DPP

DAILY PRACTICE PROBLEMS

CLASS : XIITH
DATE :

Solutions

SUBJECT : PHYSICS
DPP NO. : 5

Topic :- Current Electricity

1 **(a)**

In the first case, $Zit = m$

In the second case, $Z \times \frac{i}{4} \times 4t = m$

2 **(d)**

For conductors, resistance $\propto$ Temperature and for semiconductor, resistance $\propto \frac{1}{\text{Temperature}}$

3 **(a)**

Since resistance connected in arms CE, ED, CF and FD will form a balanced Wheatstone bridge, therefore, the resistance of arm EF becomes ineffective. Now resistance of arm CED or $CFD = 2 + 2 = 4\Omega$. Effective resistance of these two parallel arm $= \frac{4 \times 4}{4 + 4} = 2\Omega$

Now resistance of arm $ACDB = 2 + 2 + 2 = 6\Omega$, is in parallel with resistance arm $AB = 2\Omega$. Thus, effective resistance between A and B

$$= \frac{6 \times 2}{6 + 2} = \frac{3}{2}\Omega$$

4 **(c)**

$$i = \frac{dQ}{dt} = \frac{d}{dt}(5t^2 + 3t + 1) = 10t + 3$$

When $t = 5\text{s}$, $i = 10 \times 5 + 3 = 53\ A$

5 **(a)**

The current taken by the silver voltameter

$$I_1 = \frac{n}{Zt} = \frac{1}{11.2 \times 10^{-4} \times 30 \times 60} = 0.496\ A$$

and by copper voltameter

$$I_2 = \frac{1.8}{6.6 \times 10^{-4} \times 30 \times 60} = 1.515\ A$$

The current $I = (I_1 + I_2) = 2.011\ A$

Power $P = IV = 2.011 \times 12 = 24.132\, J/sec$

6 **(c)**

Average current

$i = \frac{50 + 100 + 50}{3} = \frac{200}{3}$mA

$$z = \frac{m}{it} = \frac{3m}{200 \times 10^{-3} \times 30} = \frac{m}{2}$$

7 **(c)**

The equivalent current due to motion of electrons is given by

$$I = \frac{e}{t} = \frac{1.6 \times 10^{-19}}{1.594 \times 10^{-18}}$$

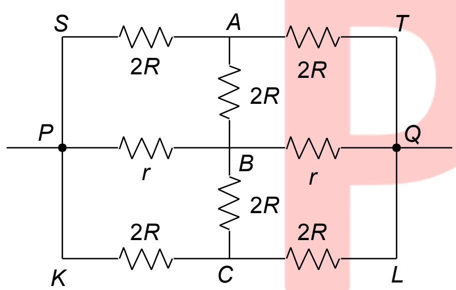
$= 1.0037 \times 10^{-1}$

$= 100.37 \times 10^{-3} A$

$= 100.37 mA$

8 **(a)**

In the circuit arrangement $PSTQ$ is a balanced Wheatstone bridge, hence resistance $2R$ joined in arm AB be omitted. Similarly, resistance $2R$ joined in arm BC may also be omitted.



$$\therefore \frac{1}{R_{eq}} = \frac{1}{4R} + \frac{1}{2r} + \frac{1}{4R} = \frac{\mu + 2R + \mu}{4\mu R} = \frac{(R + r)}{2Rr}$$

$$\Rightarrow R_{eq} = \frac{2Rr}{R + r}$$

9 **(b)**

$$\frac{dT}{dt} = \frac{d}{dt}(at^2 - bt^3) = 2at - 3bt^2$$

When $t = t_n$(ie, neutral temperature), $\frac{dE}{dt} = 0$

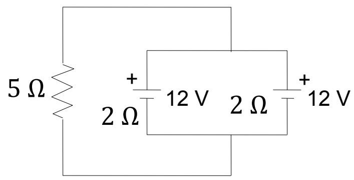
$\therefore 0 = 2at_n - 3bt_n^2$ or $t_n = \frac{2a}{3b}$.

10 **(a)**

The circuit may be redrawn as shown in the adjacent figure

Here $E_{eq} = 12V, r_{eq} = \frac{2 \times 2}{2 + 2} = 1\Omega$

$$i = \frac{E_{\text{eq}}}{R + r_{\text{eq}}} = \frac{12}{5+1} = \frac{12}{6} = 2\Omega$$



11 **(c)**

$i = nAev_d$

or $v_d = \frac{i}{nAe}$

Total number of free electrons in the unit length of conductor, $N = nA \times 1$.

Total linear momentum of all free electrons per unit length

$$= (Nm)v_d = nAm \times \frac{i}{nAe} = \frac{i}{(e/m)} = \frac{i}{s}$$

12 **(b)**

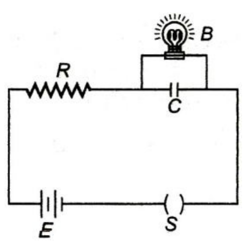
As $m = z\, I\, t = z\left(\frac{V}{R}\right)t$ $ie, m \propto Vt$

$\therefore \frac{m_2}{m_1} = \frac{V_2 t_2}{V_1 t_1}$

or $m_2 = \frac{V_2 t_2}{V_1 t_2} \times m_1 = \frac{6 \times 45 \times 2}{12 \times 30} = 1.5\text{g}.$

13 **(a)**

Neon bulb is filled with gas, so the resistance is infinite; hence no current flows through it.



Now, $V_c = E(1 - e^{-t/RC})$

$\Rightarrow \quad 120 = 200(1 - e^{-t/RC})$

$\Rightarrow e^{-t/RC} = \frac{2}{5}$

$\Rightarrow \quad t = RC \ln 2.5$

$\Rightarrow \quad R = \frac{t}{C \ln 2.5} = \frac{5}{2.303 \times 2 \times 10^6 \log 2.5}$

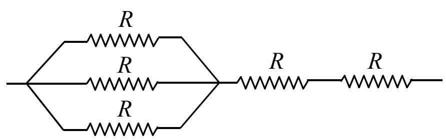
$= 2.7 \times 10^6 \, \Omega$

14 **(b)**

$v_d \propto 1/l$. Therefore, drift velocity is halued

15 **(b)**

$\frac{1}{R_P} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$



$\Rightarrow R_P = \frac{R}{3} \Omega$

$\Rightarrow R_S = R + R = 2\, R\Omega$

$\Rightarrow R_{\text{net}} = R_P + R_S = 2R + \frac{R}{3} = \frac{7R}{3} \Omega$

16 **(a)**

The resistivity of metal increases when it is converted into an alloy

$\therefore \; \rho' > \rho$

18 **(b)**

This is because of secondary ionisation which is possible in the gas filled in it

19 **(a)**

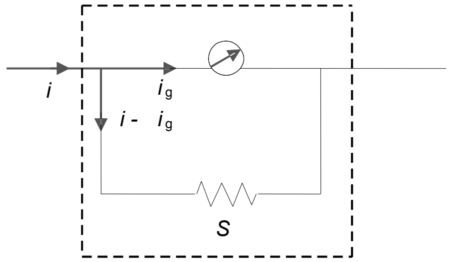
Using $R_{T_2} = R_{T_1}[1 + \alpha(T_2 - T_1)]$

$\Rightarrow R_{100} = R_{50}[1 + \alpha(100 - 50)]$

$\Rightarrow 7 = 5[1 + (\alpha \times 50)] \Rightarrow \alpha = \frac{(7-5)}{250} = 0.008/°\text{C}$

20 **(b)**

Ammeter is made by connecting a low resistance shunt S in parallel with galvanometer G. since G and S are in parallel, the potential difference across them is same.



Ammeter

$i_g \times G = (i - i_g) \times S$

Given, $G = R, i = 4i_g$

$$S = \frac{i_g}{4i_g - i_g} \times R = \frac{i_g}{3i_g} \times R = \frac{R}{3}$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	D	A	C	A	C	C	A	B	A
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	B	A	B	B	A	A	B	A	B