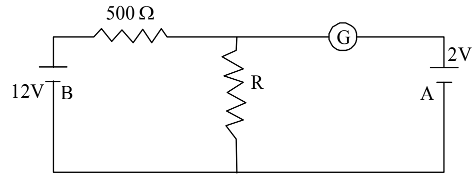
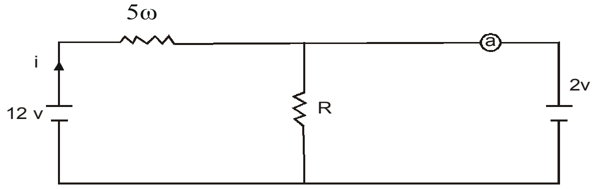
61. In the circuit, the galvanometer G shows zero deflection. If the batteries A and B have negligible internal resistance, the value of the resistor R will be -



1) 100 Ω 2) 200 Ω 3) 1000 Ω 4) 500 Ω

Sol: 1)



$12 - 2 = (5\,\omega)i$

$i = \frac{1}{50}$

$I = \frac{12}{5\omega} = \frac{1}{5_0} = \frac{12}{5\omega + R}$

$5\ \omega + R = 6\ \omega = R = 100\ \Omega$

62. A moving coil galvanometer has 150 equal divisions. Its current sensitivity is 10 divisions per milliampere and voltage sensitivity is 2 divisions per millivolt. In order that each division reads 1 volt, the resistance in ohms needed to be connected in series with the coil will be -

1) 10^5 2) 10^3 3) 9995 4) 99995

Sol: 3)

$\text{Voltage sensitivity} = \frac{\text{Current sensitivity}}{\text{Resistance of galvanometer G}} \Rightarrow G = \frac{10}{2} = 5\Omega$

Here i_g = Full scale deflection current $= \frac{150}{10} = 15mA$

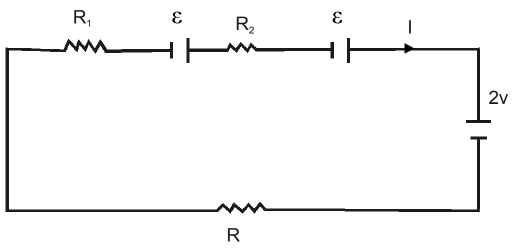
V = voltage to be measured $= \frac{150}{15 \times 10^{-3}} - 5 = 9995\Omega$

63. Two sources of equal emf are connected to an external resistance R. The internal resistances of the two sources are R_1 and R_2 ($R_2 > R_1$). If the potential difference across the source having internal resistance R_2 is zero, then

1) $R = R_2 - R_1$ 2) $R = R_2 \times (R_1 + R_2) / (R_2 - R_1)$

3) $R = R_1 R_2 / (R_2 - R_1)$ 4) $R = R_1 R_2 / (R_1 + R_2)$

Sol: 1)



$$I = \frac{2\varepsilon}{R + R_1 + R_2}$$

Potential difference across (L) cell

$$= V = \varepsilon - i\,R_2 = 0$$

$$\varepsilon - \frac{2\varepsilon}{R + R_1 + R_2}.R_2 = 0$$

$$R + R_1 + R_2 - 2R_2 = 0$$

$$R + R_1 - R_2$$

$$\therefore R = R_2 - R_1$$

64. Two voltameters, one of copper and another of silver, are joined in parallel. When a total charge q flows through the voltameters, equal amount of metals are deposited. If the electrochemical equivalents of copper and silver are z_1 and z_2 respectively the charge which flows through the silver voltameter is

1) $\frac{q}{1+\frac{z_2}{z_1}}$ 2) $\frac{q}{1+\frac{z_1}{z_2}}$ 3) $q\frac{z_2}{z_1}$ 4) $q\frac{z_1}{z_2}$

Sol: 1)

$$m = zq \Rightarrow z \propto \frac{1}{q} \Rightarrow \frac{z_1}{z_2} = \frac{q_2}{q_1} ....(i)$$

$$also\ q = q_1 + q_2 \Rightarrow \frac{q}{q_2} = \frac{q_1}{q_2} + 1 \Rightarrow q_2 = \frac{q}{1+\frac{q_1}{q_2}} ...(ii)$$

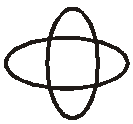
From equation (1) and (ii) $q_2 = \frac{q}{1+\frac{z_2}{z_1}}$

65. Two concentric coils each of radius equal to 2π cm are placed at right angles to each other. 3 ampere and 4 ampere are the currents flowing in each coil respectively. The magnetic induction in Weber/m^2 at the centre of the coils will be

($\mu_0 = 4\pi \times 10^{-7}$ Wb / A..m.)

1) 10^{-5} 2) 12×10^{-5} 3) 7×10^{-5} 4) 5×10^{-5}

Sol: 4)



$$B_1 = \frac{\mu_0 i_1}{2(2\pi)} = \frac{\mu_0 \times 3}{4\pi}$$

$$B_2 = \sqrt{B_1^2 + B_2^2} = \frac{\mu_0}{4\pi}.5$$

$$= 10^{-7} \times 5 \times 10^2$$

$$= 5 \times 10^{-5}\ \omega b/n^2$$

66. In a potentiometer experiment the balancing with a cell is at length 240 cm. On shunting the cell with a resistance of 2Ω, the balancing length becomes 120 cm. The internal resistance of the cell is

1) $0.5\,\Omega$ 2) $1\,\Omega$ 3) $2\,\Omega$ 4) $4\,\Omega$

Sol: 3)

$$r = \left(\frac{l_1 - l_2}{l_2}\right) \times R = \frac{240-120}{120} \times 2$$

$$= 2\Omega$$

67. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B. The time taken by the particle to complete one revolution is

1) $\frac{2\pi q^2 B}{m}$ 2) $\frac{2\pi m q}{B}$ 3) $\frac{2\pi m}{qB}$ 4) $\frac{2\pi q B}{m}$

Sol: 3)

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

$$T = \frac{2\pi r}{v} = \frac{2\pi m}{qB}$$

68. A magnetic needle is kept in a non-uniform magnetic field. It experiences

1) neither a force for a torque 2) a torque but not a force
3) a force but not a torque 4) a force and a torque

Sol: 4)

A magnetic needle kept in non-uniform magnetic field experience face and torque due to unequal forces acting on poles

69. The resistance of hot tungsten filament is about 10 times the cold resistance. What will be the resistance of 100 W and 200 V lamp when not in use ?

1) $20\,\Omega$ 2) $40\,\Omega$ 3) $200\,\Omega$ 4) $400\,\Omega$

Sol: 2)

$P = Vi = \frac{V^2}{R}$

$R = \frac{V^2}{P} = \frac{200 \times 200}{100} = 400\,\Omega$

$R\,\text{cold} = \frac{400}{10} = 40\Omega$

70. The self inductance of the motor of an electric fan is 10 H. In order to impart maximum power at 50 Hz, it should be connected to a capacitance of

1) $8\,\mu$F 2) $4\,\mu$F 3) $2\,\mu$F 4) $1\,\mu$F

Sol: 4)

$P = n = \frac{1}{2\pi\sqrt{2c}}$

$50 = \frac{1}{2\pi\sqrt{50 \times c}}$

C = 1 *uf*.

71. An energy source will supply a constant current into the load if its internal resistance is

1) very large as compared to the load resistance
2) equal to the resistance of the load
3) non-zero but less than the resistance of the load
4) zero

Sol: 4) $I = \frac{E}{R + r}$, Internal resistance (r) is

zero, $I = \frac{E}{R} = \text{cons tan t}$

72. The phase difference between the alternating current and emf is $\frac{\pi}{2}$. Which of the following cannot be the constituent of the circuit?

1) R, L 2) C alone 3) L alone 4) L, C

Sol: 4)

73. A circuit has a resistance of 12 ohm and an impedance of 15 ohm. The power factor of the circuit will be -

1) 0.4 2) 0.8 3) 0.125 4) 1.25

Sol:.2)

Power factor = $\cos\phi = \frac{R}{Z} = \frac{12}{15} = \frac{4}{5} = 0.8$

74. A uniform electric field and a uniform magnetic field are acting along the same direction in a certain region. If an electron is projected along the direction of the fields with a certain velocity then -

1) its velocity will increase
2) its velocity will decrease
3) it will turn towards left of direction of motion
4) it will turn towards right of direction of motion

Sol:.2)

due to electricfield, it experiences force and accelerates i.e, its velocity decreases.

75. A coil of inductance 300 mH and resistance 2Ω is connected to a source of voltage 2 V. The current reaches half of its steady state value in

1) 0.1 s 2) 0.05 s 3) 0.3 s 4) 0.15 s

Sol: 1)

$$i = i_0\left(1 - e^{-\frac{It}{L}}\right)$$

$$\frac{i_0}{2} = i_0(1-e)$$

$$\frac{L}{R} \times 0.693 = t$$

$$= 0.693 \times \frac{300 \times 10^{-3}}{2}$$

= 0.1 see