

Physics
Marking Scheme
For SQP – 45
XII – I Term

Q.1 Which of the _____

Ans. 1 (iii)

As all other statements are correct. In uniform electric field equipotential surfaces are never concentric spheres but are planes \perp to Electric field lines.

Q.2 Two Point charges _____

Ans. 2 (iii)

Let P is the observation point at a distance r from $-2q$ and at $(L+r)$ from $+8q$.

Given Now, Net EFI at P = 0

$\therefore \vec{E}_1 = \text{EFI (Electric Field Intensity) at P due to } +8q$

$\vec{E}_2 = \text{EFI (Electric Field Intensity) at P due to } -2q$

$$|\vec{E}_1| = |\vec{E}_2|$$

$$\therefore \frac{k(8q)}{(L+r)^2} = \frac{k(2q)}{r^2}$$

$$\therefore \frac{4}{(L+r)^2} = \frac{1}{(r)^2}$$

$$4r^2 = (L+r)^2$$

$$2r = L+r$$

$$r = L$$

\therefore P is at $x = L + L = 2L$ from origin

\therefore Correct Option is (iii) $2L$

Q3. An electric _____

Ans. 2 (ii)

$$W = pE (\cos\theta_1 - \cos\theta_2)$$

$$\theta_1 = 0^\circ$$

$$\theta_2 = 90^\circ$$

$$W = pE (\cos 0^\circ - \cos 90^\circ)$$

$$= pE (1 - 0) = pE$$

Q4. Three Capacitors _____

Ans.4. (ii)

$$\frac{1}{C_{\text{series}}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$\frac{1}{C_{\text{series}}} = \frac{1}{2} + \frac{1}{3} + \frac{1}{6}$$

$$\frac{3+2+1}{6} = \frac{6}{6}$$

$$C_{\text{series}} = 1\mu\text{F}$$

Q5. Two Point Charges _____

Ans.5. (i)

$$\frac{Q_1}{r} \frac{Q_2}{K=5} \quad F = \frac{1}{4\pi\epsilon_0 k} \frac{Q_1 Q_2}{r^2}$$

Q_1 _____ Q_2 Force in the charges in the air is

$$F = \frac{1}{4\pi\epsilon_0} \frac{Q_1 Q_2}{r^2}$$

$$= K F$$

$$= 5 F$$

Q6. Which statement is true _____

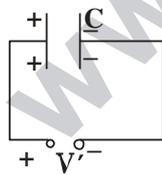
Ans.6. (iv)

All other statements except (iv) are in correct

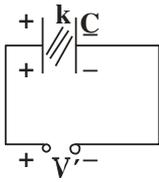
The electric field over the Gaussian surface remains continuous and uniform at every point.

Q7. A capacitor plates

Ans.7. (iii)



Battery is disconnected'



$Q = \text{Charge remains constant}$

$$C' = K C$$

$$Q' = C' V'$$

$$Q = C' V'$$

$$Q = K C V'$$

$$V' = \frac{Q}{K C} = \frac{V}{K}$$

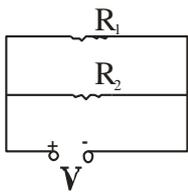
Q.8. The best instrument for _____

Ans.8. (i)

Potentiometer

Q9. An electric current _____

Ans.9. (iii) 8:27



$$l_1 : l_2 = 3 : 2$$

$$r_1 : r_2 = 2 : 3$$

$$I_1 : I_2 = ?$$

$$R_1 = \rho \frac{l_1}{\pi r_1^2}$$

$$R_2 = \rho \frac{l_2}{\pi r_2^2}$$

$$\frac{R_1}{R_2} = \frac{l_1}{l_2} \frac{\pi r_2^2}{\pi r_1^2} = \frac{l_1}{l_2} \times \frac{r_2^2}{r_1^2}$$

$$= \frac{3}{2} \times \left(\frac{3}{2}\right)^2 = \frac{(3)^3}{(2)^3} = \frac{27}{8}$$

$$\therefore \frac{I_1}{I_2} = \frac{V/R_1}{V/R_2} = \frac{R_2}{R_1} = 8/27$$

Q.10. By increasing the temperature _____

Ans. 10. (iii) Specific resistance of a conductor increases and for a semiconductor decreases with increase in temperature because for a conductor, a temperature.

coefficient of resistivity $\alpha = +ve$
and for a semiconductor, $\alpha = -ve$

Q.11. We use alloys _____

Ans. 11 (i) Alloys have low temperature coefficient of resistivity and high specific resistance. If $\alpha = \text{low}$, the value of 'R' with temperature will not change much and specific resistance is high then required length of the wire will be less.

Q.12. A constant Voltage _____



Ans. 12. (iii)

$$\begin{aligned} R &= \rho \frac{l}{A} & R' &= \rho \frac{2l}{\pi(2r)^2} \\ R &= \rho \frac{l}{\pi r^2} & R' &= \rho \frac{2l}{\pi 4r^2} \\ H &= \frac{V^2}{R} t & H' &= \frac{V^2}{R'} t \end{aligned}$$

$\therefore V = \text{constant}$

$$\begin{aligned} \frac{H'}{H} &= \frac{V^2}{R'} \frac{R}{V^2} \frac{t}{t} \\ &= \frac{R}{R'} = \rho \frac{1}{\pi r^2} \frac{2\pi r^2}{\rho l} \\ \frac{H'}{H} &= \frac{2}{1} \\ H' &= 2H \end{aligned}$$

Correct option is (iii)

Q.13. If the potential diff _____

Ans.13. We know

$$\begin{aligned} V_d &= \frac{eE}{ml} \tau \\ &= e \frac{V}{ml} \tau \end{aligned}$$

If temperature is kept constant, relaxation time τ - will remain constant, and e, m are also constants.

$$V_d \propto V$$

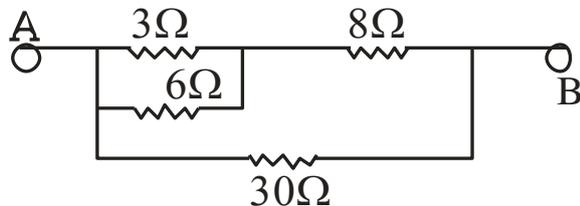
$$V_d \propto 2V$$

Correct option is (ii)

Q.14. The equivalent resistance _____

Ans. 14. (iii)

Redrawing the circuit, we get



3Ω & 6Ω are in parallel.

$$\therefore R_1 = \frac{3 \times 6}{3 + 6} = \frac{18}{9} = 2\Omega$$

Now R_1 and 8Ω in series

$$\therefore R_2 = R_1 + 8 = 2 + 8 = 10\Omega$$

Now R_2 and 30Ω in parallel

$$R_{\text{eq}} = \frac{R_2 \times 30}{R_2 + 30} = \frac{10 \times 30}{10 + 30}$$

$$= \frac{300}{40} = \frac{30}{4} = \frac{15}{2}$$

$$= 7.5\Omega \quad \text{(iii) correct option}$$

Q.15. The SI unit of magnetic field intensity is _____

Ans.15. We know

$$B = \frac{F}{Il \sin\theta}$$

$$\text{SI Unit of } B = \frac{N}{Am} = \text{NA}^{-1}\text{m}^{-1}$$

Correct option is (ii)

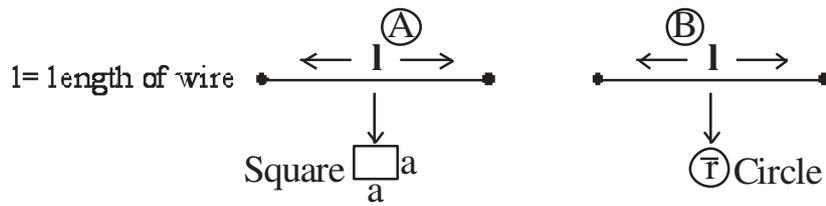
Q16. The coil of _____

Ans. (iv) Correct Option

The coil of a moving coil galvanometer is wound over metallic frame to provide electromagnetic damping so it becomes dead beat galvanometer.

Q.17. Two wires of _____

Ans.17. Correct option (iii)



Area of a Square	Area of a Circle
$= a^2$	$= \pi r^2$
Also here $l = 4a$	Also here, $2\pi r = l$
$a = \frac{l}{4}$	$r = \frac{l}{2\pi}$
$\therefore \text{Area} = \frac{l^2}{16}$	Now Area = $\pi \left(\frac{l}{2\pi}\right)^2$
$A_1 = \frac{l^2}{16}$	$A_2 = \frac{l^2}{4\pi}$

Now Magnetic moment = I A

$$\therefore M_1 = IA, \quad \& \quad M_2 = I A_2$$

Since I (current) is same in both

$$\therefore \frac{M_1}{M_2} = \frac{A_1}{A_2} = \frac{l^2}{16} \div \frac{l^2}{4\pi} = \frac{4\pi}{16} = \frac{\pi}{4}$$

$$M_1 : M_2 = \pi : 4$$

Correct option is (iii)

Q.18. The horizontal comp _____

Ans.18. Correct option (i)

Target law $B_v = B_H \tan \delta$

$$\tan\delta = \frac{B_v}{B_H}$$

Given $B_H = \sqrt{3} B_v$

$$\tan\delta = \frac{B_v}{\sqrt{3} B_v} = \frac{1}{\sqrt{3}}$$

$$\delta = 30^\circ \text{ or } \frac{\pi}{6} \text{ radians.}$$

Q.19. The small _____

Ans. 19. Correct option is Magnetic declination or Angle of declination. It is the small angle between geographic axis & magnetic axis.

Q.20. Two coils _____

Ans.20. Correct option is (ii)

Mutual inductance of a pair of two coils depends on the relative position and orientation of two coils, other statements are incorrect.

Q.21. A conducting _____

Ans. 21. Correct option is (iv)

$$\text{Current induced is } I = \frac{lel}{R}$$

$$\text{Now } lel = \frac{d\phi}{dt}$$

But there is no change of flux with time, as \vec{B} , \vec{A} & θ all remain constant with time.

\therefore No current is induced

Q22. The magnetic flux _____

Ans.22.

$$\phi = 5t^2 + 3t + 16$$

$$|e| = \frac{d\phi}{dt}$$

$$= \frac{d}{dt} [5t^2 + 3t + 16]$$

$$= 10t + 3$$

$$|e|_{t=4} = 10(4) + 3 = 43V$$

$$e = -43 \text{ Volts}$$

Correct option is (ii)

Q23 Which of the following _____

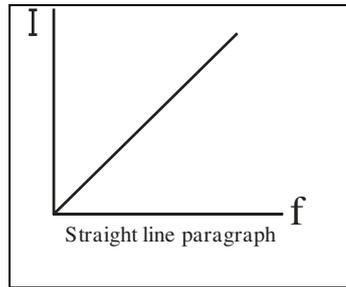
Ans.23. Correct option is (iii)

$$I = \frac{V}{X_c} \quad \text{in Pure Capacitor}$$

$$= \frac{V}{\frac{1}{2\pi f c}} = V 2\pi f c$$

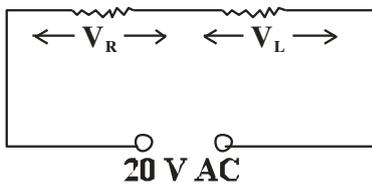
$$\Rightarrow I \propto f$$

other parameters kept constant



Q24. A 20 Volt AC _____

Ans.24. Correct option is (i)



V_R = Effective Voltage across R

$$\therefore V_R = I_{\text{eff}} R$$

V_L = Effective Voltage across L

$$V_L = I_{\text{eff}} \times L$$

$$\text{Net } V = \sqrt{V_R^2 + V_L^2}$$

$$= \sqrt{I_{\text{eff}}^2 R^2 + I_{\text{eff}}^2 \times L^2}$$

$$20 = \sqrt{(12)^2 + V_L^2}$$

$$(20)^2 = (12)^2 + V_L^2$$

$$400 = 144 + V_L^2$$

$$V_L = \sqrt{400 - 144} = \sqrt{256} = 16 \text{ Volts}$$

Q25. The instantaneous _____

Ans. 25.

$$E = E_0 \sin \omega t$$

$$I = I_0 \sin \left(\omega t + \frac{\pi}{3} \right)$$

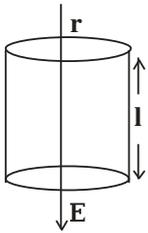
Correct option is (iv)

as I can lead the Voltage in RC and LCR circuit, so it can be RC or LCR circuit.

(iv) is correct option.

Section - B

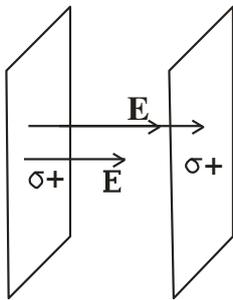
Q26.



Correct option is (i)
 Since -ve electric flux
 = + ve flux electric flux enclosed with a cylinder
 here
 \therefore Total Electric
 Flux = 0.

Q27. Two Parallel _____

Ans. 27. (iv) Correct option.

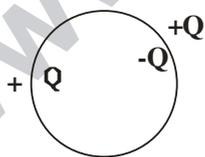


Surface Charge density, $\sigma = 26.4 \times 10^{-12} \frac{\text{C}}{\text{m}^2}$

$$\begin{aligned} E &= \frac{\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0} \\ &= \frac{2\sigma}{2\epsilon_0} = \frac{\sigma}{\epsilon_0} \\ &= \frac{26.4 \times 10^{-12}}{8.85 \times 10^{-12}} \frac{\text{N}}{\text{C}} \\ &= 3 \frac{\text{N}}{\text{C}} \end{aligned}$$

Correct option is (iv)

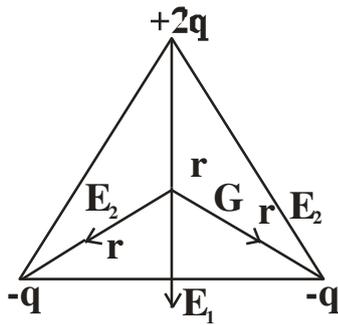
Q28. Consider _____



Ans.28. Equal and Opposite charges appear on the nearby conductor due to induction, but still net charge on the conductor is zero. Correct option (iv)

Q29. Three Charges _____

Ans.29.



Net E F I at G \neq 0

Net Potential at G,

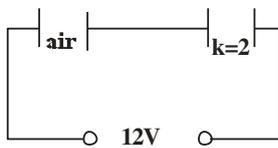
$$V = \frac{K2Q}{r} - \frac{KQ}{r} - \frac{KQ}{r}$$

$$= 0$$

Correct option is (iii)

Q30. Two parallel _____

Ans.30.



A = Same
d = Same

Q = Same in Series

$$C_x = \frac{\epsilon_0 A}{d} \quad C_y = \frac{2\epsilon_0 A}{d}$$

$$U_x = \frac{Q^2}{2C_x} \quad U_y = \frac{Q^2}{2C_y}$$

$$\therefore \frac{U_x}{U_y} = \frac{C_y}{C_x} = \frac{2C_x}{C_x} = \frac{2}{1}$$

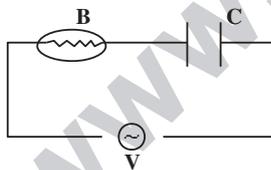
Correct Option is (iii)

Q31. Which among _____

Ans.31. Correct statement is option (iv) as Primary coil made of Thick Copper wire has very less R. Therefore negligible power loss. Rest all options are reasons for power losses in a transformer.

Q32. An alternating Voltage _____

Ans.32.



$\omega \uparrow$

$$X_c = \frac{1}{2\pi f c} = \frac{1}{\omega c} \downarrow \text{ i.e. } X_c \downarrow$$

$I \uparrow \therefore$ Brightness of the bulb will \uparrow .

Correct option is (ii)

Q.33. A solid Sphere _____

Ans.33. Correct option is (4)

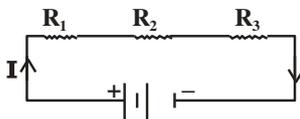
As all other statements seem incorrect in context with the given figure.

Q. 34. A battery is connected

Ans. Correct option is (iv).

Rest all quantities change with area of cross-section of a conductor.

Q. 35. Three resistors.....



Ans.

Given

$$I = 2 \text{ A}, R_2 = 3 \Omega, P_3 = 6 \text{ W}$$

$$\text{Power across } R_3 = V_3 I$$

$$6 \text{ W} = I^2 R_3$$

$$\frac{6}{4} = R_3 = \frac{3}{2} = 1.5 \Omega$$

$$V_3 = I R_3 = 2 (1.5) = 3 \text{ V}$$

Correct option is (iii).

Q. 36. A straight line.....

Ans. $I = 0, V = E, \therefore E = 5.6 \text{ V}$

$$r = \frac{E}{I} = \frac{5.6}{2.0} = 2.8 \Omega$$

Correct option is (i).

Q. 37. A 10 m long potentiometer

Ans. Let PQ is a potentiometer wire of length 10m,

$$I = \frac{E}{R + R'} = \frac{5}{480 + 20} = \frac{5}{500}$$

$$= \frac{1}{100} = 0.01 \text{ A}$$

$$V_{PQ} = I R_{PQ} = 0.01 \times 20$$

$$= 0.2 \text{ V}$$

If 10 m potentiometer wire balances $\Rightarrow 0.2 \text{ V}$

Then 1 m potentiometer wire balances $\Rightarrow \frac{0.2}{10} \text{ V}$

Then 6 m potentiometer wire balances $\frac{0.2}{10} \times 6 \text{ V}$

$$= \frac{1.2}{10} = 0.12 \text{ V}$$

Correct option is **(iv)**.

Q. 38. The current sensitivity.....

Ans. Given,

$$I'_g = I_g + \frac{20}{100} I_g$$

$$= \frac{120}{100} I_g = 1.2 I_g$$

$$R' = R + \frac{25}{100} R = \frac{125}{100} R$$

$$= 1.25 R$$

$$V'_g = ?$$

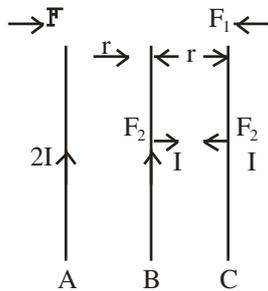
$$V'_g = \frac{I'_g}{R'} = \frac{1.2 I_g}{1.25 R}$$

$$= \frac{120}{125} V_g = \frac{25}{25} V_g$$

$$\begin{aligned}
 \% \text{ change} &= \frac{V'_g - V_g}{V_g} \times 100 \\
 &= \frac{\left(\frac{24}{25}V_g - V_g\right)}{V_g} \times 100 \\
 &= \frac{(24 - 25)}{25} \times 100 \\
 &= \frac{-1}{25} \times 100 = 4\%
 \end{aligned}$$

Decrease by 4%. Correct option is **(iv)**.

Q. 39. Three infinitely long parallel



Ans.

Let F_1 is force per unit, length between A & C

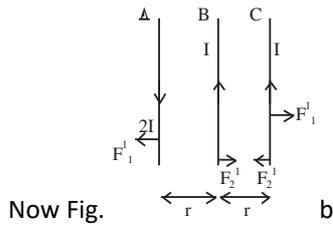
$$\therefore \text{i.e. } F_1 = \frac{\mu_0}{4\pi} \frac{2I \times I}{2r}$$

And F_2 is force per unit, length between B & C

$$\therefore F_2 = \frac{\mu_0}{4\pi} \frac{I \times I}{r}$$

Now net force on 'C' is per unit length

$$\begin{aligned}
 F_1 + F_2 &= \frac{\mu}{4\pi} \frac{I^2}{r} (1 + 1) \\
 &= \frac{2\mu_0}{4\pi} \frac{I^2}{r} = F \text{ (given)}
 \end{aligned}$$



$$F_1' = \text{Repulsive force between A \& C}$$

$$= \frac{\mu_0}{4\pi} \frac{2I^2}{2r}$$

$$F_2' = F_2 = \text{A reactive force between B \& C}$$

$$\therefore \text{Net force on 'C' } F_1' - F_2' = 0$$

$$\therefore F_1' = F_2' = \frac{\mu}{4\pi} \frac{2I^2}{2r}$$

\therefore Net Force on 'C' is zero.

Correct option is (i).

Q. 40. In a H-atom

Ans. $R = 0.5 \text{ \AA}$

$$\omega = 10 \text{ rps} = 10 \times 2\pi \text{ rad/s}$$

$$v = 10 \text{ Hz}$$

$$M = IA = e v \pi r^2$$

$$= 1.6 \times 10^{-19} \times 10 \times 3.14 \times 0.5 \times 0.5 \times 10^{-10} \times 10^{-10}$$

$$= 1.256 \times 10^{-38} \text{ Am}^2$$

Ans. (ii).

Q. 41. An air-cored solenoid

Ans. Magnetic field inside a solenoid

$$B = \mu_0 \frac{N}{l} I$$

Flux linked with 'N' turns

Initial flux

$$\phi_1 = NBA = N\mu_0 \frac{N}{l} IA$$

$$\begin{aligned}
 &= \mu_0 \frac{N^2}{l} I A \\
 &= \frac{4\pi \times 10^{-7} \times 800 \times 800 \times 2.5 \times 2.5 \times 10^{-4}}{0.30} \\
 &= 16.74 \times 10^{-3} \text{ Wb}
 \end{aligned}$$

Final flux $\phi_2 = 0$

Average back emf

$$|e| = \frac{d\phi}{dt} = \frac{16.74 \times 10^{-3} - 0}{10^{-3}}$$

$$= 16.74 \text{ V}$$

Correct option is (ii).

Q. 42.

$$V_0 = 283 \text{ V}, f = 50 \text{ Hz}$$

$$R = 3 \ \Omega, L = 25.48 \text{ mH}$$

$$C = 796 \ \mu\text{F}$$

$$P \text{ |}_{\text{at resonance}} = ?$$

Power dissipated

$$P = I^2 R$$

$$I = \frac{I_0}{\sqrt{2}} = \frac{1}{\sqrt{2}} \left(\frac{283}{3} \right)$$

$$= 66.7 \text{ A}$$

$$P = I^2 R$$

$$= (66.7)^2 \cdot 3$$

$$= 13.35 \text{ kW}$$

Correct option is (iii).

Q. 43. A circular loop

Ans. Let flux linked with smaller loop is ϕ_1 and with bigger loop is ϕ_2 .

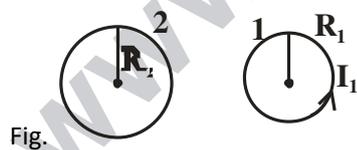


Fig.

Given

$$R_2 = 0.2 \text{ m}$$

$$R_1 = 0.003 \text{ m}$$

$$x = 15 \text{ cm} = 0.15 \text{ m}$$

Now

$$\begin{aligned} \phi_1 &= B_2 A_1 \\ &= \frac{\mu_0}{4\pi} \left[\frac{2\pi R_2^2 I_2}{(R_2^2 + x^2)^{3/2}} \right] \pi R_1^2 \end{aligned}$$

$$M = \frac{\phi_1}{I_2} = \frac{\mu_0}{4\pi} \frac{2\pi R_2^2 \pi R_1^2}{(R_2^2 + x^2)^{3/2}}$$

Now

$$\begin{aligned} \phi_2 &= M I_1 \\ &= \frac{\mu_0}{4\pi} \frac{2\pi R_2^2 \pi R_1^2}{(R_2^2 + x^2)^{3/2}} \cdot I_1 \\ &= 9.1 \times 10^{-11} \text{ Weber} \end{aligned}$$

Correct answer is (iv).

Q. 44. If both the no. of turns.....

Ans.

$$\begin{aligned} L &= \mu_0 \frac{N^2}{l} A \\ L' &= \mu_0 \frac{(2N)^2}{2l} A \\ &= 2\mu_0 \frac{N^2}{l} A = 2L \end{aligned}$$

Correct answer is (ii). Doubted.

Q.45. Given below _____

To increase the range

Ans. 45. Correct option is (iv) as both statements are false. To increase the range of an ammeter, suitable low R (or shunt) should be connected in parallel to it. The ammeter with increased range has low resistance.

Q.46. An electron _____

Ans.46. Correct option is (iii)

Statements correct but reason is wrong because electrons move from a region of low potential to high potential.

Q. 47. A magnetic needle

Ans. The given statement is correct and reason is the correct explanation of the above statement. At poles, magnetic needle orient itself vertically because horizontal components of earth's field is zero there. (correct option is (i))

Q. 48. A proton and an electron,

Ans. we know $\frac{mv^2}{r} = Bqv \sin \theta = Bqv \sin \theta$

Centripetal force = magnetic Lorentz force

$\sin \theta = \sin 90^\circ = 1$ (\angle between \vec{V} & $\vec{B} = 90^\circ$)

$$\frac{mv^2}{r} = Bqv$$

$$\frac{mv}{r} = Bq$$

$$r = \frac{mv}{Bq} = \frac{p}{Bq} = \frac{\text{linear momentum}}{Bq}$$

Since $r = \frac{p}{Bq}$

Given p, B are same

Also q for proton & electron is same except its sign

\therefore Radius is same. So statement is correct but

reason is not the correct explanation of the given assertion.

correct option is (ii)

Q. 49. On increasing.....

Ans. 49. When we increase current sensitivity by increasing no. of turns, then resistance of coil also increases. So increasing current sensitivity does not necessarily imply that voltage sensitivity will increase because $V_g = \frac{I_g}{R}$

\therefore if $I_g \uparrow$ & $R \uparrow$ by different amounts, then V_g may increase or decrease.

Correct option is (i).

Q.50. A small object.....

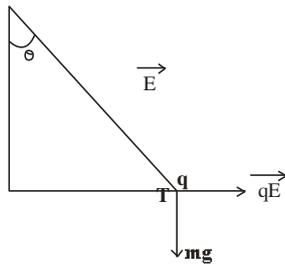
Ans. 50. Ans is (ii)

$$F_e = mg \tan \theta$$

$$qE = mg \tan \theta$$

$$q = \left(\frac{mg}{E} \right) \tan \theta$$

$$\tan \theta = \frac{F_e}{mg}$$



Correct ans. is (ii)

Q. 51. A free electron.....

Ans. 51. Correct ans. (ii) i.e. II only

$$\because F_p = F_e \quad \because F = qE$$

$$E = \text{same}$$

$$'q' = \text{same}$$

$$\text{Now, } P\varepsilon = qV(r)$$

$$(P.\varepsilon)_p > (P.\varepsilon)_e$$

Q. 52. Correct ans is (iv) i.e. step down transformer decreases the ac voltage.

Q.53. correct ans is (i)

$$\text{i.e. } \frac{N_s}{N_p} = \frac{E_s}{E_p}$$

i.e. if no. of turns in secondary coil are more than no. of turns in primary, then voltage is increased or stepped up in secondary, so called step up transformer.

Q.54 Correct ans. is (i).

i.e. current is reduced if voltage is stepped – up so corresponding I^2R losses are cut down.

Q. 55. Correct ans is (iii)

$$\text{Given } E_i = 2300V$$

$$E_o = 230V$$

$$N_p = 4000$$

$$N_s = ?$$

$$\frac{E_i}{E_o} = \frac{N_p}{N_s}$$

$$\frac{2300}{230} = \frac{4000}{x}$$

$$x = 400 = N_s = \text{No of turns in secondary coil}$$