PRACTICE PAPER 24

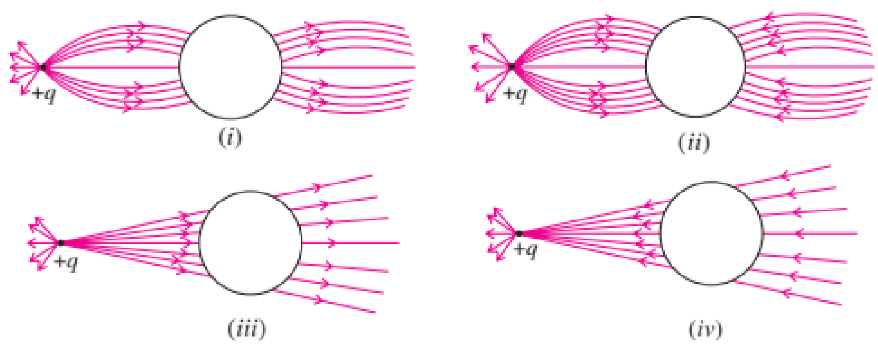
Time allowed: 45 minutes **Maximum Marks: 200**

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

Choose the correct option in the following questions.

1. **A body can be negatively charged by**
   (*a*) giving excess of electrons to it
   (*b*) removing some electron from it
   (*c*) giving some protons to it
   (*d*) removing some neutrons from it.

2. **A point positive charge is brought near an isolated conducting sphere (Fig. given below). The electric field is best given by**



   (*a*) Fig (*i*)
   (*b*) Fig (*ii*)
   (*c*) Fig (*iii*)
   (*d*) Fig (*iv*)

3. **There are two kinds of charges—positive charge and negative charge. The property which differentiates the two kinds of charges is called**
   (*a*) amount of charge
   (*b*) polarity of charge
   (*c*) strength of charge
   (*d*) field of charge

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

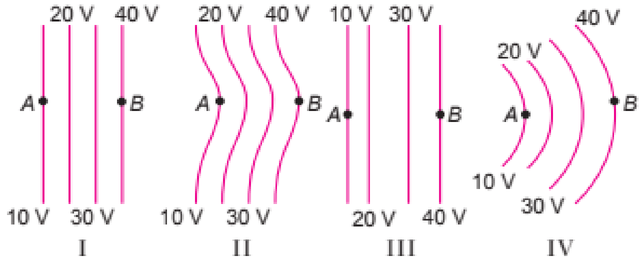
   Statement P : All the charge in a conductor gets distributed on whole of its outer surface.

   Statement Q : In a dynamic system, charges try to keep their potential energy minimum.

   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

5. **A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system**
   (*a*) decreases by a factor of 2
   (*b*) remains the same
   (*c*) increases by a factor of 2
   (*d*) increases by a factor of 4

6. **The diagrams below show regions of equipotentials.**



A positive charge is moved from A to B in each diagram.

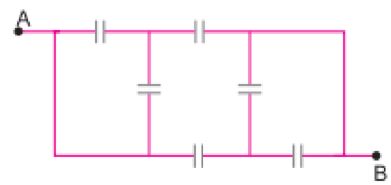
(*a*) In all the four cases the work done is the same.

(*b*) Minimum work is required to move q in figure (I).

(*c*) Maximum work is required to move q in figure (II).

(*d*) Maximum work is required to move q in figure (III).

7. **A network of six identical capacitors, each of value C is made as shown in fig. The equivalent capacitance between points A and B is**



(*a*) $\frac{C}{4}$ (*b*) $\frac{3C}{4}$

(*c*) $\frac{3}{2}C$ (*d*) $\frac{4}{3}C$

8. **An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$ .Then**

(*i*) the torque on the dipole is $\vec{p} \times \vec{E}$

(*ii*) the potential energy of the system is $\vec{p} \cdot \vec{E}$

(*iii*) the resultant force on the dipole is zero.

Choose the correct option:

(*a*) (*i*), (*ii*) and (*iii*) are correct (*b*) (*i*) and (*iii*) are correct and (*ii*) is wrong

(*c*) only (*i*) is correct (*d*) (*i*) and (*ii*) are correct and (*iii*) is wrong

9. **The drift velocity of the free electrons in a conducting wire carrying a current I is v. If in a wire of the same metal, but of double the radius, the current be $2I$, then the drift velocity of the electrons will be**

(*a*) $v/4$ (*b*) $v/2$ (*c*) v (*d*) $4v$

10. **Which of the following characteristics of electrons determines the current in a conductor?**

(*a*) Drift velocity alone (*b*) Thermal velocity alone

(*c*) Both drift velocity and thermal velocity (*d*) Neither drift nor thermal velocity.

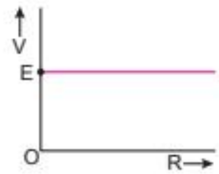
11. **Column I contains energy stored/dissipated while column II contains expression. Match columns I and II.**

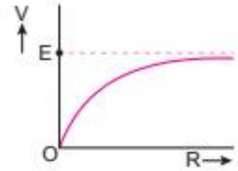
	Column A		**Column B**
(*i*)	Total energy stored by a parallel plate capacitor	(*p*)	CV^2
(*ii*)	Total energy supplied to a parallel plate capacitor	(*q*)	$\frac{1}{2}\varepsilon_0 E^2 Ad$
(*iii*)	Energy stored per unit volume in an electric field	(*r*)	$\frac{1}{2}CV^2$
(*iv*)	Energy dissipated while charging a parallel plate capacitor	(*s*)	$\frac{1}{2}\varepsilon_0 E^2$

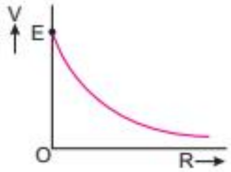
(*a*) (*i*)–(*q*), (*r*) (*ii*)–(*p*), (*iii*)–(*s*), (*iv*)–(*q*), (*r*) (*b*) (*i*)–(*p*), (*ii*)–(*q*), (*iii*)–(*r*), (*iv*)–(*s*)

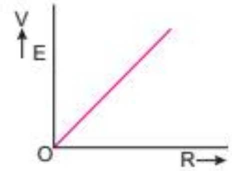
(*c*) (*i*)–(*r*), (*ii*)–(*s*), (*q*) (*iii*)–(*p*), (*iv*)–(*q*) (*d*) (*i*)–(*s*), (*ii*)–(*r*), (*iii*)–(*p*), (*iv*)–(*q*)

12. **A cell of emf (E) and internal resistance r is connected across a variable external resistance R. The graph of terminal potential difference V as a function of R is**

(a) 

(b) 

(c) 

(d) 

13. **A current carrying circular loop of radius R is placed in the x-y plane with centre at the origin. Half of the loop with $x > 0$ is now bent so that it now lies in the y-z plane.**

(a) The magnitude of magnetic moment now diminishes.

(b) The magnetic moment does not change.

(c) The magnitude of B at $(0,0, z)$, $z >> R$ increases.

(d) The magnitude of B at $(0,0, z)$, $z >> R$ is unchanged.

14. **A charge of +5 mC enters a uniform magnetic field parallel to the direction of the field. What will happen to the motion of the charge?**

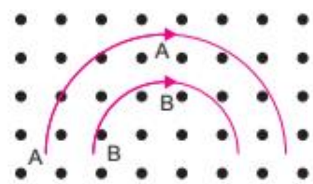
(a) It will move undedicated.

(b) It will perform circular motion in a plane parallel to the field.

(c) It will perform circular motion in a plane perpendicular to the field.

(d) It will continue to move in the field direction with acceleration.

15. **Two particles and of masses m_A and m_B respectively and having the same charge are moving in a plane. A uniform magnetic field exists perpendicular to this plane. The speeds of particles are v_A and v_B respectively and trajectories are shown in figure. Then**



(a) $m_A v_A < m_B v_B$

(b) $m_A v_A > m_B v_B$

(c) $m_A < m_B$ and $v_A v_B$

(d) $m_A = m_B, v_A = v_B$

16. **A bar magnet of magnetic length $2l$ 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) $2pl$ directed from north pole to south pole

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

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

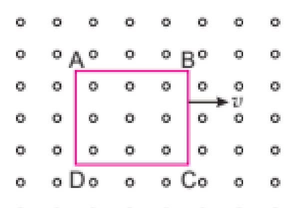
(a) $WA^{-1}m^{-1}$

(b) $NA^{-1}m^{-1}$

(c) NA^{-2}

(d) Both $WA^{-1}m^{-1}$ and NA^{-2}

18. **A metallic square loop $ABCD$ is moving in its own plane with a velocity v in a uniform magnetic field perpendicular to plane as shown in fig. An electric field is induced**



(a) in AD but not in BC

(b) in BC but not in AD

(c) neither in AD nor in BC

(d) in both AD and BC

19. Oscillating metallic pendulum in a uniform magnetic field directed perpendicular to the plane of oscillation

(*a*) remains unaffected (*b*) oscillates with changing frequency

(*c*) slows down (*d*) becomes faster

20. A metallic cylinder is held vertically and then a small magnet is dropped along its axis. It will fall with

(*a*) acceleration $a = g$ (*b*) constant velocity $a = 0$

(*c*) acceleration $a > g$ (*d*) acceleration $a < g$

21. Lenz's law is essential for

(*a*) conservation of energy (*b*) conservation of mass

(*c*) conservation of momentum (*d*) conservation of charge

22. An inductive circuit have zero resistance. When *ac* voltage is applied across this circuit, then the current lags behind the applied voltage by an angle

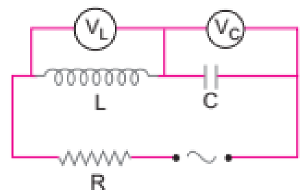
(*a*) 30° (*b*) 45° (*c*) 90° (*d*) 0°

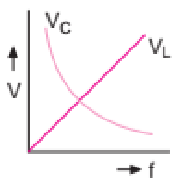
23. When *ac* source is connected across series R-L-C combination, maximum power loss will occur provided

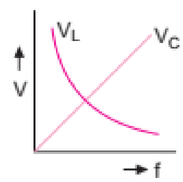
(*a*) current and voltage are in phase (*b*) current from source is minimum

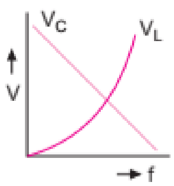
(*c*) inductance is minimum (*d*) capacitance is maximum

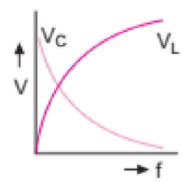
24. A series *LCR* circuit is shown in figure. The source frequency *f* is varied, but the current is kept unchanged. Which of the curves shows changes of V_C and V_L with frequency?



(*a*)


(*b*)


(*c*)


(*d*)


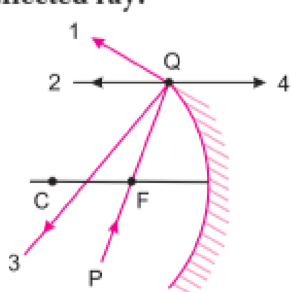
25. In an electromagnetic wave in free space the root mean square value of the electric field is E_{rms} = 6 V/m. The peak value of the magnetic field is

(*a*) 1.41×10^{-8} T (*b*) 2.83×10^{-8} T (*c*) 0.70×10^{-8} T (*d*) 4.23×10^{-8} T

26. An EM wave is propagating in a medium with a velocity $\vec{v} = v\,\hat{i}$. The instantaneous oscillating electric field of this EM wave is along +Y axis. Then the direction of oscillating magnetic field of the EM wave will be along

(*a*) – *Z* direction (*b*) – *X* direction (*c*) – *Y* direction (*d*) + *Z* direction

27. The direction of ray of light incident on a concave mirror is shown by *PQ* while directions in which the ray would travel after reflection is shown by four rays marked 1, 2, 3 and 4 (Given Figure). Which of the four rays correctly shows the direction of reflected ray?

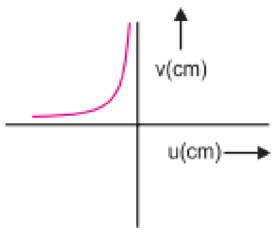


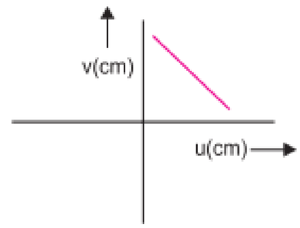
(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

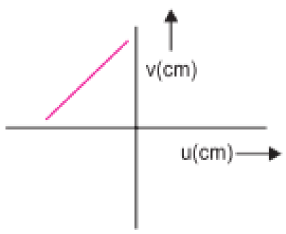
28. **Which of the following is not due to total internal reflection ?**

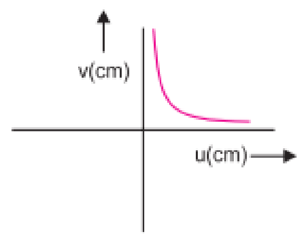
(*a*) Working of optical fibre
(*b*) Difference between apparent and real depth of a pond
(*c*) Mirage on hot summer days
(*d*) Brilliance of diamond

29. **A student measures the focal length of a convex lens by putting an object pin at a distance '*u*' from the lens and measuring the distance '*v*' of the image pin. The graph between '*u*' and '*v*' plotted by the student should look like**

(*a*)


(*b*)


(*c*)


(*d*)


30. **Two thin lenses of focal lengths f_1 and f_2 are in contact and coaxial. The power of the combination is**

(*a*) $\frac{f_1+f_2}{f_1f_2}$ (*b*) $\sqrt{\frac{f_1}{f_2}}$ (*c*) $\sqrt{\frac{f_2}{f_1}}$ (*d*) $\frac{f_1+f_2}{2}$

31. **The angle of incidence for a ray of light at a refracting surface of a prism is 45°. The angle of prism is 60°. If the ray suffers minimum deviation through the prism, the angle of minimum deviation and refractive index of the material of the prism respectively are**

(*a*) $45°;\sqrt{2}$ (*b*) $30°;\frac{1}{\sqrt{2}}$ (*c*) $45°;\frac{1}{\sqrt{2}}$ (*d*) $30°;\sqrt{2}$

32. **The wavelength of light in air is 6000 Å and in medium its value is 4000 Å. It means that the refractive index of that medium with respect to air is**

(*a*) 1·2 (*b*) 2·4 (*c*) 0·66 (*d*) 1·5

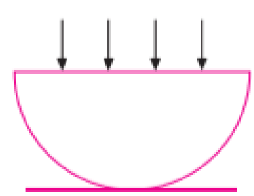
33. **The resolving power of a telescope can be increased by increasing**

(*a*) wavelength of light. (*b*) diameter of objective.
(*c*) length of the tube. (*d*) focal length of eyepiece.

34. **The two coherent sources with intensity ratio β produce interference. The fringe visibility will be**

(*a*) $\frac{2\sqrt{\beta}}{1+\beta}$ (*b*) $2\beta.1$ (*c*) $\frac{2}{(1+\beta)}$ (*d*) $\frac{\sqrt{\beta}}{1+\beta}$

35. **A thin slice is cut out of a glass cylinder along a line parallel to its axis. The slice is placed on a flat glass plate as shown. The observed interference fringes from this combination will be**



(*a*) straight
(*b*) circular
(*c*) equally spaced
(*d*) having fringe spacing which increases as we go outwards.

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

Statement P : It is not possible to have interference between the waves produced by two violins.

Statement Q : For interference of two waves the phase difference between the waves must remain 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

37. In a double-slit experiment instead of slits of equal widths, one slit is made twice as wide as the other. Then in the interference pattern

(*a*) the intensity of both the maxima and the minima increase
(*b*) the intensity of maxima increase and the minima has zero intensity
(*c*) the intensity of maxima decreases and that of minima increases
(*d*) the intensity of maxima decrease and minima has zero intensity

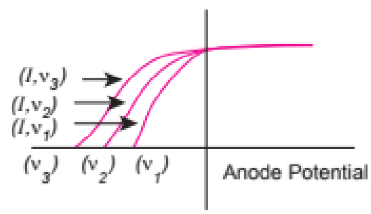
38. A proton, a neutron, an electron and an α-particle have same energy. Then their de Broglie wavelengths compare as

(*a*) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$
(*b*) $\lambda_\alpha < \lambda_p = \lambda_n > \lambda_e$
(*c*) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$
(*d*) $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$

39. Photoelectric effect occurs when the frequency of the light incident on the photosensitive material is _______________ the threshold frequency for the material.

(*a*) less than
(*b*) half of
(*c*) greater than
(*d*) one-third of

40. Identify the correct relation for the given diagram for frequency



(*a*) $\nu_1 = \nu_2 = \nu_3$
(*b*) $\nu_1 = \nu_2 = \nu_3$
(*c*) $\nu_1 < \nu_2 < \nu_3$
(*d*) $\nu_1 = 2\nu_2 = 3\nu_3$

41. The frequency and the intensity of a beam of light falling on the surface of photoelectric material are increased by a factor of two. This will

(*a*) decrease the maximum kinetic energy of the photoelectrons, as well as the photoelectric current by a factor of two
(*b*) increase the maximum kinetic energy of the photoelectrons and would increase the photoelectric current by a factor of two
(*c*) increase the maximum kinetic energy of the photoelectrons by a factor of two and will have no effect on the magnitude of the photoelectric current produced
(*d*) not produce any effect on the kinetic energy of the emitted electrons but will increase the photoelectric current by a factor of two.

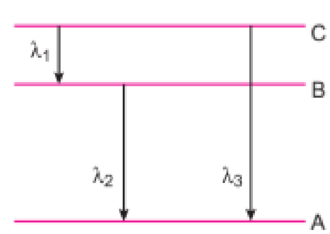
42. An ac wave being modulated and having frequency of the order of MHz is called

(*a*) a carrier
(*b*) a signal
(*c*) an amplitude modulated wave
(*d*) a frequency modulated wave

43. The energy required to remove an electron in the $n = 2$ state of hydrogen atom is

(*a*) 27·2 eV
(*b*) 13·6 eV
(*c*) 6·8 eV
(*d*) 3·4 eV

44. Energy levels A, B, C of a certain atom correspond to increasing values of energy, *i.e.*, $E_A < E_B < E_C$. If λ_1, λ_2, λ_3 are the wavelengths of radiations corresponding to transitions C to B, B to A and C to A respectively, which of the following options is correct?



(*a*) $\lambda_3 = \lambda_1 + \lambda_2$
(*b*) $\lambda_3 = \dfrac{\lambda_1 \lambda_2}{\lambda_1 + \lambda_2}$
(*c*) $\lambda_1 + \lambda_2 + \lambda_3 = 0$
(*d*) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

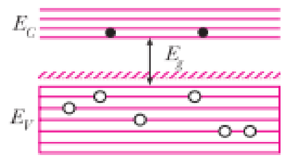
45. **When two nuclei (A ≤ 10) fuse together to form a heavier nucleus, the**

(*a*) binding energy per nucleon increases.
(*b*) binding energy per nucleon decreases.
(*c*) binding energy per nucleon does not change.
(*d*) total binding energy decreases.

46. **A nucleus disintegrates into two nuclear parts, which have their velocities in the ratio 2 : 1. The ratio of their nuclear sizes will be**

(*a*) $2^{1/3} : 1$
(*b*) $1 : 3^{1/2}$
(*c*) $3^{1/2} : 1$
(*d*) $1 : 2^{1/3}$

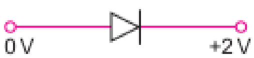
47. **In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively.**

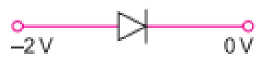


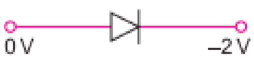
The material is

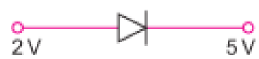
(*a*) an insulator
(*b*) a metal
(*c*) an *n*-type semiconductor
(*d*) a *p*-type semiconductor

48. **In which of the following figures the junction diode is forward biased?**

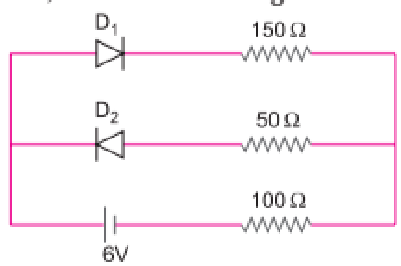
(*a*) 

(*b*) 

(*c*) 

(*d*) 

49. **The circuit shown in fig. contains two diodes each with a forward resistance of 50 Ω and with infinite reverse resistance. If the battery voltage is 6 V, the current through the 100 Ω resistance (in ampere) is**



(*a*) zero
(*b*) 0.02
(*c*) 0.03
(*d*) 0.036

50. **In a semiconductor, the mobilities of electrons and holes are μ_e and μ_n respectively. Then:**

(*a*) $\mu_e > \mu_h$
(*b*) $\mu_e < \mu_h$
(*c*) $\mu_e = \mu_h$
(*d*) $\mu_e < 0, \mu_h > 0$

ANSWERS

PRACTICE PAPER – 4

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

SOLUTIONS

PRACTICE PAPER–4

1. (*a*) A body can be negatively charged by giving excess of electrons to it.

2. (*a*) When a point positive charge is brought near an isolated conducting sphere, then due to induction there develops some negative charge on the leftside of the sphere and an equal positive charge on the right side of the sphere. The electric field lines emanating from the point positive charge end normally on the left side of the sphere. Due to accumulation of positive charge on the right side of the sphere, the field lines emerge outward normally. So, option (*a*) is correct.

As electric field lines are not perpendicular to the surface of sphere, so (*iii*) and (*iv*) are rejected.

5. (*a*) $U_i = \frac{1}{2}CV^2 = \frac{Q^2}{2C}$

After connecting another capacitor in parallel,

$$\frac{q_1}{C} = \frac{q_2}{C} \Rightarrow q_1 = q_2$$

$$q_1 + q_2 = Q \quad \Rightarrow \quad q_1 = \frac{Q}{2}$$

⇒ Battery is disconnected,

Therefore, charge is constant

$$\Rightarrow U_f = \frac{\left(\frac{Q}{2}\right)^2}{2C} + \frac{\left(\frac{Q}{2}\right)^2}{2C} = \frac{Q^2}{4C} = \frac{U_i}{2}$$

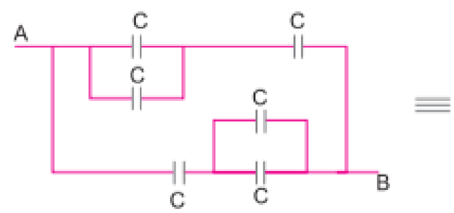
Hence, total electrostatic energy of resulting system is decreased by a factor of 2.

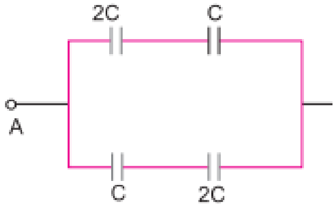
6. (*a*) Work done is given as $W = q\Delta V$

∵ In all the four cases the potential difference from A to B is same.

∴ In all the four cases the work done is same.

7. (*d*) Equivalent circuit is shown in figure





Effective capacitance of each row,

$$C' = \frac{C \times 2C}{C + 2C} = \frac{2}{3}C$$

$$\therefore \quad C_{eff} = \frac{2}{3}C + \frac{2}{3}C = \frac{4}{3}C$$

8. (*b*) In a uniform electric field $\vec{E}$, dipole experiences a torque $\vec{\tau}$ given by $\vec{\tau} = \vec{p} \times \vec{E}$ but experiences no force. The potential energy of the dipole in a uniform electric filed $\vec{E}$ is U = $-\vec{p} \cdot \vec{E}$

9. (*b*) $I = Ane\, v_d \quad \Rightarrow \quad v_d \propto \frac{I}{A}$

Now, $\frac{v_d'}{v_d} = \left(\frac{I'}{I} \times \frac{A}{A'}\right) = \frac{2I}{I} \times \frac{\pi r^2}{\pi (2r)^2} = \frac{1}{2}$

$\Rightarrow \quad v_d = \frac{v_d}{2} = \frac{v}{2}$

10. (*a*) $I = Anev_d \Rightarrow I \propto v_d$

Thus, only drift velocity determines the current in conductor.

12. (*b*) $V = IR = E - Ir$

13. (*a*) The magnetic moment of circular loop and the net magnitudes of moment of each semi-circular loop of radius *R* lie in *x*-*y* plane and y-z plane.

So, $M_{net} = \sqrt{M'^2 + M'^2} = \sqrt{2}M' = \sqrt{2}\, IA'$

$= \sqrt{2}I(\pi r^2)/4$

where, $M = I(\pi r^2)$, so, $M_{net} < M$.

14. (*a*) As $\theta = 0° \Rightarrow F = qVB \sin\theta = 0$

15. (*b*) $r = \frac{mv}{qB} \propto mv$; As $r_A > r_B \Rightarrow m_A v_A > m_B v_B$

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

18. (*d*) When loop moves in uniform magnetic field, equal and opposite emf's are induced in side *AD* and *BC*.

19. (*c*) Slows down due to Eddy current.

20. (*d*) Due to lenz law, falling magnet will increase the magnetic flux which is opposed by metallic cylinder.

24. (*a*) $V_C = \frac{1}{2\pi f C} \propto \frac{1}{f}$ and $V_L = (2\pi f L) \propto f$

25. (*b*) As we know that,

$$E_0 = \sqrt{2}E_{rms} = \sqrt{2} \times 6 \ \text{Vm}^{-1}$$

$$B_0 = \frac{E_0}{c} = \frac{\sqrt{2} \times 6}{3 \times 10^8}$$

$$= 2 \times 1.414 \times 10^{-8} \text{ T}$$

$$= 2.83 \times 10^{-8} \text{ T}$$

26. (*d*) We have,

$$\vec{E} \times \vec{B} = \vec{v}$$

$$(E\hat{j}) \times (\vec{B}) = v\,\hat{i}$$

$\Rightarrow \quad \vec{B} = B\hat{k}$, because $\hat{j} \times \hat{k} = \hat{i}$

Therefore, the magnetic field oscillates along $+Z$ direction.

27. (*b*) The ray *PQ* of light passes through focus *F* and incident on the concave mirror, after reflection, should become parallel to the principal axis and shown by ray 2 in given figure.

28. (*b*) Different between apparent and real depth of a pond is based on phenomenon of refraction of light in medium (Pond).

i.e., Apparent depth = $\frac{\text{Real depth}}{n}$,

n = refractive index of medium.

29. (*a*) For real image *u* is negative and *v* is positive, the graph between *u* and *v* is rectangular hyperbola.

30. (*a*) Equivalent focal length of the combination

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

Power of the combination

$$P = \frac{1}{F}$$

$$P = \frac{1}{f_1} + \frac{1}{f_2} = \frac{f_1 + f_2}{f_1 f_2}$$

31. (*d*) Given, $i = 45°$ and $A = 60°$

Since the ray undergoes minimum deviation, therefore, angle of emergence from second face,

$$e = i = 45°$$

$$\therefore \quad \delta_m = i + e - A$$

$$= 45° + 45° - 60° = 30°$$

The refractive index,

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

$$= \frac{\sin 45°}{\sin 30°} = \frac{1}{\sqrt{2}} \times \frac{2}{1} = \sqrt{2}$$

32. (*d*) Refractive index of 2 w.r.t 1.

$$ {}_1n_2 = \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2} = \frac{6000 \text{ Å}}{4000 \text{ Å}} = 1.5 $$

34. (*a*) Fringe visibility $= \dfrac{I_{max} - I_{min}}{I_{max} + I_{min}}$

$$ = \frac{(A_1 + A_2)^2 - (A_1 - A_2)^2}{(A_1 + A_2)^2 + (A_1 - A_2)^2} = \frac{4A_1A_2}{2(A_1^2 + A_2^2)} $$

$$ = \frac{2\left(\frac{A_1}{A_2}\right)}{\left(\frac{A_1}{A_2}\right)^2 + 1} = \frac{2\sqrt{\beta}}{\beta + 1} $$

35. (*b*) The fringes are locus of equal thickness which are circular. These are called Newton's rings.

37. (*a*) **Case I:** When slit are equal width, if I_0 is intensity of light then,

$I_{max} = I_0 + I_0 + 2\sqrt{I_0 I_0} = 4\, I_0$

$I_{min} = I_0 + I_0 - 2\sqrt{I_0 I_0} = 0$

Case II: When slit are of unequal width, intensity from one slit would increases to twice, then

$I'_{max} = 2I_0 + I_0 + 2\sqrt{2I_0 I_0} = 5.8\, I_0$

$I'_{min} = 2I_0 + I_0 - 2\sqrt{2I_0 I_0} = 0.17\, I_0$

Hence, intensities of both the maxima and minima increases.

38. (*b*) $\lambda = \dfrac{h}{\sqrt{2mK}} \Rightarrow \lambda \propto \dfrac{1}{\sqrt{m}}$ where,

$m_\alpha > m_p = m_n > m_e$

then, $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$

40. (*c*) Greater is the frequency of incident light, greater is the maximum kinetic energy of photoelectrons.

$\therefore$ Energy required to remove this election

$= +3.4$ eV

44. (*b*) As we know

$$ E = \frac{hc}{\lambda} $$

$$ E_C - E_A = (E_C - E_B) + (E_B - E_A) $$

$$ \frac{hc}{\lambda_3} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2} \quad \Rightarrow \quad \frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2} $$

$$ \Rightarrow \lambda_3 = \frac{\lambda_1 \lambda_2}{\lambda_1 + \lambda 2} $$

45. (*a*) binding energy per nucleon increases.

46. (*d*) By conservation of momentum,

$$ m_1 v_1 = m_2 v_2 \quad \text{or} \quad \frac{m_1}{m_2} = \frac{v_2}{v_1} = \frac{1}{2} $$

As $\quad m = \frac{4}{3}\pi r^3 \rho$

$\therefore \quad m \propto r^3 \quad$ or $\quad r \propto m^{1/3}$

$$ \therefore \quad \frac{r_1}{r_2} = \left(\frac{m_1}{m_2}\right)^{1/3} = \left(\frac{1}{2}\right)^{1/3} = 1 : 2^{1/3}. $$

47. (*d*) The concentration of holes in the given material is greater than that of electrons. Thus, the given material is a *p*-type semiconductor.

48. (*b*) In forward biased, the *p*-side is more negative than the *n*-side.

49. (*b*) D_1 is forward and D_2 is reversed biased *i.e.*,

$i_2 = 0$

$$ i = \frac{E}{R_F + 150 + 100} = \frac{6}{300} = 0.02 \text{ A} $$

50. (*a*) The mass of electron is significantly less than that of a hole making the electron more mobile.

41. (*b*) The kinetic energy of photoelectrons depends on the frequency of incident light and is independent of the intensity whereas the photo current is independent of the frequency and increases with increase in intensity of incident radiation. Therefore the maximum kinetic energy and photoelectric current both will increase by a factor of two.

43. (*d*) For hydrogen atom,

$$E_n = \frac{-13 \cdot 6}{n^2}\,\text{eV} = -13 \cdot 6 \times \frac{1}{4} = -3 \cdot 4\ \text{eV}$$

Energy of electron in $n = 2$ state $= -3.4$ eV