15 PRACTICE PAPER

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

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

Choose the correct option in the following questions.

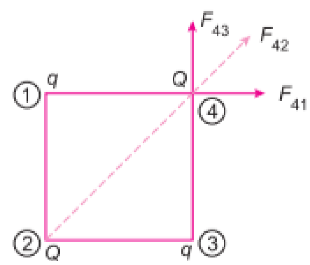
1. Electric flux is

(*a*) scalar quantity
(*b*) vector quantity
(*c*) sometimes scalar and sometimes vector
(*d*) neither scalar nor vector.

2. The number of electrons contained in 1 coulomb of charge is equal to

(*a*) 6.25×10^{17} (*b*) 6.25×10^{18}
(*c*) 1.6×10^{-19} (*d*) 0.625×10^{18}

3. A charge Q is placed at each of the opposite corners of a square. A charge q is placed at each of the other two corners. If the net electrical force on Q is zero, then $\frac{Q}{q}$ equals



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

4. In which of the following cases the electric field strength is independent of distance?

(*a*) Due to a point charge (*b*) Due to a line charge
(*c*) Due to a spherical charge (*d*) Due to infinite flat sheet of charge

5. Two large conducting spheres carrying charges Q_1 and Q_2 are kept with their centres r distance apart. The magnitude of electrostatic between them is not exactly $\frac{1}{4\pi\varepsilon_0}\frac{Q_1Q_2}{r^2}$ because

(*a*) these are not point charges.
(*b*) charge distribution on the spheres is not uniform.
(*c*) charges on spheres will shift towards the centres of their respective spheres.
(*d*) charges will shift towards the portions of the spheres which are closer and facing towards each other.

6. A parallel plate capacitor is charged by a battery. Once it is charged, the battery is removed. Now a dielectric material is inserted between the plates of the capacitor, which of the following does not change?

(*a*) Electric field between the plates
(*b*) Potential difference across the plates
(*c*) Charge on the plates
(*d*) Energy stored in the capacitor

7. **A charge q contain n electrons each of mass m. This charge is accelerated under the potential difference V. The speed acquired by the charge is**

(*a*) $\sqrt{\frac{2eV}{m}}$ (*b*) $\sqrt{\frac{2qV}{m}}$ (*c*) $\sqrt{\frac{2e}{mV}}$ (*d*) $\sqrt{\frac{2q}{mnV}}$

8. **A test charge q_0 is brought from infinity along the perpendicular bisector of an electric dipole. The work done on q_0 by the electric field of the dipole is**

(*a*) zero (*b*) negative
(*c*) positive (*d*) proportional to q_0

9. **The resistance of a metal wire increases with increasing temperature on account of**

(*a*) decrease in free electron density. (*b*) decrease in relaxation time.
(*c*) increase in mean free path. (*d*) increase in the mass of electron.

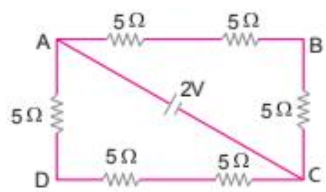
10. **The conductivity of a metal decreases with the increase in temperature on account of**

(*a*) decrease in number density of electrons. (*b*) decrease in resistivity.
(*c*) decrease in relaxation time. (*d*) increase in mean free path.

11. **The current in the primary circuit of a potentiometer is 0.2 A. The specific resistance and cross-section area of the potentiometer wire are 4×10^{-7} ohm metre and 8×10^{-7} m^2 respectively. The potential gradient will be equal to**

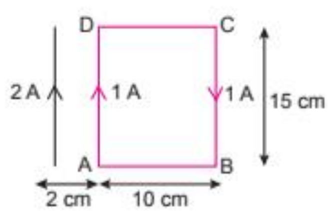
(*a*) 0.1 Vm^{-1} (*b*) 0.2 Vm^{-1}
(*c*) 0.5 Vm^{-1} (*d*) 1 Vm^{-1}

12. **The potential difference between points A and B of adjoining figure is**



(*a*) $\frac{2}{3}$V (*b*) $\frac{8}{9}$V
(*c*) $\frac{4}{3}$V (*d*) 2V

13. **A rectangular coil ABCD is placed near a long straight current carrying straight wire as shown. What is the net force on the rectangular coil?**



(*a*) 35×10^{-7} N towards the wire (*b*) 35×10^{-7} N away from the wire
(*c*) 25×10^{-7} N towards the wire (*d*) 25×10^{-7} N away from the wire

14. **An electron moving in a circular orbit of radius r makes n rotations per second. The magnetic field produced at the centre is**

(*a*) $\frac{\mu_0 n^2 e^2}{r}$ (*b*) $\frac{\mu_0 n^2 e}{r}$

(*c*) $\frac{\mu_0 ne}{2\pi r}$ (*d*) $\frac{\mu_0 ne}{2r}$

15. **The ratio of magnetic length to the geometrical length of a bar magnet is**

(*a*) $\frac{5}{6}$ (*b*) $\frac{6}{5}$

(*c*) $\frac{7}{6}$ (*d*) $\frac{6}{7}$

16. **The SI unit of magnetic permeability μ_0 is**

(*a*) $WA^{-1}m^{-1}$ (*b*) $NA^{-1}m^{-1}$

(*c*) NA^{-2} (*d*) both $WA^{-1}m^{-1}$ and NA^{-2}

17. **A current carrying conductor of length 44 cm turns into circular loop. It carries 1 A current around circular path. The dipole moment generated in the loop is $\left[\text{take } \pi = \frac{22}{7}\right]$**

(*a*) 150 Acm^2 (*b*) 152 Acm^2

(*c*) 154 Acm^2 (*d*) 156 Acm^2

18. **The magnetic moment of a current (*I*) carrying circular coil of radius (*r*) varies as**

(*a*) $\frac{1}{r^2}$ (*b*) $\frac{1}{r}$ (*c*) r (*d*) r^2

19. **A bar magnet of magnetic length 2*l* has pole strength *p* and magnetic moment *m*. Then *m* is equal to**

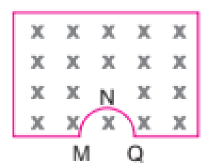
(*a*) *pl* directed from north pole to south pole

(*b*) *pl* directed from south pole to north pole

(*c*) 2*pl* directed from north pole to south pole

(*d*) 2*pl* directed from south pole to north pole

20. **A thin semicircular conducting ring of radius *R* is falling with its plane vertical in horizontal magnetic induction $\vec{B}$. At the position *MNQ* the speed of ring is *v* then the potential difference developed across the ring is:**



(*a*) zero

(*b*) $\frac{B v \pi R^2}{2}$ and *M* at higher potential

(*c*) πRBv and *Q* at higher potential

(*d*) $2RBv$ and *M* at higher potential

21. **Two identical circular loops *A* and *B* of metal wire are lying on a table without touching each other. Loop *A* carries a current which increases with time. In response the loop *B***

(*a*) remains stationary

(*b*) is attracted by loop A

(*c*) is repelled by loop A

(*d*) rotates about its centre of mass with centre of mass fixed

22. **A transformer has 20 turns of primary and 100 turns of secondary coil. If the two ends of the primary are connected to a 220 V *dc* supply, the voltage across the secondary will be**

(*a*) 0 V (*b*) 11 V

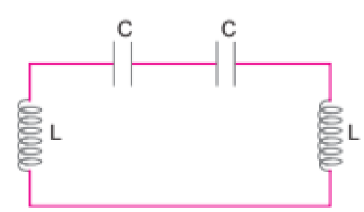
(*c*) 220 V (*d*) 1100 V

23. **A step up transformer is used in a 120 V line to provide a potential difference of 2400 V. If the primary coil has 75 turns, the number of turns in the secondary coil is**

(*a*) 150 (*b*) 1200

(*c*) 1500 (*d*) 1575

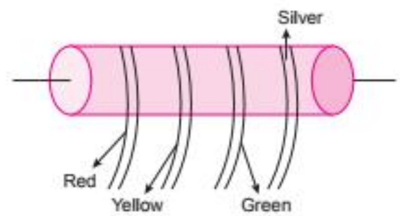
24. **The natural frequency of the circuit shown in fig. is**



(*a*) $\frac{1}{2\pi\sqrt{LC}}$ (*b*) $\frac{1}{2\pi\sqrt{2LC}}$

(*c*) $\frac{2}{2\pi\sqrt{LC}}$ (*d*) none of these

25. In the figure a carbon resistor has bands of different colours on its body as mentioned in the figure. The value of the resistance is



(*a*) $24 \times 10^6\ \Omega \pm 5\%$
(*b*) $35 \times 10^6\ \Omega \pm 10\%$
(*c*) $5.6\ k\ \Omega$
(*d*) $24 \times 10^5\ \Omega \pm 10\%$

26. Greenhouse effect is due to

(*a*) absorption of ultraviolet light by atmosphere
(*b*) reflection of infrared rays from atmosphere
(*c*) transmission of green light by atmosphere
(*d*) reflection of green light from atmosphere

27. $\sqrt{\mu / \varepsilon}$ has the dimensions of

(*a*) inductance
(*b*) impedance
(*c*) capacitance
(*d*) electric field

28. Two identical glass ($\mu_g = 3/2$) equiconvex lenses of focal length f each are kept in contact. The space between the two lenses is filled with water ($\mu_w = 4/3$). The focal length of the combination is

(*a*) $4f / 3$
(*b*) $3f / 4$
(*c*) $f / 3$
(*d*) f

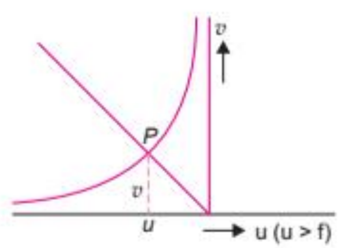
29. A planet is observed by an astronomical refracting telescope having objective of focal length 16 m and eye piece of focal length 2 cm. Then we may conclude that

(*a*) the image of planet is erect
(*b*) the angular magnification of planet is 80
(*c*) the angular magnification of planet is 800
(*d*) the objective is smaller than eye piece

30. An astronomical refracting telescope will have large angular magnification and high angular resolution, when it has an objective lens of

(*a*) small focal length and large diameter
(*b*) small focal length and small diameter
(*c*) large focal length and large diameter
(*d*) large focal length and small diameter

31. In an optical experiment, with the position of the object fixed, a student varies the position of a convex lens and for each position, the screen is adjusted to get a clear image of the object. A graph between the object distance *u* and the image distance *v*, from the lens is plotted using the same scale for the two axes. A straight line passing through the origin and making an angle of 45° with the *X*-axis meets the experimental curve at *P*. The coordinates of *P* will be



(*a*) $(2f, 2f)$
(*b*) $\left(\frac{f}{2}, \frac{f}{2}\right)$
(*c*) (f, f)
(*d*) $(4f, 4f)$

32. A fish looking up through the water sees the outside world contained in a circular horizon. If the refractive index of water is 4/3 and the fish is 12 cm below the surface. The radius of circle is

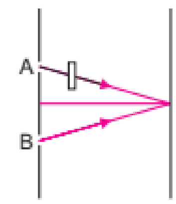
(*a*) $12 \times 3 \times \sqrt{5}$
(*b*) $12 \times 3 \times \sqrt{7}$
(*c*) $12 \times \sqrt{(5/3)}$
(*d*) $(12 \times 3) / \sqrt{7}$

33. Match the following lenses or mirror in Column A with their nature of image formation in Column B.

Column A	Column B
(*i*) Convex mirror	(*p*) real and inverted
(*ii*) Concave lens	(*q*) virtual and erect
(*iii*) Concave mirror	(*r*) virtual and inverted
(*iv*) Convex lens	(*s*) may be real or virtual

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

34. In Young's experiment, monochromatic light is used to illuminate the slits A and B. Interference fringes are observed on a screen placed in front of the slits. Now if a thin glass plate is placed in the path of the beam coming from A, then



(*a*) the fringes will disappear
(*b*) the fringe width will increase
(*c*) the fringe width will decrease
(*d*) there will be no change in the fringe width

35. In Young's double-slit experiment, the distance between the slit sources and the screen is 1 m. If the distance between the slits is 2 mm and the wavelength of light used is 600 nm, the fringe width is

(*a*) 3 mm
(*b*) 0.3 mm
(*c*) 6 mm
(*d*) 0.6 mm

36. Resolving power of compound microscope is

(*a*) $d = \dfrac{\lambda}{2n\sin\theta}$
(*b*) $\dfrac{1}{d} = \dfrac{2n\sin\theta}{\lambda}$
(*c*) $d\theta = \dfrac{1.22\lambda}{D}$
(*d*) $\dfrac{1}{d\theta} = \dfrac{D}{1.22\lambda}$

37. When the screen is moved near to the plane of slits in Young's double slit experiment, the angular width of interference fringes

(*a*) increases
(*b*) decreases
(*c*) remain constant
(*d*) may or may not increase

38. If an electron and a photon propagate in the form of waves having same wavelength, it implies that they have same:

(*a*) speed
(*b*) momentum
(*c*) energy
(*d*) all the above

39. A particle of mass 1 mg has the same wavelength as an electron moving with a velocity of 3×10^6 ms^{-1}. The velocity of the particle is (mass of electron = 9.1×10^{-31} kg)

(*a*) 2.7×10^{-18} ms^{-1}
(*b*) 9×10^{-2} ms^{-1}
(*c*) 3×10^{-31} ms^{-1}
(*d*) 2.7×10^{-21} ms^{-1}

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

Statement P : The de Broglie equation has significance for any microscopic or sub-microscopic particle.

Statement Q : The de Broglie wavelength is inversely proportional to the mass of the object if velocity is constant.

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. **A set of atoms in an excited state decays**

(*a*) in general to any of the states with lower energy
(*b*) into a lower state only when excited by an external electric field
(*c*) all together simultaneously into a lower state
(*d*) to emit photons only when they collide

42. **The experiment of scattering of alpha particle showed for the first time that the atom has**

(*a*) nucleus (*b*) proton
(*c*) neutron (*d*) electron

43. **The Bohr's model is applicable to which kind of atoms?**

(*a*) Having one electron only (*b*) Having two electrons
(*c*) Having eight electrons (*d*) Having more than eight electrons

44. **The 'rad' is the correct unit used to report the measurement of**

(*a*) the ability of beam of gamma ray photon to produce ions on a target
(*b*) the energy delivered by radiation to a target
(*c*) the biological effect of radiation
(*d*) the rate of decay of a radioactive source

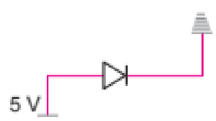
45. **In a working nuclear reactor, cadmium rods are used to**

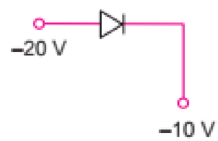
(*a*) speed up neutrons (*b*) slow down neutrons
(*c*) absorb some neutrons (*d*) absorb all neutrons

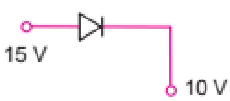
46. **Heavy water is one of the substance used as moderator in reactors. Which of the following is also used as moderator?**

(*a*) Sea water (*b*) Graphite
(*c*) Cobalt (*d*) Titanium

47. **Which is reverse biased diode?**

(*a*)


(*b*)


(*c*)


(*d*)


48. **Modulation is used to**

(*a*) reduce the band width used
(*b*) separate the transmission of different waves
(*c*) ensure that the intelligence may be transmitted to long distances
(*d*) both (*b*) and (*c*)

49. **Carbon, silicon and germanium have four valence electrons each. These are characterized by valence and conduction bands separated by energy band gap respectively equal to (E_g)C, (E_g)Si and (E_g) Ge. Which of the following statements is true?**

(*a*) $(E_g)\text{Si} < (E_g)\text{Ge} < (E_g)\text{C}$ (*b*) $(E_g)\text{C} < (E_g)\text{Ge} < (E_g)\text{Si}$
(*c*) $(E_g)\text{C} > (E_g)\text{Si} > (E_g)\text{Ge}$ (*d*) $(E_g)\text{C} = (E_g)\text{Si} = (E_g)\text{Ge}$

50. **In an unbiased *p-n* junction, holes diffuse from the *p*-region to *n*-region because**

(*a*) free electrons in the *n*-region attract them
(*b*) they move across the junction by the potential difference
(*c*) hole concentration in *p*-region is more as compared to *n*-region.
(*d*) all the above

ANSWERS

PRACTICE PAPER – 15

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

SOLUTIONS

PRACTICE PAPER—15

2. (*b*) $Q = ne$

$1 = n \times 1.6 \times 10^{-19}$

$n = 6.25 \times 10^{18}$

3. (*a*) Here, $|\vec{F}_{42}| = |\vec{F}_{43} + \vec{F}_{41}|$

$$\Rightarrow \frac{KQ^2}{(\sqrt{2}a)^2} = \frac{2KQq}{a^2} \times \frac{1}{\sqrt{2}}$$

$$\Rightarrow \frac{Q}{q} = 2\sqrt{2}$$

(where Q and q is opposite in sign)

4. (*d*) For an infinite sheet to charge, $E = \dfrac{\sigma}{2\varepsilon_0}$ (independent of distance)

5. (*b*) Charge distribution on the spheres is not uniform.

7. (*b*) $\frac{1}{2}mv^2 = W = qV$.

Hence, $v = \sqrt{\dfrac{2qV}{m}}$

9. (*b*) In case of conductor (metal wire) with increase in temperature, relaxation time decreases. So, resistivity increases.

10. (*c*) In case of metal wire with increase in temperature, relaxation time decreases. So, resistivity increases and conductivity is inversely proportional to the resistivity. Hence, it decreases.

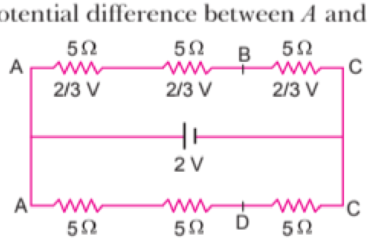
11. (*a*) Let l be the length of potentiometer wire and V be the potential drop across length l.

Potential gradient,

$$k = \frac{V}{l} = \frac{IR}{l} = \frac{I}{l}\left(\rho\frac{l}{A}\right) = \frac{I\rho}{A}$$

$$\therefore k = \frac{0.2 \times 4 \times 10^{-7}}{8 \times 10^{-7}} = 0.1\ \text{Vm}^{-1}$$

12. (*c*) For identical resistances, potential difference distributes equally among all. Hence potential difference across each resistance is $\frac{2}{3}$ V, and potential difference between A and B is $\frac{4}{3}$ V.



13. (*c*) $F_{net} = \vec{F_1} - \vec{F_2}$, $r_2 = 10 + 2 = 12$ cm $= 0.12$ m, $r_1 = 2$ cm $= 0.02$ m

$$= \frac{\mu_0}{2\pi r_1} I_1 I_2 l_1 - \frac{\mu_0 I_1 I_2 l_2}{2\pi r_2}$$

$$= \frac{4\pi \times 10^{-7} \times 2 \times 1 \times 0.15}{2\pi \times 0.02} - \frac{4\pi \times 10^{-7} \times 2 \times 1 \times 0.15}{2\pi \times 0.12}$$

$= 30 \times 10^{-7} - 5 \times 10^{-7}$

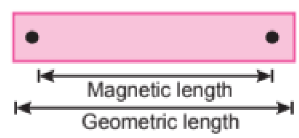
$= 25 \times 10^{-7}$ N towards the wire.

14. (*d*) B at centre $= \dfrac{\mu_0 I}{2r}$

Here, $I = ne$

So, $B = \dfrac{\mu_0 ne}{2r}$

15. (*a*) In a bar magnet, the poles are situated a little distance inside the ends of the magnet. The distance between these poles is known as magnetic length whereas the actual length of the magnet is the geometrical length.



The magnetic length of magnet is always slightly less than the geometrical length and is given as

Magnetic length $= \dfrac{5}{6}$(Geometric length)

17. (*c*) Here, $l = 44$ cm

$\Rightarrow \quad 2\pi r = 44$

$$\Rightarrow \quad r = \frac{44}{2\pi} = \frac{44 \times 7}{2 \times 22} = 7 \text{ cm}$$

$I = 1$ A

M = IA

$= 1 \times \pi r^2 = 1 \times \frac{22}{7} \times 7 \times 7$

$M = 154$ A cm^2

18. (*d*) Magnetic moment, $M = NIA$

For circular coil, $A = \pi r^2$

$M = N I \pi r^2$

$\therefore \quad M \propto r^2$

19. (*d*) $m = p \times 2l = 2pl$ (S to N)

20. (*d*) For induced p.d., we have to take the component of length normal to both magnetic field and velocity, so induced emf, $Bvl = Bv.2R$. By Fleming's left hand rule, the direction of induced current is from M to Q; so M is at higher potential.

21. (*c*) Opposite currents are induced in loops, so loops repel each other.

22. (*a*) A transformer does not operates on dc voltage supply (*i.e.*, magnetic flux does not change inside the core of transformer). It only operates on ac voltage supply because magnetic flux is changing due to time varying magnetic field inside the core of transformer.

23. (*c*) Here, in step up transformer, $N_S > N_P$

$$\frac{V_P}{V_S} = \frac{N_P}{N_S} \Rightarrow N_S = N_P \times \frac{V_S}{V_P} = 75 \times \frac{2400}{120} = 1500$$

$\therefore\ N_S = 1500$

24. (*a*) The two capacitors are in series and two inductors are also in series.

So, $L_S = L + L = 2L$ and $\frac{1}{C_S} = \frac{1}{C} + \frac{1}{C} = \frac{2}{C}$

$\Rightarrow \quad C_S = \frac{C}{2}$

$\therefore$ Natural frequency of the circuit,

$$\nu_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{2L \times \frac{C}{2}}} = \frac{1}{2\pi\sqrt{LC}}$$

25. (*d*) The colour of carbon resistor has specific significant value.

i.e., Red $\rightarrow$ 2 (1st bond value)

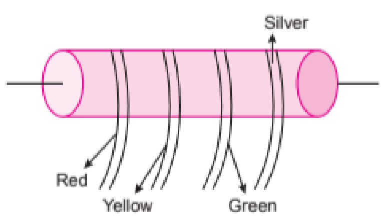
Yellow $\rightarrow$ 4 (2nd bond value)

Green $\rightarrow 10^5$ (3rd bond, multipliers)

Silver $\rightarrow$ 10% (4th bond, tolerance %)

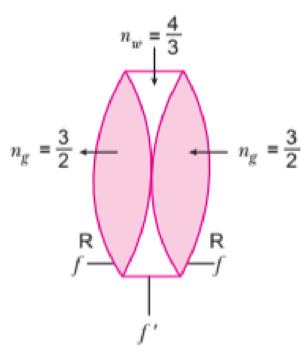
Hence the required resistance,

$R = 24 \times 10^5 \Omega \pm 10\%$



26. (*b*) The infrared radiation heats the atmosphere to the common temperature we experience.

28. (*b*) By using lens maker's formula,



For convex lens,

$$\frac{1}{f} = (n_g - 1)\left(\frac{2}{R}\right) = \left(\frac{3}{2} - 1\right)\frac{2}{R}$$

and $\quad \frac{1}{f} = \frac{1}{R}$

For concave lens,

$$\frac{1}{f'} = n_w\left(-\frac{2}{R}\right)$$

$$= \left(\frac{4}{3} - 1\right)\left(-\frac{2}{R}\right) = -\frac{2}{3R} = -\frac{2}{3f}$$

Now, combined focal length of combinations,

$$\frac{1}{f_{eq}} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3}$$

$$= \frac{1}{f} - \frac{2}{3f} + \frac{1}{f} = \frac{4}{3f}$$

$\therefore \quad f_{eq} = \frac{3f}{4}$

29. (*c*) Image of planet is inverted.

Angular magnification,

$$M = \frac{f_0}{f_e} = \frac{16}{2 \times 10^{-2}} = 800$$

30. (*c*) For a telescope,

Angular magnification $= \frac{f_0}{f_e}$

Angular resolution $= \frac{D}{1.22\lambda}$

For large angular magnification focal length of the objective should be large and for high angular resolution, its diameter D should be large.

31. (*a*) From graph, the straight line is 45° with *x*-axis, $u = v$.

$$\therefore \quad \frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{2}{v} \quad \text{or} \quad v = 2f$$

Since it is possible when object kept at center of curvature, we have $u = v$. Therefore, u is also equal to $2f$.

32. (*d*) Radius of circular horizon,

$$r = \frac{h}{\sqrt{n^2 - 1}} = \frac{12}{\sqrt{\left(\frac{4}{3}\right)^2 - 1}} = \frac{12 \times 3}{\sqrt{7}}$$

34. (*d*) By introduction of thin glass plate in the path of interfaring beams the whole interference pattern get shifted, towards the side of the plate without any change in fringe width.

35. (*b*) Fringe width,

$$\beta = \frac{\lambda D}{d} = \frac{600 \times 10^{-9} \times 1}{2 \times 10^{-3}} = 3 \times 10^{-4} = 0.3\,\text{mm}$$

37. (*c*) Angular width,

$$\beta_\theta = \frac{\lambda}{d}$$

i.e., independent of D

38. (*b*) $\lambda = \frac{h}{p}$ $\quad p = \frac{h}{\lambda}, \lambda_e = \lambda_p$ (given)

then, $p_e = p_p$

but, $K.E = \frac{p^2}{2m} \Rightarrow K.E. \propto \frac{1}{m}, \; m_e > m_p$

so, $(K.E)_e < (K.E)_p$

39. (*a*) de-broglie wavelength,

$$\lambda = \frac{h}{mv} \; i.e., \frac{h}{mv} = \frac{h}{m_e v_e}$$

So, $v = \frac{m_e v_e}{m} = \frac{9.1 \times 10^{-31} \times 3 \times 10^6}{10^{-6}}$

$= 2.7 \times 10^{-18}\ ms^{-1}$

40. (*c*) de-Broglie hypothesis,

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

For constant v, $\lambda \propto \frac{1}{m}$

λ is significantly measurable only in case of microscopic or sub-microscopic particles.

41. (*a*) Atoms in an excited state decay to any of the states with lower energy.

42. (*a*) Some α-particles were scattered in the scattering experiment while most of them passed through the gold foil undeviated showing that most part of the atom is empty. Out of those scattered particles only a few of them experienced a strong repulsive force and traced their path back. On the basis of these observations, Rutherford concluded that the positive charge of atom is concentrated in a small central core called nucleus.

43. (*a*) Bohr's model is applicable to hydrogen - like species *i.e.*, atoms having one electron only.

44. (*b*) 'Rad' is the unit of energy given by radiation to a target.

45. (*c*) Cadmium rods absorb the neutrons and control the chain reaction process.

46. (*b*) Graphite can be used as moderator in nuclear reactors to slow down the fast neutrons.

47. (*b*) Because *p*-side is more negative as compared to *n*-side.

48. (*d*) The purpose of modulations is to impress the information on the carrier wave which is used to carry the information to another location.

49. (*c*) As we move down the group, metallic properties increase and energy gap decreases. So, the current sequence is (E_g)C > (E_g)Si > (E_g)Ge.

50. (*c*) The diffusion of charge carriers across a junction takes place from the region of higher concentration to the region of lower concentration. In this case, the *p*-region has greater concentration of holes then the *n*-region. Hence, in an unbiased *p*-*n* junctions, holes diffuse from the *p*-region to the *n*-region.