# MT EDUCARE LTD.

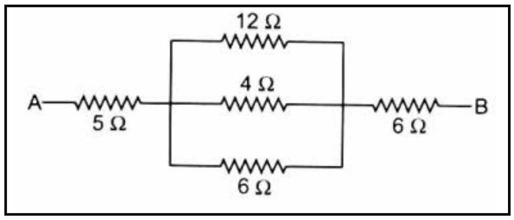
**ICSE X** SUBJECT : **PHYSICS**

**Current Electricity, Household Circuits (Numericals)**

**Assignment Sheet**

**STEP UP ANSWERSHEET**

26. In the given circuit, 4 Ω, 4 Ω and 4 Ω in series gives $R_1$ = 4 + 4 + 4 = 12 Ω and 2 Ω, 2 Ω and 2 Ω in series gives $R_2$ = 2 + 2 + 2 = 6 Ω.
Now, $R_1$ = 12 Ω, R2 = 6 Ω and $R_3$ = 4 Ω are in parallel.



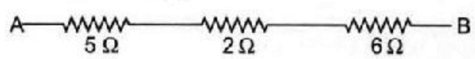

The equivalent resistance R' is given by

$$\frac{1}{R'} = \frac{1}{12} + \frac{1}{4} + \frac{1}{6}$$

$$= \frac{1+3+2}{12} = \frac{6}{12}$$

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

$$R' = 2\Omega$$




Total resistance = 5 + 2 + 6 = 13 Ω. **(ICSE 2013)**

27. (i) We know, $V = IR'$

$6 = 0.5 \times R'$

$R' = 12\ \Omega$

$R' = 3 + R$

$12 = 3 + R$

$R = 90$

(ii) Charge, $q = I\,t$

$q = 0.5 \times 120 = 60$ coulomb

(iii) Power dissipation, $P = I^2R$

$P = 0.52 \times 3 = 0.75$ W **(ICSE 2013)**

28. $R' = n^2R$

$= 2^2 \times 6 = 24\Omega$. **(ICSE 2013)**

29. **(29 and 31 Same Answer)**

$$\frac{1}{R_1} = \left(\frac{1}{3} + \frac{1}{3} + \frac{1}{3}\right)$$

$\Rightarrow \quad \frac{1}{R_1} = 1$

$\Rightarrow \quad R_1 = 1\Omega$

$R_2 = 5\Omega$

$\frac{1}{R_3} = \frac{1}{4}+\frac{1}{6}=\frac{10}{24}$

$\Rightarrow \quad R_3 = \frac{24}{10}\Omega$

$\therefore$ Equivalent resistance can be calculated as,

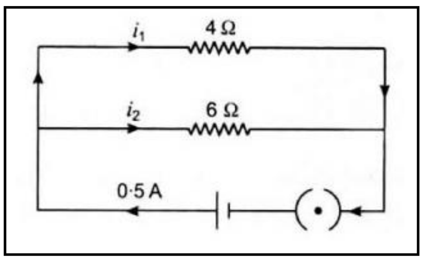
$R_{eq.} = R_1 + R_2 + R_3$

$= 1 + 5 + \frac{24}{10}$

$R = 8.4\Omega$ **(ICSE 2014)**

30. **(30 and 32 Same Answer)**

(i)




(ii) $\frac{1}{R} = \frac{1}{4}+\frac{1}{6}$

$R = 2.4\Omega$

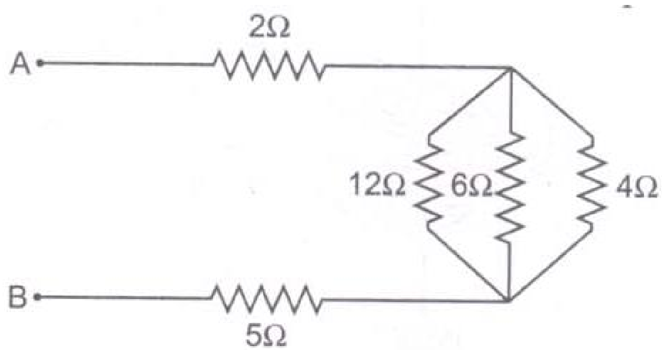
Now, $V = IR$

$V = 0.5 \times 2.4 = 1.2V$

$i_1 = \frac{V}{R_1} = \frac{1.2}{4} = 0.3A$

$i_2 = \frac{1.2}{6} = 0.2A$ **(ICSE 2014)**

33. Three resistance 12Ω, 6Ω and 4Ω are combined in parallel.

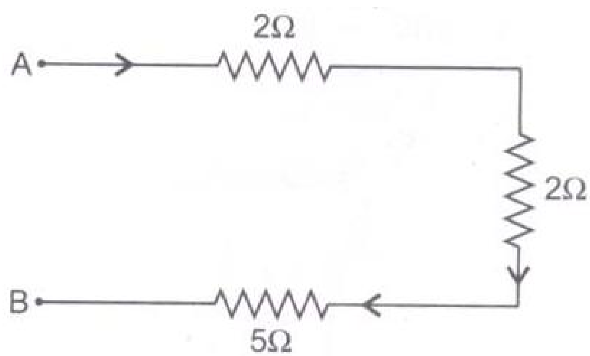



The equivalent resistance in parallel is given by

$\frac{1}{R_P} = \frac{1}{12}+\frac{1}{6}+\frac{1}{4}$

$$\frac{1}{R_P} = \frac{1+2+3}{12}$$

$$\frac{1}{R_P} = \frac{12}{(1+2+3)} = 2\Omega$$




Now, 2Ω, $R_p$ and 5Ω are in series.
Thus, the equivalent resistance between A and B = 2Ω + 2Ω + 5Ω = 9Ω

**(ICSE 2015)**

34. The resistance of 4.5 Ω and 9 Ω are connected in parallel
∴ Equivalent resistance,

$$R_1 = \frac{(4.5 \times 9)}{(4.5 + 9)} = \frac{40.5}{13.5} = 3\Omega$$

Total resistance in the circuit (R) = 1.2 + 0.8 + 3 = 5Ω

(i) Current in the circuit (I) = Reading of the ammeter

$$= \frac{\text{Total e.m.f. (E)}}{\text{Total resistance (R)}}$$

$$= \frac{2}{5} \text{ amperes} = 0.4 \text{ ampere}$$

(ii) Potential difference across the terminals of the cell (V)
= total p.d in the external circuit
= E – Ir
= 2 – (0.4 × 1.2)
= 2 – 0.48
= 1.52 volts

**(ICSE 2015)**

35. Given : $I$ = 400 mA = 400 × $10^{-3}$ A = 0.4 A, V = 12 V

(i) Resistance $R = \frac{V}{I} = \frac{12}{0.4} = 30\Omega$

(ii) Current drops to $I'$ = 320 mA = 320 × $10^{-3}$ A = 0.32 A
Now battery voltage V = I'R = 0.32 × 30 = 9.6 V

**(ICSE 2016)**

36. Given : R = 20 Ω, $I$ = 2.5 A, $t$ = 5 min = 5 × 60 s = 300 s
Heat produced $H = I^2Rt = (2.5)^2 \times 20 \times 300 = 3.75 \times 10^4$ J

**(ICSE 2016)**

37. $\varepsilon = 12$ V, $r = 2\ \Omega$, $R_A = 4\ \Omega$, $R_B = 6\ \Omega$, $t = 1$ min $= 60$ s

(i) Total resistance of circuit R $= R_A + R_B + r = 4 + 6 + 2 = 12\ \Omega$

Current in the circuit I $= \dfrac{\varepsilon}{R} = \dfrac{12V}{12\Omega} = 1$ A

(ii) Terminal voltage of the battery V $= \varepsilon - IR = 12 - 1 \times 2 = 10$ V

(iii) p.d. across the resistor B (of 6 Ω) $V_B = IR_B = 1 \times 6 = 6$ V

(iv) Electrical energy spent in resistor A (= 4 Ω) $= 1^2 R_A t$

$= (1)^2 \times 4 \times 60 = 240$ J

**(ICSE 2016)**

38. Given, R = 500 Ω, $I = 0.4$ A.

Power of bulb $P = I^2R = (0.4)^2 \times 500 = 80$ W.

Potential difference at the ends of the bulb $V = IR = 0.4 \times 500 = 200$ V.

**(ICSE 2017)**

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