Physicsaholics

DPP – 3 (Current Electricity)

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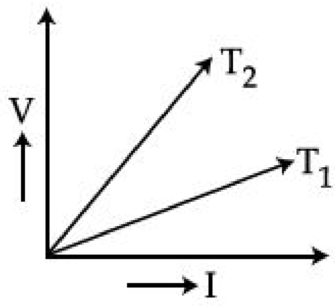
Q 1. An electric wire is connected across a cell of e.m.f. E. The current I is measured by an ammeter of resistance R. According to ohm's law:

(a) $E = I^2R$
(b) $E = IR$
(c) $E = \frac{I}{R}$
(d) $E = \frac{R}{I}$

Q 2. In Ohm's law experiment, potential drop across a resistance was measured as $v = 5\ Volt$ and current was measured as $i = 2\ amp$. If least count of the (voltage measuring device) and ammeter (current measuring device) are 0.1V and 0.01A respectively then find the maximum permissible error in measuring resistance:

(a) 1.5%
(b) 2.5%
(c) 1%
(d) 5%

Q 3. The voltage-current (V-I) graph of a metallic circuit at two different temperature T_1 and T_2 is shown, then:



(a) $T_1 < T_2$
(b) $T_1 > T_2$
(c) $T_1 = T_2$
(d) cant say anything

Q 4. By a cell a current of 0.9 A flows through 2 ohm resistor and 0.3 A through 7 ohm resistor. The internal resistance of the cell is:

(a) 0.5Ω
(b) 1.0Ω
(c) 1.2Ω
(d) 2.0Ω

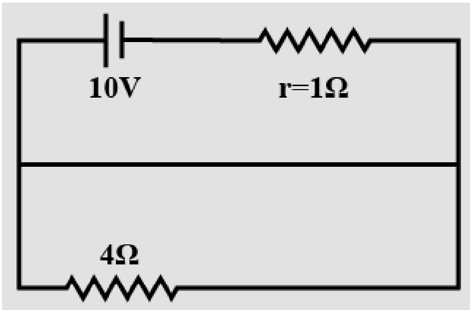
Q 5. A cell of e.m.f. E is connected with an external resistance R, then potential difference across cell is V. The internal resistance of cell will be:

(a) $\frac{(E-V)}{E}R$
(b) $\frac{(E-V)}{V}R$
(c) $\frac{(V-E)}{V}R$
(d) $\frac{(V-E)}{E}R$

Q 6. The potential difference in open circuit for a cell is 2.2 volts. When a 4 ohm resistor is connected between its two electrodes the potential difference becomes 2 volts. The internal resistance of the cell will be:

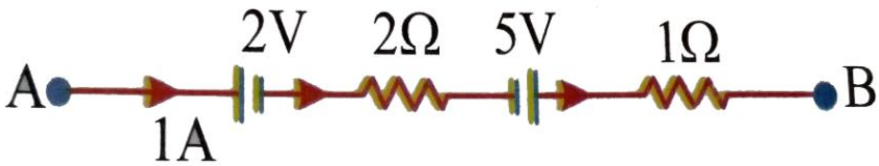
(a) 1 ohm (b) 0.2 ohm
(c) 2.5 ohm (d) 0.4 ohm

Q 7. Potential difference across the terminals of the battery shown in figure is - (r= internal resistance of battery)



(a) 8 V (b) 10 V
(c) 6 V (d) zero

Q 8. The potential difference between points A and B is:

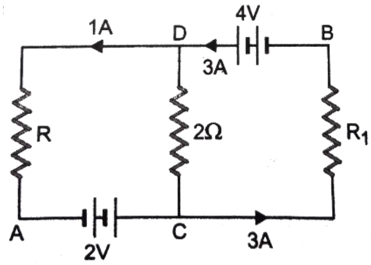


(a) 0 V (b) 2 V
(c) 1 V (d) 3 V

Q 9. The potential difference across terminals of a battery is 9V, when a current of 3.5A flows through it from its negative terminal to the positive terminal .When a current of 2A flows through in the opposite direction, the terminal potential difference is 12V. Find the internal resistance and emf of the battery:
(a) $0.545\Omega,\ 8.1\ V$ (b) $1.54\Omega,\ 8.1\ V$
(c) $0.545\Omega,\ 10.91\ V$ (d) $1.345\Omega,\ 9.1\ V$

Q 10. Kirchhoff's current law represents a mathematical statement of fact that:
(a) voltage cannot accumulate at node
(b) charge cannot accumulate at node
(c) charge at the node is infinite
(d) none of the mentioned

Q 11. In the given circuit assuming point A at zero potential use Kirchhoff's rules to determine the potential at point B:

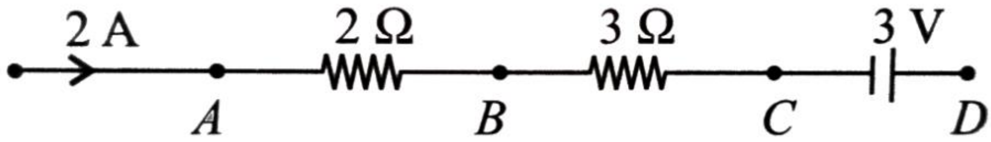


(a) 2 V
(b) 4 V
(c) 8 V
(d) 10 V

Q 12. If E is the emf of a cell of internal resistance r and external resistance R, then potential difference (V) across R is given as:

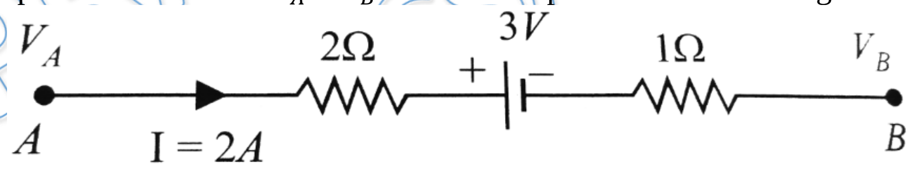
(a) $V = \frac{E}{R+r}$
(b) V = E
(c) $V = \frac{E}{1+\frac{r}{R}}$
(d) $V = \frac{E}{1+\frac{R}{r}}$

Q 13. In the given circuit the potential at point B is zero, the magnitude of potential at points A and D will be:



(a) $V_A = 4\,V, V_D = 9\,V$
(b) $V_A = 3\,V, V_D = 4\,V$
(c) $V_A = 9\,V, V_D = 3\,V$
(d) $V_A = 4\,V, V_D = 3\,V$

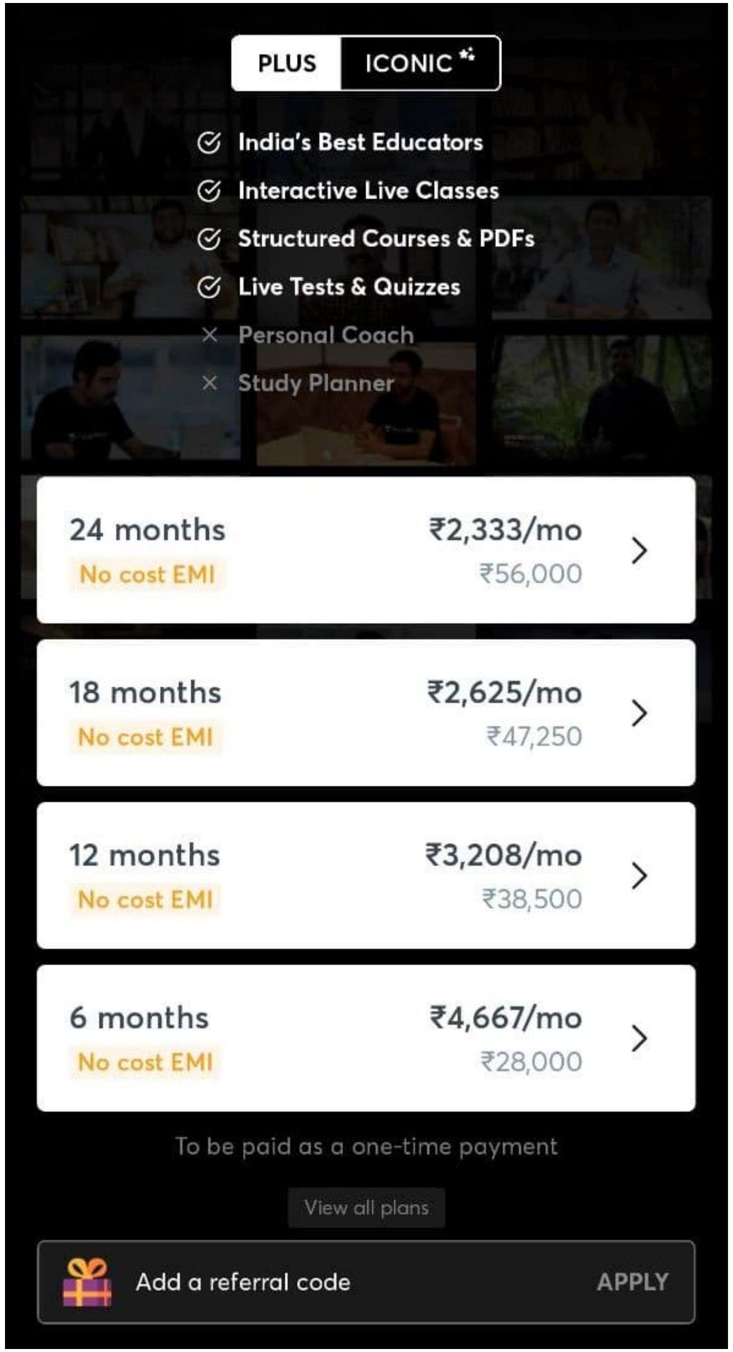
Q 14. The potential difference $V_A - V_B$ between the point A and B in the given figure is:



(a) $6\,V$
(b) $9\,V$
(c) $-3\,V$
(d) $3\,V$

Answer Key

Q.1 b	**Q.2 b**	**Q.3 a**	**Q.4 a**
Q.5 b	**Q.6 d**	**Q.7 d**	**Q.8 a**
Q.9 c	**Q.10 b**	**Q.11 a**	**Q.12 c**
Q.13 d	**Q.14 b**		



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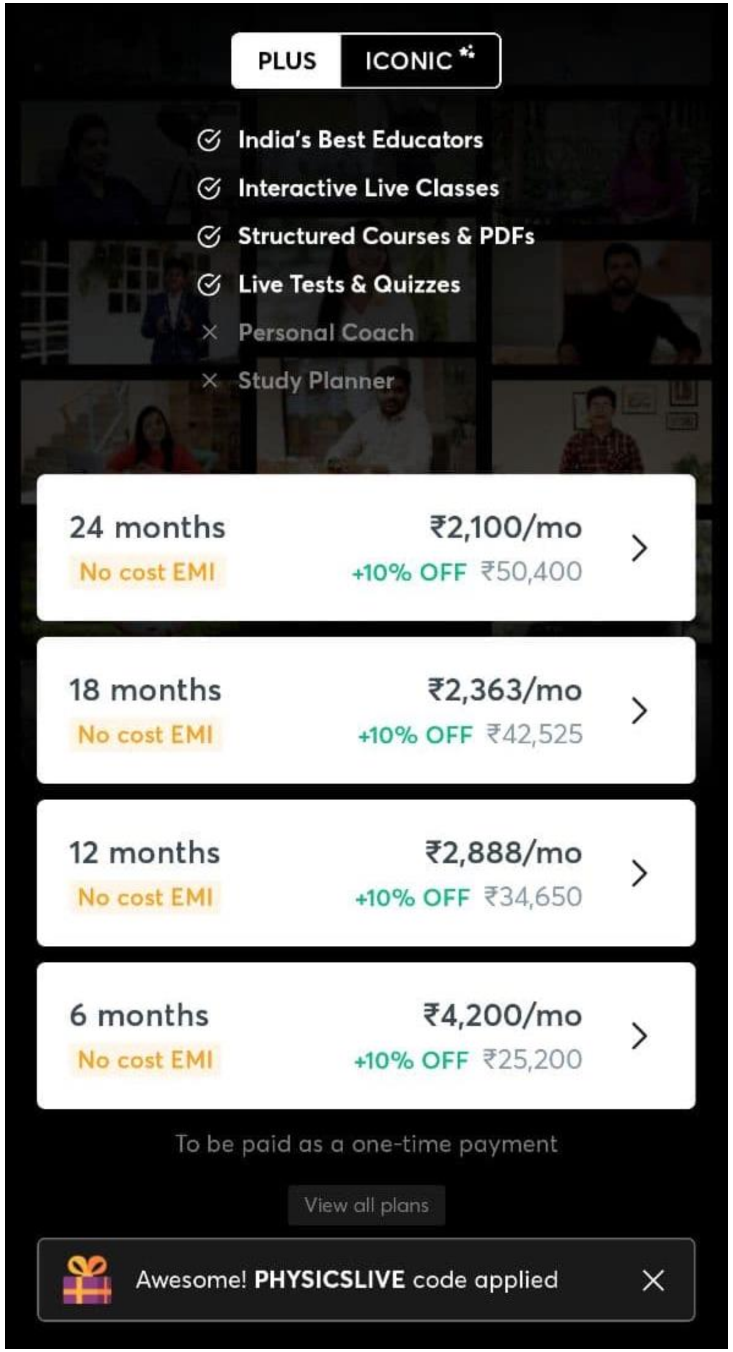

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Written Solution

DPP-3 Current Electricity: Ohm's Law, Battery and Kirchhoff's current law

By Physicsaholics Team

Solution: 1

By ohm's law

$$I \propto E$$

$$I = \frac{E}{R} \quad \left(\frac{1}{R} - \text{proportional constant}\right)$$

& R = Resistence

$$\therefore \boxed{E = IR}$$

Ans. b

Solution: 2

$$R = \frac{V}{I}$$

$$R = \frac{5}{2}\,\Omega = 2.5\,\Omega$$

$$\frac{\Delta R}{R} \times 100 = \frac{\Delta V}{V} \times 100 + \frac{\Delta I}{I} \times 100$$

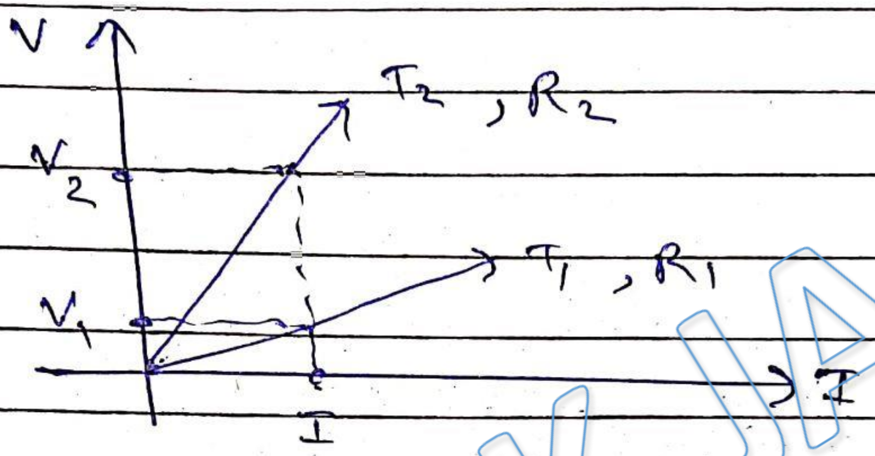
$$\% \Delta R = \frac{0.1}{5} \times 100 + \frac{0.01}{2} \times 100$$

$$= 2\% + 0.5\%$$

$$\boxed{\% \Delta R = 2.5\%}$$

Ans. b

Solution: 3



$V = IR$

when, I = constant or same

$V \propto R$

$V_2 > V_1 \Rightarrow R_2 > R_1$

when $T \uparrow \Rightarrow R \uparrow$

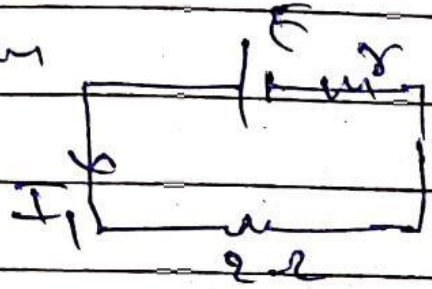
$\therefore$ $T_2 > T_1$

Ans. a

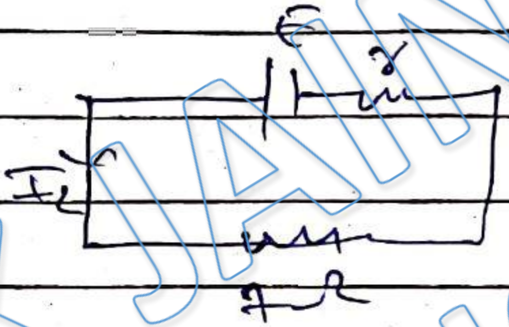
Solution: 4

Let internal resistance $= r$

then



&



$I_1 = \frac{E}{r+2} = 0.9$ $\quad$ $I_2 = \frac{E}{7+r} = 0.3$

$E = 0.9(r+2)$ — (1) $\quad$ $E = 0.3(7+r)$ — (2)

from eqn (1) & (2)

$0.9(r+2) = 0.3(7+r)$

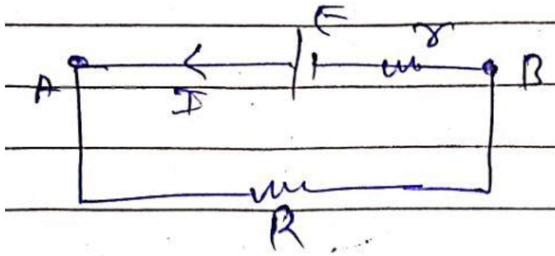
$r = \frac{1}{2}\Omega$

or

$r = 0.5\Omega$

Ans. a

Solution: 5



$$I = \frac{E}{R+r}$$

$V_A - V_B = V = ?$

$V_A - E + Ir = V_B$

$V_A - V_B = V = E - Ir$

$$V = E - \frac{E}{R+r} r$$

$$V = \frac{ER + Er - Er}{R+r}$$

$$V = \frac{ER}{R+r}$$

$V(R+r) = ER$

~~$r = V(R)$~~

$$r = \left(\frac{E-V}{V}\right)R$$

Ans. b

Solution: 6

Emf ; $\epsilon = 2.2$ Volt

$R = 4\,\Omega$

then ; $V = 2$ Volt

$\therefore r = \left(\frac{\epsilon - V}{V}\right)R$

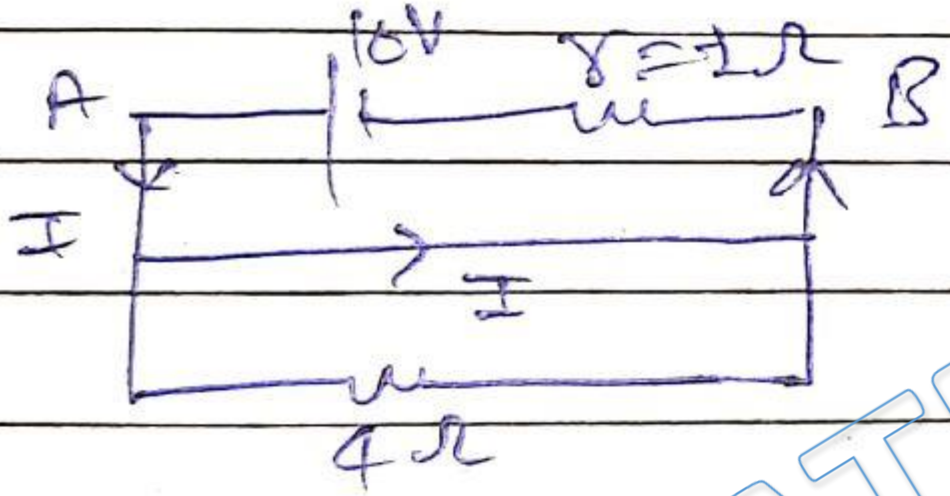
$= \frac{2.2 - 2}{2} \times 4$

$r = \frac{0.2}{2} \times 4$

$r = 0.4\,\Omega$

Ans. d

Solution: 7



current will not ~~go~~ flow in 1Ω resistance

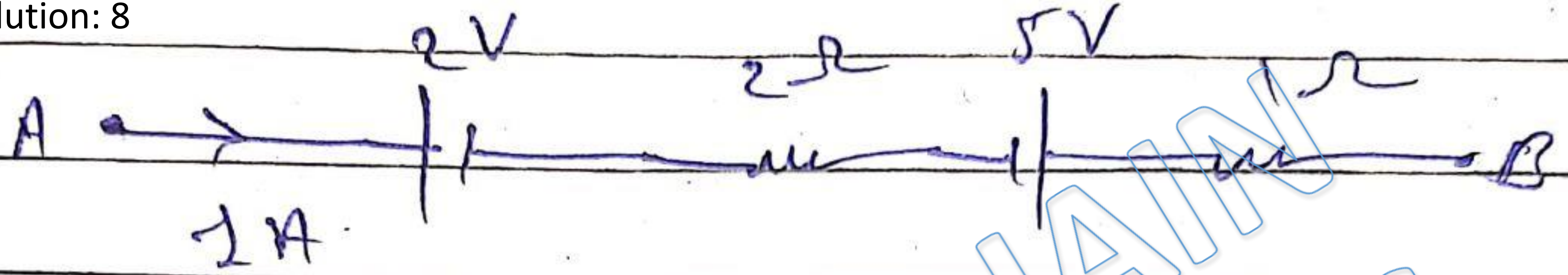
$I = \frac{10}{1} = 10$ Amp

$V_A - V_B = 10 - 10 \times 1$

$\boxed{V_A - V_B = \text{Zero}}$

Ans. d

Solution: 8



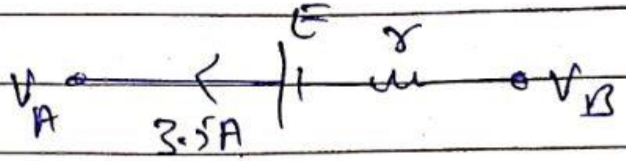
$$V_A - 2 - 1\times 2 + 5 - 1\times 1 = V_B$$

$$V_A - V_B = 2 + 2 - 5 + 1$$

$$V_A - V_B = \text{zero}$$ (a) 0 Volt

Ans. a

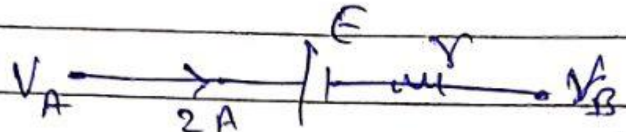
Solution: 9



$V_A - E + 3.5r = V_B$

$V_A - V_B = E - 3.5r$

$E - 3.5r = 9V$ — (1)



$V_A - E - 2r = V_B$

$V_A - V_B = E + 2r$

$E + 2r = 12\ V$ — (2)

eqn (2) − eqn (1) ⇒ $5.5r = 3$

$r = \frac{3}{5.5} = 0.545\,\Omega$

Put value of r in eqn (2)

$E = 10.91\,V$

∴ $r = 0.545\,\Omega$ & $E = 10.91\,V$

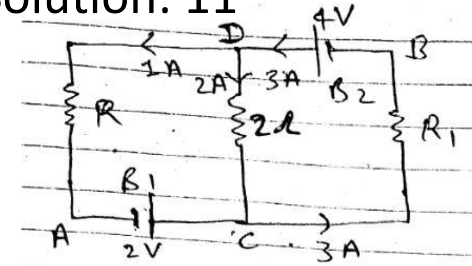
Ans. c

Solution: 10

Charge cannot accumulate at the node, it can only flow in and out of the node

Ans. b

Solution: 11



From kirchoff's current law at node D; $\Sigma I = 0$

$\therefore$ current in Branch DC

$I_{DC} = 2A$

Now for Battery B_1

$V_C - V_A = 2$ Volt

& $V_A = 0$ Volt (given)

$\therefore$ $\boxed{V_C = 2\text{ Volt}}$

& $I_{DC} = \frac{V_D - V_C}{2} = 2$

$\Rightarrow V_D - V_C = 4 \Rightarrow V_D = 4 + V_C$

$\Rightarrow \boxed{V_D = 6\text{ Volt}}$

Now for Battery B_2

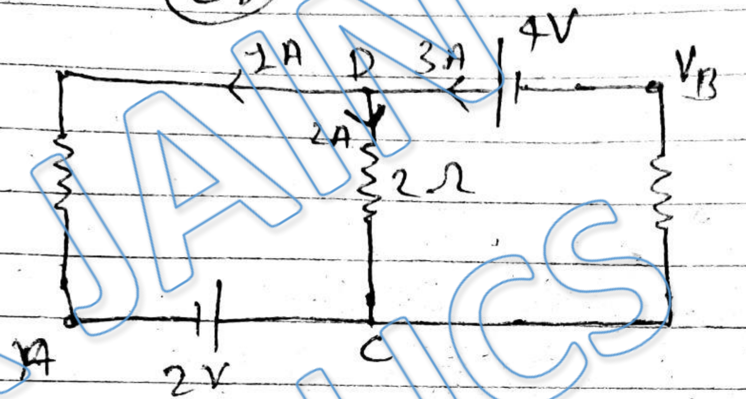
$V_D - V_B = 4$ Volt

$V_B = V_D - 4$ Volt

$V_B = 6 - 4$

$\boxed{V_B = 2\text{ Volt}}$

(or)



Current in DC will be

$I_{DC} = 3 - 1 = 2$ Amp

for the path

$A \rightarrow C \rightarrow D \rightarrow B$

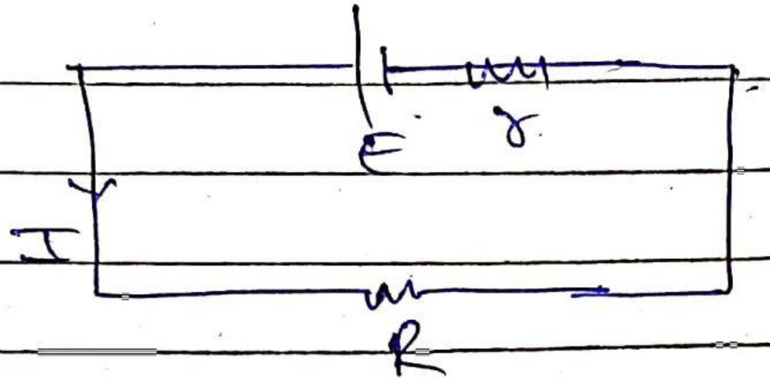
$V_A + 2 + 2 \times 2 - 4 = V_B$

$V_B = 2 + 4 - 4 + V_A$ ($V_A \rightarrow 0$)

$\boxed{V_B = 2\text{ Volt}}$

Ans. a

Solution: 12



$$R_{eq} = r + R$$

$$\therefore I = \frac{E}{R+r}$$

$$V = IR$$

$$V = \frac{E}{R+r} \times R = \frac{E}{\left(\frac{R+r}{R}\right)}$$

$$\boxed{V = \frac{E}{1 + \frac{r}{R}}}$$

Ans. c

Solution: 13

$V_B = 0$

$I_{AB} = 2\ \text{Amp} = \dfrac{V_A - V_B}{2}$

$V_A - V_B = 4$

$\boxed{V_A = 4\ \text{Volt}}$

Now

from B to D

$I = 2A$

$V_B - 2 \times 3 + 3 = V_D$

$V_D = V_B - 6 + 3$

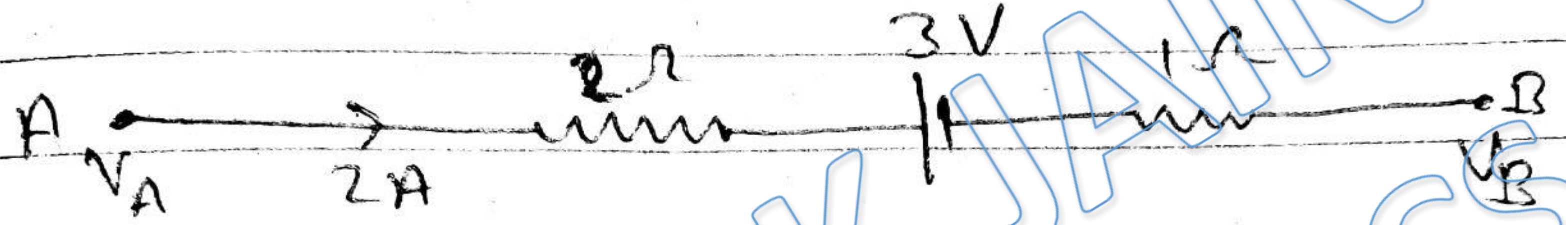
$= 0 - 6 + 3$

$\boxed{V_D = -3\ \text{Volt}}$

$\boxed{|V_A| = 4\ \text{Volt},\ |V_D| = 3\ \text{Volt}}$

Ans. d

Solution: 14



$$V_A - 2\times 2 - 3 - 1\times 2 = V_B$$

$$V_A - V_B = 2\times 2 + 3 + 1\times 2$$

$$\boxed{V_A - V_B = 9 \text{ Volt}}$$

Ans. b

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Chalo Niklo