PHYSICS

171. (3)

Ratio of magnetic moment and angular momentum is given by $\frac{M}{L}=\frac{q}{2m}$

which is a function of q and m only. This can be derived as follows,

$M = iA = (qf)(\pi r^2)$

$= (q)\left(\frac{\omega}{2\pi}\right)(\pi r^2) = \frac{q\omega r^2}{2}$ and

$L = I\omega = (mr^2\omega)$

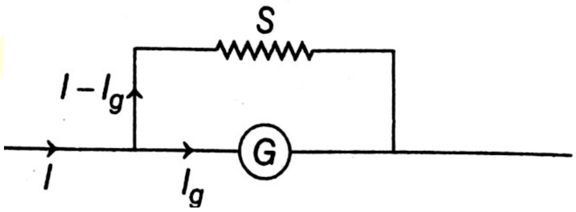
$\therefore \frac{M}{L} = \frac{a\frac{\omega r^2}{2}}{mr^2\omega} = \frac{q}{2m}$

172. (3)

Magnetic force on a current carrying loop in uniform magnetic field is zero.

173. (1)

Ammeter circuit is shown in the figure below,



So, $I_gG = (I - I_g)S$

Here, $I_g = 0.002$ A, $I = 0.5$ A, $G = 50\ \Omega$

So, shunt resistance required is

$S = \frac{I_gG}{I - I_g} = \frac{0.002 \times 50}{(0.5 - 0.002)} \approx 0.2\ \Omega$

174. (2)

175. (2)

Drift velocity, $v_d = \frac{I}{neA} = \frac{eE\tau}{m}$

Electrical resistivity,

$\rho = \frac{1}{\sigma} = \frac{E}{J} \qquad \left(\because \sigma = \frac{J}{E}\right)$

Relaxation period, $\tau = \frac{m}{ne^2\rho}$

Current density, $J = \frac{I}{A} = nev_d$

Relation between drift velocity, v_d, electrical resistivity (ρ) relaxation period (τ) and current density (J)

$v_d = \frac{i}{neA} = \frac{J}{ne} = \frac{\sigma E}{ne} = \frac{E}{\rho ne} = \frac{v}{\rho l n e}$

$R\frac{l}{A} = \frac{m}{ne^2\tau}\cdot\frac{l}{A}$

176. (2)

$R = \rho\frac{l}{A}$

$R_1 = \rho\frac{L}{A}$ … (1)

$R_2 = \rho\frac{2L}{A}\times 2$ … (2)

$R_3 = \rho\frac{L}{2.2A} = \frac{\rho L}{4A}$ … (3)

$\Rightarrow R_3 < R_1 < R_2$

177. (4)

Current in the circuit

$= \frac{E+E}{r_1+r_2+R} = \frac{2E}{r_1+r_2+R}$

P.D. across first cell = $E - ir_1$

$= E - \frac{2E\times r_1}{(r_1+r_2)+R}$

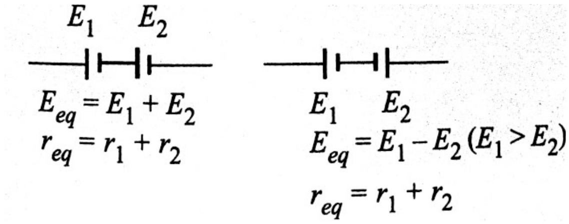
Now, $E = \frac{2Er_1}{(r_1+r_2)+R} = 0$

$\Rightarrow E = \frac{2Er_1}{r_1+r_2+R} \Rightarrow 2r_1 = r_1 + r_2 + R$

$R = r_1 - r_2$

In series groupmg of cells their emfs are additive

or subtractive while their internal resistances are always additive If dissimilar plates of cells are connected together their emf's are added to each other while if their similar plates are connected together their emf's are subtractive.



178. (2)

$$\text{Time} = \frac{10 \times 40}{10 + 40} = \frac{400}{50} = 8 \text{ min}$$

179. (1)

Potential gradient Potential fall per unit 1ength. In this case resistance of unit length. $R = \frac{\rho l}{A} = \frac{10^{-7} \times 1}{10^{-6}} = 10^{-1}\ \Omega$

Potential fall across R is

$V = IR = 0.1 \times 10^{-1} = 0.01\ V\ m^{-1}$

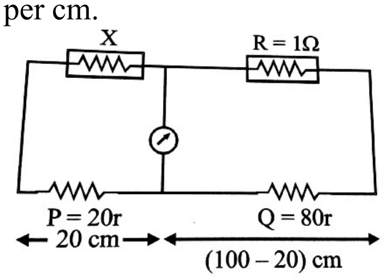
$= 10^{-2}\ V\ m^{-1}$

180. (1)

Let unknown resistance be X.

Then condition of Wheatstone's bridge gives

$\frac{X}{R} = \frac{20r}{80r}$, where r is of wire resistance per cm.



$$\therefore X = \frac{20}{80} \times R = \frac{1}{4} \times 1 = 0.25\ \Omega$$