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 ⊥ 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

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

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

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

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

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

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

$$2r = L+r$$

$$r = L$$

∴ P is at x = L + L = 2L from origin
∴ Correct Option is (iii) 2L

Q3. An electric_____________________

Ans. 2 (ii)

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

$$\theta_1 = 0^o$$

$\theta_2 = 90^o$

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

$= pE(1 - 0) = pE$

Q4. Three Capacitors______________

Ans.4. (ii)

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

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

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

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

Q5. Two Point Charges___________________

Ans.5. (i)

Q_1 ——— r ——— Q_2 K = 5

$$F = \frac{1}{4\pi\varepsilon o k} \frac{Q_1 Q_2}{r^2}$$

Q_1 ——————— Q_2 Force in the charges in the air is

$$F^- = \frac{1}{4\pi\varepsilon o} \frac{Q_1 Q_2}{r^2}$$

= K F

= 5 F

Q6. Which statement is true________________

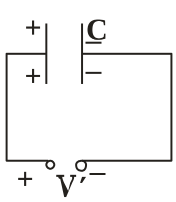
Ans.6. (iv)

All other statements except (iv) are in correct

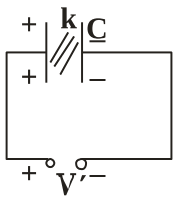
The electric field over the Gaussian surface remains continuous and uniform at every point.

Q7. A capacitor plates

Ans.7. (iii)



Battery is disconnected`′



Q = Charge remains context

$C' = K\,C$

$Q' = C'\,V'$

$Q = C'\,V'$

$Q = K\,C\,V'$

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

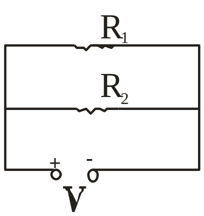
Q.8. The best instrument for__________________

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 $\alpha = +\text{ve}$
and for a semiconductor, $\alpha = -\text{ve}$

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)

$$R = \rho\frac{l}{A} \quad \Big| \quad R' = \rho\frac{2l}{\pi(2r)^2}$$

$$R = \rho\frac{l}{\pi r^2} \quad \Big| \quad R' = \rho\frac{2l}{\pi 4r^2}$$

$$H = \frac{V^2}{R}t \quad \& \quad H' = \frac{V^2}{R^1}t$$

$\because$ V = constant

$$\frac{H'}{H} = \frac{V^2}{R'}\ \frac{R}{V^2}\ \frac{t}{t}$$

$$= \frac{R}{R'} = \rho\frac{l}{\pi r^2}\quad\frac{2\pi r^2}{\rho l}$$

$$\frac{H'}{H} = \frac{2}{1}$$

$$H' = 2H$$

Correct option is (iii)

Q.13. If the potential diff____________________

Ans.13. We know

$$V_d = \frac{eE}{ml}\bar{\tau}$$

$$= e\frac{V}{ml}\bar{\tau}$$

If temperature is kept constant, relaxation time $\bar{\tau}$ - will remain constant, and e, m are also constants.

$V_d \propto V$

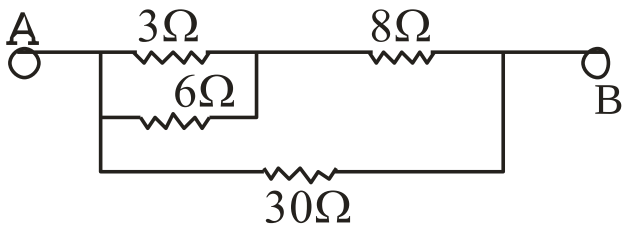
$V_d \propto 2V$

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

$$Rep = \frac{R_2 \times 30}{R_2 + 30} = \frac{10 \times 30}{10 + 30}$$

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

$= 7.5\Omega$ (iii) correct option

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

Ans.15. We know

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

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

Correct option is (ii)

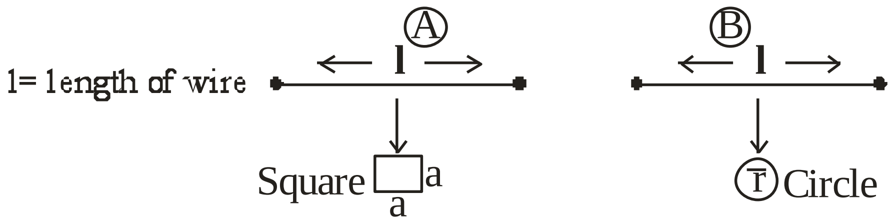
Q16. The coil of ______________________

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

Now Magnetic moment = I A

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

Since I (current) is same in both

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

$M_1 \; M_2 = \pi : 4$

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 $B_H = \sqrt{3}\ B_v$

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

$$\delta = 30^0 \text{ or } \frac{\pi}{6}\text{radians.}$$

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)

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

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

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.

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

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

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

$= 10t + 3$

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

e = -43Volts

Correct option is (ii)

Q23 Which of the following________________

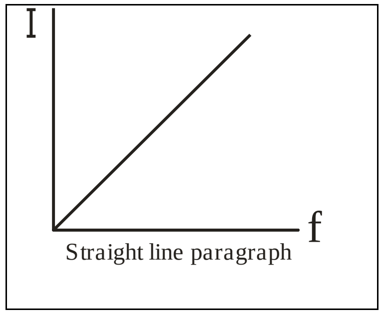
Ans.23. Correct option is (iii)

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

$$= \frac{V}{\frac{1}{2\pi fc}} = V\,2\pi fc$$

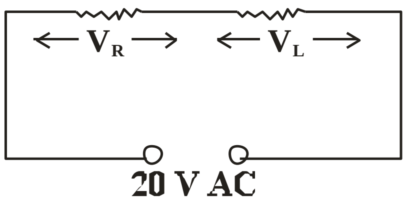
$$\Rightarrow \; I \; \alpha \; f$$

other parameters kept cosntant



Q24. A 20 Volt AC_________________

Ans.24. Correct option is (i)



V_R = Effective Voltage across R

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

V_L = Effective Voltage across L

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

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

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

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

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

$$400 = 144 + V_L^2$$

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

Q25. The instantaneous__________________

Ans. 25.

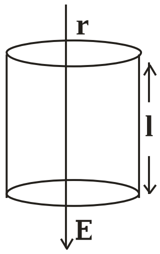
$$E = E_0 \sin \omega t$$

$$I = I_0 \sin\left(\omega t + \pi/3\right)$$

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

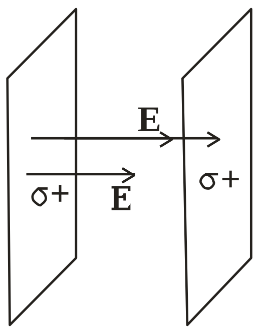
Q26.



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

Q27. Two Parallel_______________________

Ans. 27. (iv) Correct option.



Surface Charge density, $\sigma = 26.4\times10^{-12}\ \frac{C}{m^2}$

$$E = \frac{\sigma}{2\varepsilon_0} + \frac{\sigma}{2\varepsilon_0}$$

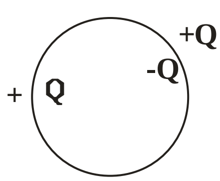
$$= \frac{2\sigma}{2\varepsilon_0} = \frac{\sigma}{\varepsilon_0}$$

$$= \frac{26.4\times10^{-12}}{8.85\times10^{-12}}\ \frac{N}{C}$$

$$= 3\ \frac{N}{C}$$

Correct option is (iv)

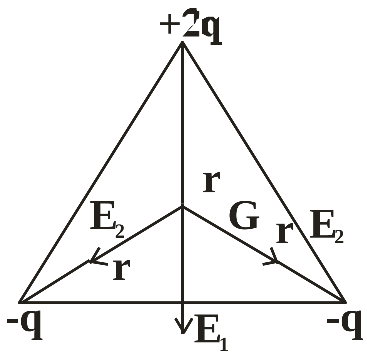
Q28. Consider___________________



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 $\neq$ O

Net Potential at G,

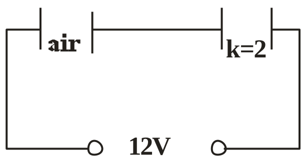
$$V = \frac{K2Q}{r} - \frac{KQ}{r} - \frac{KQ}{r}$$

$$= 0$$

Correct option is (iii)

Q30. Two parallel_____________

Ans.30.



A = Same
d = Same

Q = Same in Series

$$C_x = \frac{\varepsilon_0 A}{d} \quad C_y = \frac{2\varepsilon_0 A}{d}$$

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

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

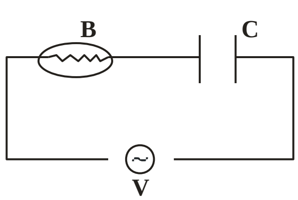
Correct Option is (iii)

Q31. Which among________________

Ans.31. Correct statement is option (iv) as Primary coil made of Thick Coper 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.



$\omega \uparrow$

$X_c = \dfrac{1}{2\pi fc} = \dfrac{1}{\omega c} \downarrow$ 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.

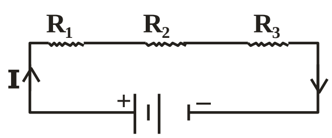
Q. 34. A battery is connected .....

Ans. Correct option is **(iv)**.

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

Q. 35. Three resistors……

Ans.



Given

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

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

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

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

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

Correct option is **(iii)**.

Q. 36. A straight line……

Ans. $I = O$, $V = E$, $\therefore$ $E = 5.6$ 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 wore 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 V

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

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

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

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

$$= 1.25\,R$$

$$V'_g = ?$$

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

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

$$\% \text{ change} = \frac{V_g' - V_g}{V_g} \times 100$$

$$= \frac{\left(\frac{24}{25}V_g - V_g\right)}{V_g} \times 100$$

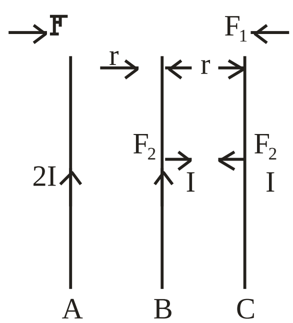
$$= \frac{(24-25)}{25} \times 100$$

$$= \frac{-1}{25} \times 100 = 4\%$$

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

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

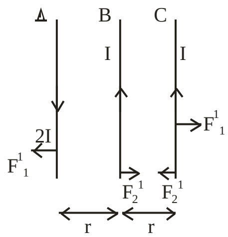
And F_2 is force per unit, length between B & C

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

Now net force on 'C' is per unit length

$$F_1 + F_2 = \frac{\mu}{4\pi}\frac{I^2}{r}(1+1)$$

$$= \frac{2\mu_0}{4\pi}\frac{I^2}{r} = F \text{ (given)}$$

Now Fig.  b

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

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

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

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

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

$\therefore$ Net Force on 'C' is zero.

Correct option is **(i)**.

Q. 40. In a H-atom …….

Ans. $R = 0.5$ A°

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

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

$$M = IA = e\,\nu\,\pi\,r^2$$

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

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

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 $$\phi_1 = NBA = N\mu_0 \frac{N}{l} I A$$

$$= \mu_0 \frac{N^2}{l} I A$$

$$= \frac{4\pi \times 10^{-7} \times 800 \times 800 \times 2.5 \times 2.5 \times 10^{-4}}{0.30}$$

$$= 16.74 \times 10^{-3} \text{ Wb}$$

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. $V_o = 283$ V, $f = 50$ Hz

$R = 3\ \Omega$, $L = 25.48$ mH

$C = 796\ \mu$F

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

Power dissipated $P = I^2 R$

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

$$= 66.7 \text{ A}$$

$$P = I^2 R$$

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

$$= 13.35 \text{ kW}$$

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.

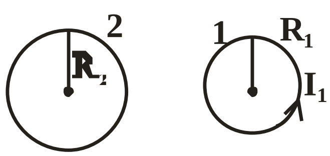


Fig.

Given $R_2 = 0.2$ m

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

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

Now $\phi_1 = B_2 A_1$

$$= \frac{\mu_0}{4\pi}\left[\frac{2\pi R_2^2 I_2}{(R_2^2 + x^2)^{3/2}}\right]\pi R_1^2$$

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

Now $\phi_2 = M I_1$

$$= \frac{\mu_0}{4\pi}\frac{2\pi R_2^2 \pi R_1^2}{(R_2^2 + x^2)^{3/2}}.I_1$$

$$= 9.1 \times 10^{-11} \text{ Weber}$$

Correct answer is **(iv)**.

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

Ans. $$L = \mu_0 \frac{N^2}{l} A$$

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

$$= 2\mu_0 \frac{N^2}{l} A = 2L$$

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 orients 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 $\frac{mv^2}{r} = Bqvsin\,\theta = Bqv\,Sin\,\theta$

Centripetal force = magnetic Lorentz force

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

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

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

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

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

Given p, B are same

Also q for proton & electron is same except its sign

∴ 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 $V_g = \frac{I_g}{R}$

∴ 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………

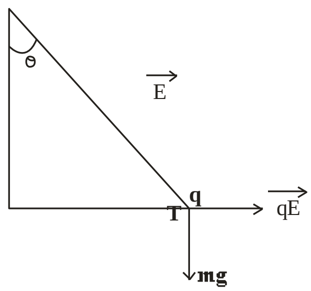
Ans. 50. Ans is (ii)

$F_e = mg\ tan\theta$

$qE = mg\ tan\theta$

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

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



Correct ans. is (ii)

Q. 51. A free electron…………

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

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

$E = \ same$

$'q' = \ same$

Now, $P\varepsilon = q\,V(r)$

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

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

Q.53. correct ans is (i)

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)

Given $E_i = 2300V$

$E_o = 230V$

$N_p = 4000$

$N_s = ?$

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

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

$x = 400 = N_s$ = No of turns in secondary coil