \frac{v}{u}$

and using, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

Multiply the equation by v, we get

$$1 - \frac{v}{u} = \frac{v}{f} \quad\Rightarrow\quad \frac{v}{u} = 1 - \frac{v}{f}$$

$$M = 1 - \frac{v}{f}$$

Hence, compare with standard linear equation of a line,

$y = mx + c$ where, m = slope

and c = y-intercept

We get, $m = -\frac{1}{f}$

$$\text{Slope} = -\frac{1}{f} = \tan\theta = \frac{b}{c} \quad\Rightarrow\quad \frac{1}{f} = \frac{b}{c}$$

$$\text{or} \quad f = \frac{c}{b}$$

34. (*c*) At Brewster angle, only the reflected light is completely plane polarised, but the transmitted (refracted) light is partially polarised.

35. (*d*) For position of first minimum, path difference

$a\sin\theta = \lambda$;

Phase difference $= \frac{2\pi}{\lambda}\times\lambda = 2\pi$

36. (*b*) $\dfrac{I_{max}}{I_{min}} = \left(\dfrac{r+1}{r-1}\right)^2 = \dfrac{9}{1}$

$\Rightarrow \quad \dfrac{r+1}{r-1} = 3$

$\Rightarrow \quad r + 1 = 3r - 3$

$\Rightarrow \quad r = 2$

$\therefore \quad \dfrac{I_1}{I_2} = \dfrac{a_1^2}{a_2^2} = r^2 = 4:1$

37. (*b*) It is more difficult to observe diffraction with light waves because wavelength of light waves is far too smaller compared to that of sound waves.

38. (*a*) Number of photons,

$$N = \frac{P}{hc/\lambda} = \frac{P\lambda}{hc} = \frac{9\times10^{-3}\times667\times10^{-9}}{6.6\times10^{-34}\times3\times10^{8}}$$

$$= 3 \times 10^{16}$$

39. (*a*) Blue light because it has frequency more than the green light.

42. (*b*) According to Bohr's model angular momentum of electron is quantised and is an integral multiple of $\dfrac{h}{2\pi}$.

43. (*a*) The minimum energy required to eject an electron from its valence shell of isolated gaseous state atom is called ionisation energy.

44. (*b*) From radioactive decay law,

$N = N_0 e^{-\lambda t}$

At t_2, $N = N_0 - \dfrac{2N_0}{3} = \dfrac{N_0}{3}$

At t_1, $N = N_0 - \dfrac{N_0}{3} = \dfrac{2N_0}{3}$

Now $\dfrac{N_0}{3} = N_0 e^{-\lambda t_2}$ ...(*i*)

$\dfrac{2N_0}{3} = N_0 e^{-\lambda t_1}$ ...(*ii*)

Divide equation (*i*) and (*ii*)

$e^{\lambda(t_2 - t_1)} = 2$

$$t_2 - t_1 = \frac{\log_e 2}{\lambda} = 50 \text{ days} \left[\because t_{1/2} = \frac{\log_e 2}{\lambda}\right]$$

45. (*d*) For α-decay, $m' = m - 4$; $n' = n - 2$ and for β-decay, $m'' = m - 4$; $n'' = n - 2 + 1 = n - 1$

49. (*a*) A transistor - oscillator using resonant circuit with a inductor L (of negligible resistance) and capacitor C is series produce oscillations of frequency (f').

If L is doubled and C becomes $4C$ then frequency,

$$f = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

So, $\dfrac{f}{f'} = \sqrt{\dfrac{L'C'}{LC}} = \sqrt{\dfrac{4C\times2L}{LC}}$

$$= \sqrt{8} = \sqrt{4\times2} = {}^{2}\sqrt{2}$$

$$f' = \frac{f}{2\sqrt{2}}$$

50. (*b*) Diode D_1 is reverse biased and D_2 is forward biased, so there is no current in D_1.

Current, $I = \dfrac{12}{4+2} = 2.0$ A