

1) Calculate the Resistance of
a 0.30m long Copper wire of
Cross-Section area $5 \times 10^{-6} \text{ m}^2$
[Resistivity of Copper is $1.7 \times 10^{-8} \Omega \text{ m}$]

Soln

$$L = 0.30 \text{ m}$$

$$A = 5 \times 10^{-6} \text{ m}^2$$

$$\rho = 1.7 \times 10^{-8} \Omega \text{ m}$$

$$R = ?$$

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

$$= \frac{1.7 \times 10^{-8} \times 0.3}{5 \times 10^{-6}}$$

$$R = 1.02 \times 10^{-3} \Omega$$

$$R = 1.02 \text{ m}\Omega$$

$$10^{-3} = \text{m}\Omega$$

2) Repeat question ① with silicon
for silicon $\rho = 2300 \Omega m$

Soln.

$$L = 0.3 m$$

$$A = 5 \times 10^{-6} m^2$$

$$\rho = 2300 \Omega m$$

$$R = \rho \cdot \frac{L}{A}$$

$$R = \frac{2300 \times 0.3}{5 \times 10^{-6}} = 138 \times 10^6 \Omega.$$

$$10^3 \rightarrow \text{kilo} \rightarrow k$$

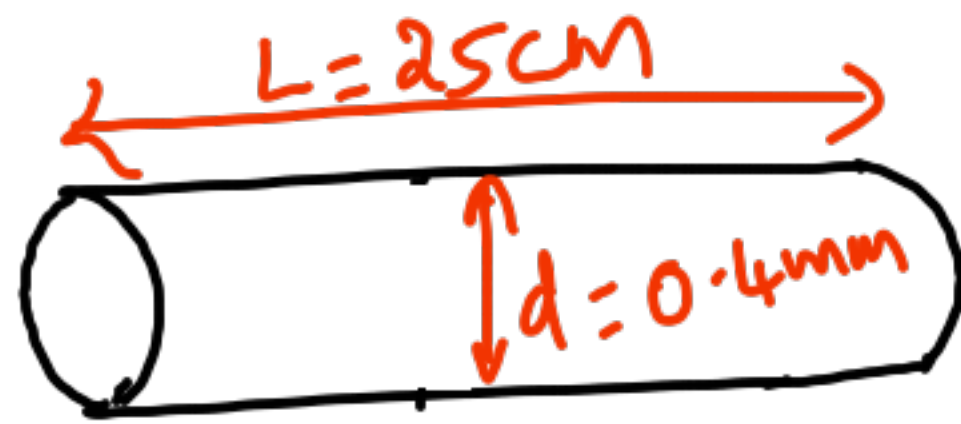
$$10^6 \rightarrow \text{mega} \rightarrow M$$

$$10^9 \rightarrow \text{Giga} \rightarrow G$$

3) Calculate the Resistivity of a metal wire of cross-section diameter 0.4mm, if a 25cm length of this wire has a resistance of 6Ω

Soln.

$$\rho = ?$$



$$d = 0.4\text{mm} = 0.4 \times 10^{-3}\text{m}$$

$$L = 25\text{cm} = 25 \times 10^{-2}\text{m}$$

$$R = 6\Omega$$

$$\rho = \frac{RA}{L}$$

Area of cylinder (or) wire.

$$A = \pi r^2$$

$$A = \pi \left(\frac{d}{2}\right)^2$$

$$A = \pi \left(\frac{0.4 \times 10^{-3}}{2}\right)^2$$

$$A = 1.3 \times 10^{-7}\text{m}^2$$

$$r = \frac{d}{2}$$

$$\rho = \frac{6 \times 1.3 \times 10^{-7}}{25 \times 10^{-2}}$$

$$\rho = 3.01 \times 10^{-6} \Omega m$$

4) Calculate the Resistivity of a material with a Resistance of 2Ω , Cross sectional area of 25 cm^2 and the length of 15 cm .

Soln:

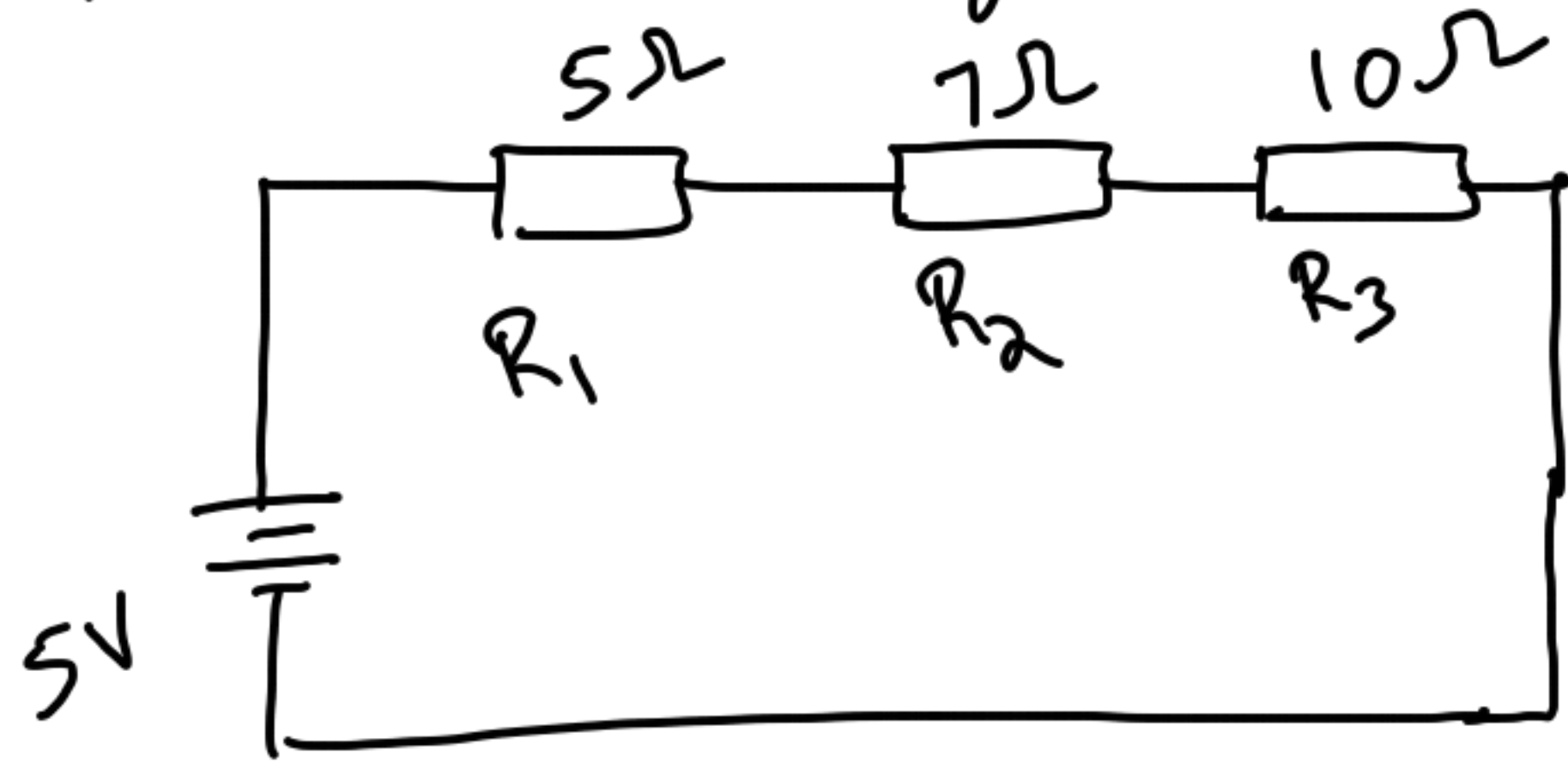
$$R = 2 \Omega$$

$$A = 25 \text{ cm}^2 = 25 \times 10^{-4} \text{ m}^2$$

$$L = 15 \text{ cm} = 15 \times 10^{-2} \text{ m}$$

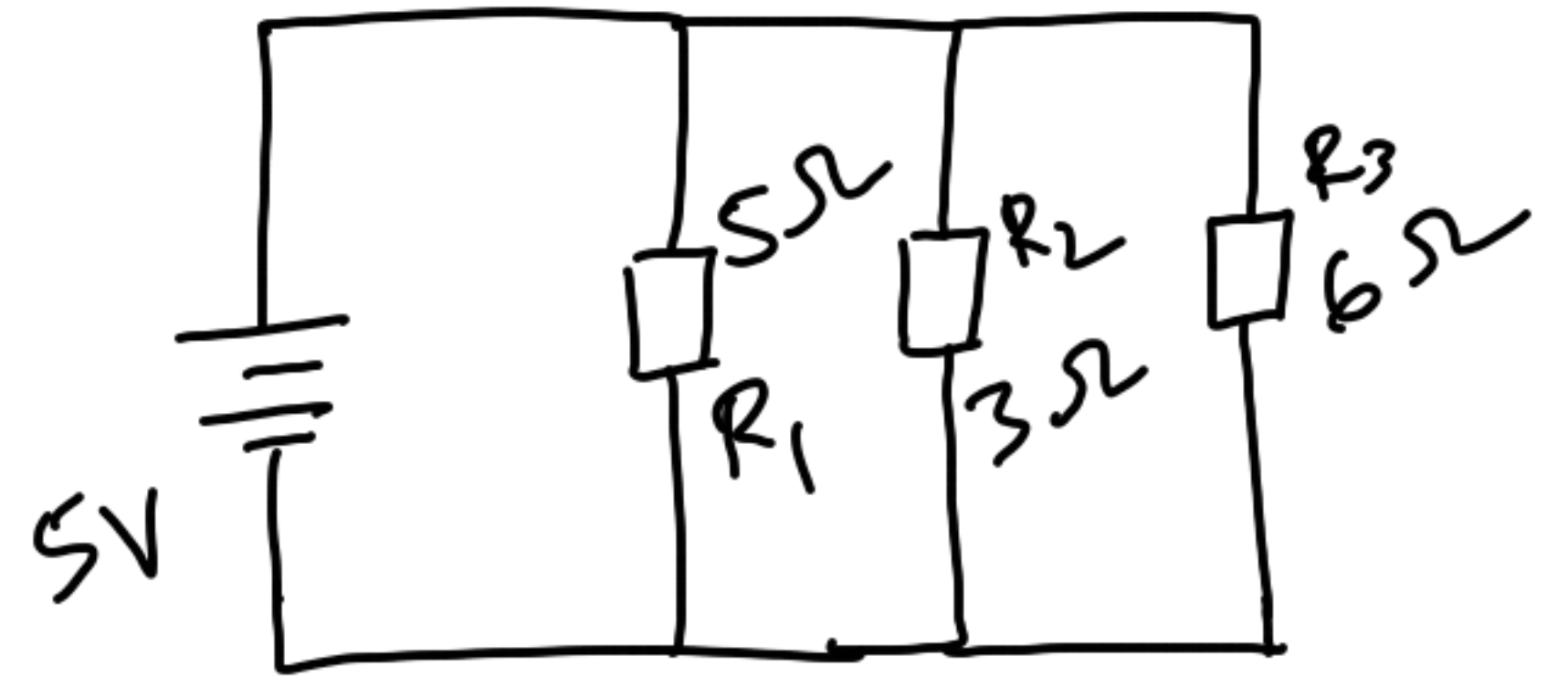
$$\rho = \frac{RA}{L} = \frac{2 \times 25 \times 10^{-4}}{15 \times 10^{-2}} = 33.3 \times 10^{-3} \Omega m$$

5) Calculate the equivalent Resistance for the circuit given below.



$$R_{\text{total}} = R_1 + R_2 + R_3 \\ = 5 + 7 + 10 = 22\Omega$$

6) Calculate the equivalent Resistance for the circuit given below.

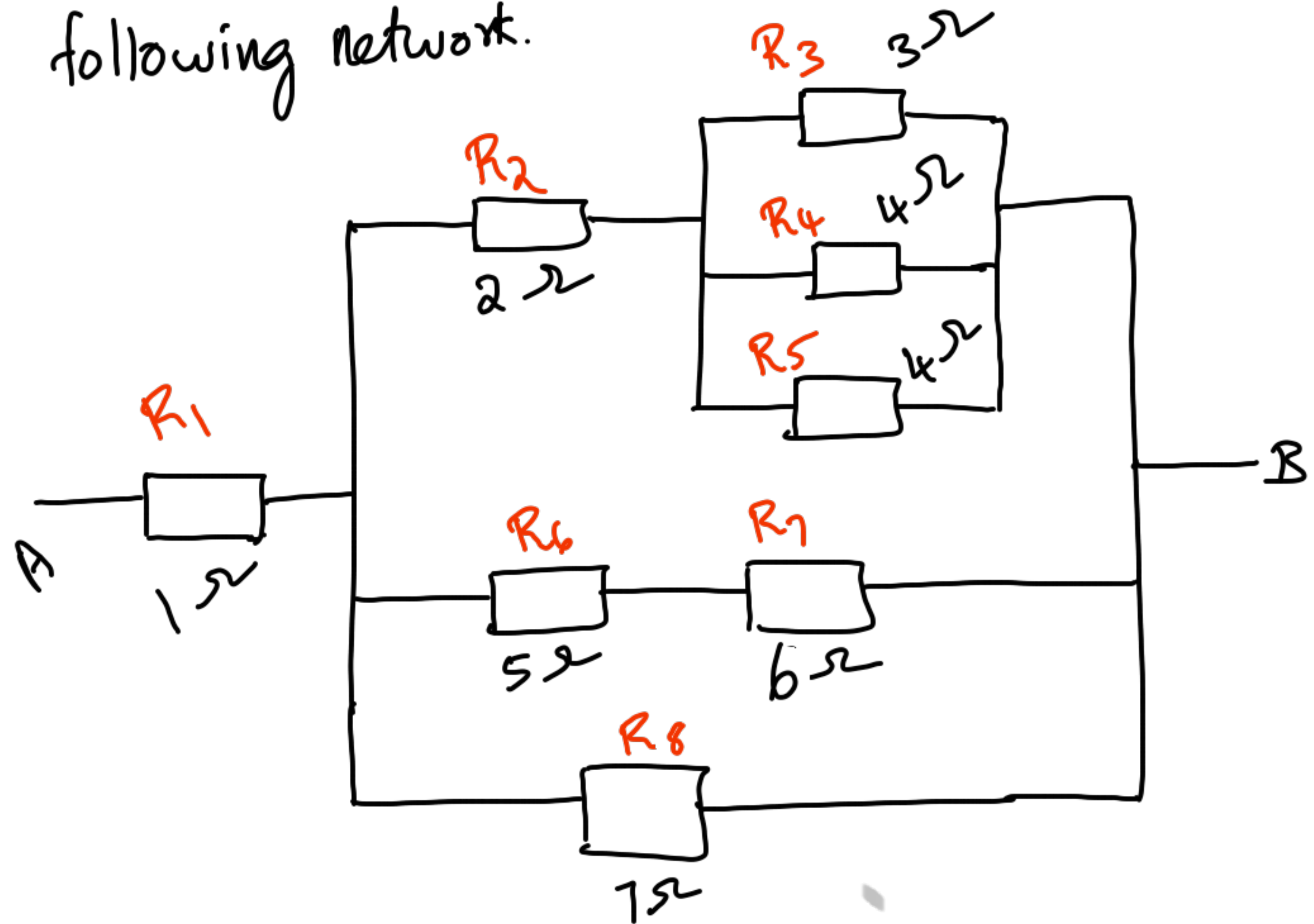


$$\frac{1}{R_{\text{tot}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$
$$R_{\text{tot}} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

$$R_{tot} = \frac{1}{\frac{1}{5} + \frac{1}{3} + \frac{1}{6}}$$

$$R_{tot} = 1.43 \Omega$$

7) Calculate the total Resistance in the following network.



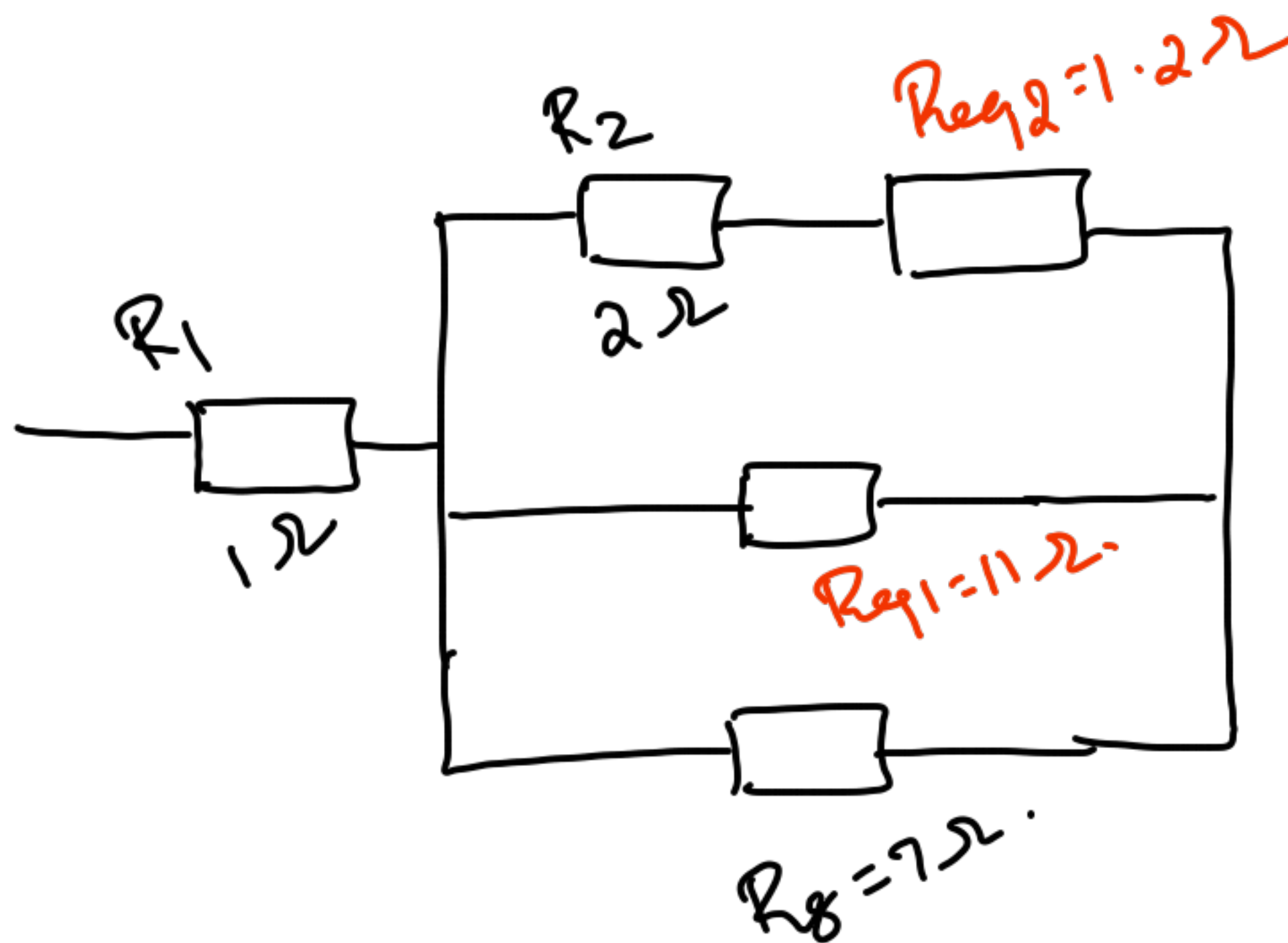
Soln.

R_6 and R_7 in series

$$R_{eq1} = R_6 + R_7 = 5 + 6 = 11\Omega$$

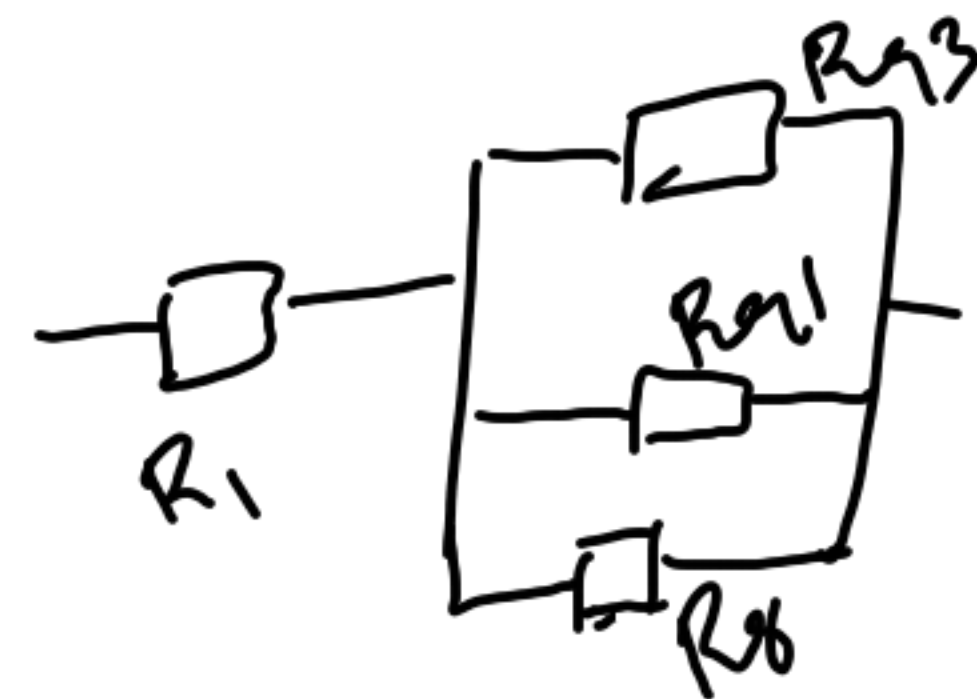
R_3 , R_4 and R_5 are in parallel

$$R_{eq2} = \frac{1}{\frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}}$$
$$= \frac{1}{\frac{1}{3} + \frac{1}{4} + \frac{1}{4}} = 1.2\Omega$$
$$R_{eq2} = 1.2\Omega$$



R_2 and R_{eq2} are in series

$$R_{eq3} = R_2 + R_{eq2} = 2 + 1.2 = 3.2\Omega$$



R_{eq3} , R_{eq1} and R_8 are in parallel

$$R_{eq4} = \frac{1}{\frac{1}{R_{eq3}} + \frac{1}{R_{eq1}} + \frac{1}{R_8}}$$

$$= \frac{1}{\frac{1}{3.2} + \frac{1}{11} + \frac{1}{7}}$$

$$R_{eq4} = 1.83 \Omega.$$

$$R_{tot} = R_1 + R_{eq4} = 1 + 1.83 = 2.83 \Omega.$$