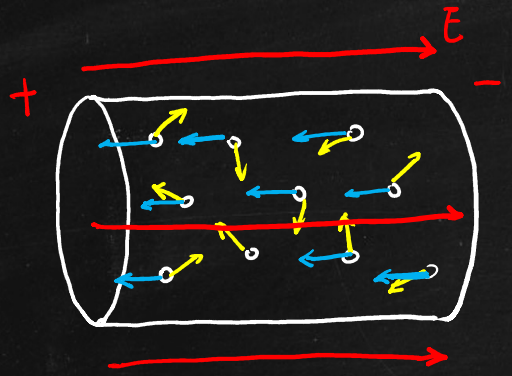


Conductor electron $q = -e = -1.6\times10^{-19}\,C$

insulator

drift speed v

$dq = dV \cdot n \cdot q = dl \cdot A \cdot nq$

$= v\,dt\,A\,nq$

current $i = \dfrac{dq}{dt}$

$1A = \dfrac{1C}{1s} = 1C/s$

charge carrier

$dq = i\,dt \qquad \int dq = \int i\,dt \qquad Q = \int_0^t i\,dt$

Resistance $R = \rho \dfrac{l}{A}$

ρ — resistivity

l — length

A — cross-sectional Area.

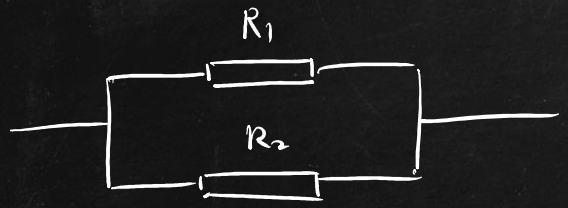
$i = nAvq$

n — charge carrier density

v — drift velocity q — charge

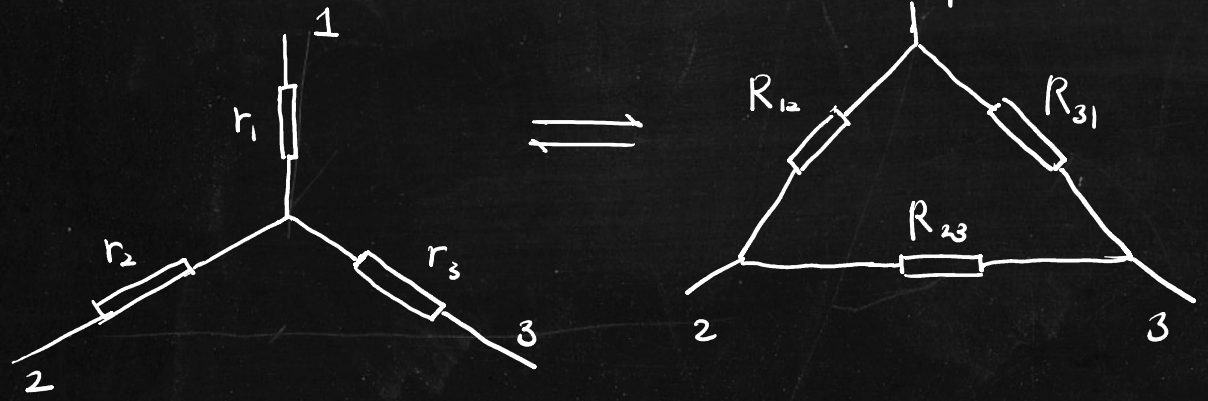
$$R = \frac{V}{I} \qquad V = IR$$

$$R = R_1 + R_2 \quad \text{in series}$$



$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} \quad \text{in parallal}$$

Y – Δ Transform / Star – Δ transform

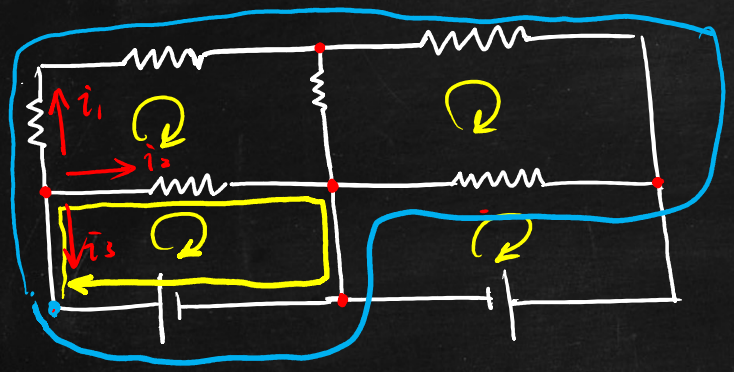


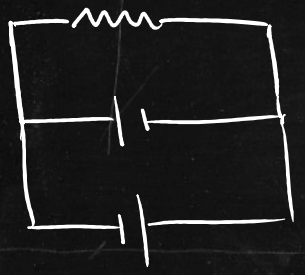
$$\begin{cases} R_{12} = r_1 + r_2 + \dfrac{r_1 \cdot r_2}{r_3} \\ R_{23} = r_2 + r_3 + \dfrac{r_2 r_3}{r_1} \\ R_{31} = r_3 + r_1 + \dfrac{r_3 r_1}{r_2} \end{cases}$$

$$\begin{cases} r_1 = \dfrac{R_{12} \cdot R_{31}}{R_{12} + R_{23} + R_{31}} \\ r_2 = \dfrac{R_{23} R_{12}}{R_{12} + R_{23} + R_{31}} \end{cases} \qquad r_3 = \frac{R_{31} \cdot R_{23}}{R_{12} + R_{23} + R_{31}}$$

$P = VI$ $\quad P = I^2R = \frac{V^2}{R}$

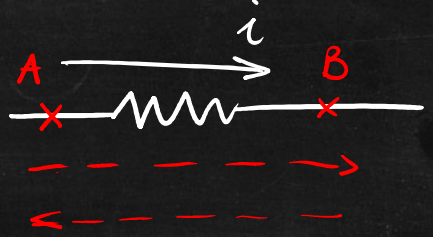
Kirchoff's Law





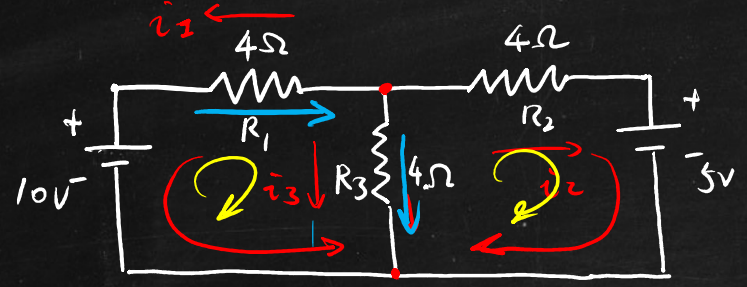
junction. $\sum i = 0$ $\quad i_1 + i_2 + i_3 = 0$

Circle $\sum V = 0$



$-Ki$

Ri



$$\begin{cases} i_1+i_2+i_3=0 \\ i_1R_1-i_3R_3+10=0 \\ -i_2R_2-5+i_3R_3=0 \end{cases} \Rightarrow \begin{cases} i_1+i_2+i_3=0 \\ 4i_1-4i_3+10=0 \\ -4i_2-5+4i_3=0 \end{cases}$$

$$4i_1-4i_3+10=0 \Rightarrow i_1=\frac{4i_3-10}{4}$$

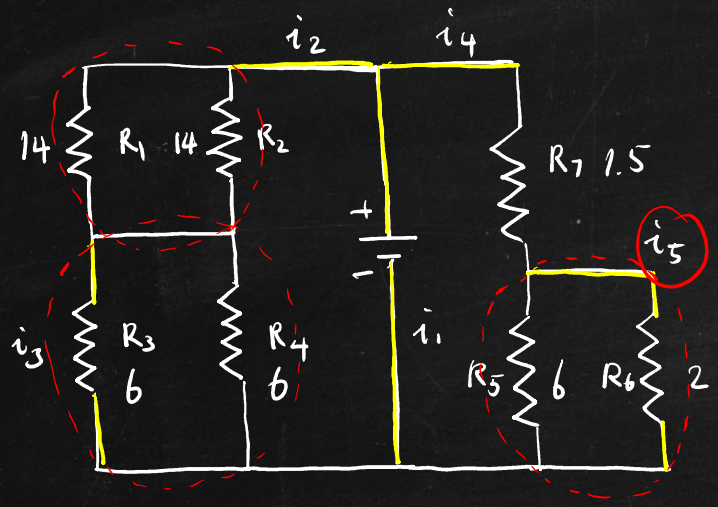
$$-4i_2-5+4i_3=0 \Rightarrow i_2=\frac{4i_3-5}{4}$$

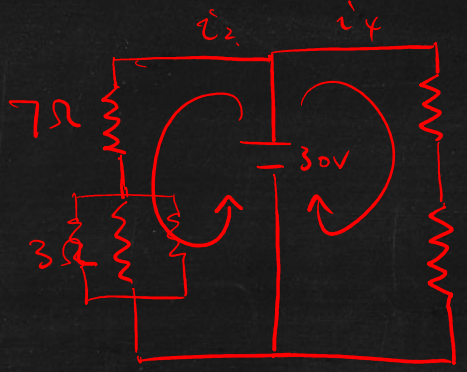
$$\frac{4i_3-10}{4}+\frac{4i_3-5}{4}+i_3=0$$

$$3i_3-\frac{15}{4}=0 \qquad i_3=\frac{5}{4}=1.25\ (A)$$

$$i_1=\frac{5-10}{4}=-\frac{5}{4}\ (A) \qquad i_2=\frac{5-5}{4}=0$$

P826 72





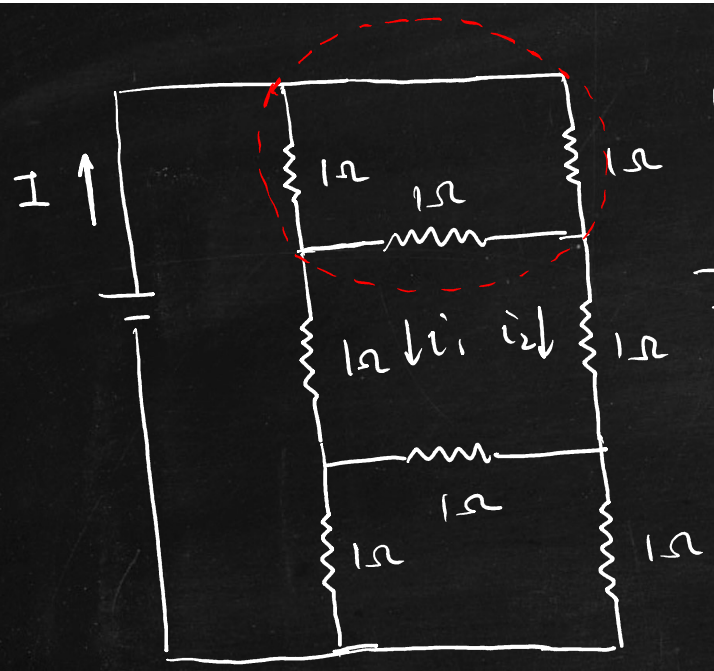
$$R = \frac{R_1 R_2}{R_1 + R_2}$$

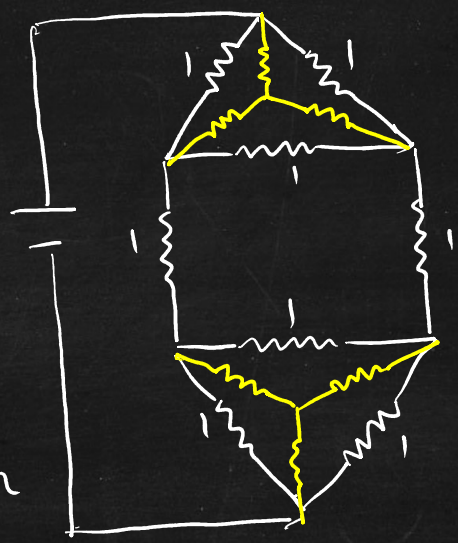
$$\frac{6 \times 2}{6+2} = \frac{12}{8} = 1.5\,(\Omega)$$

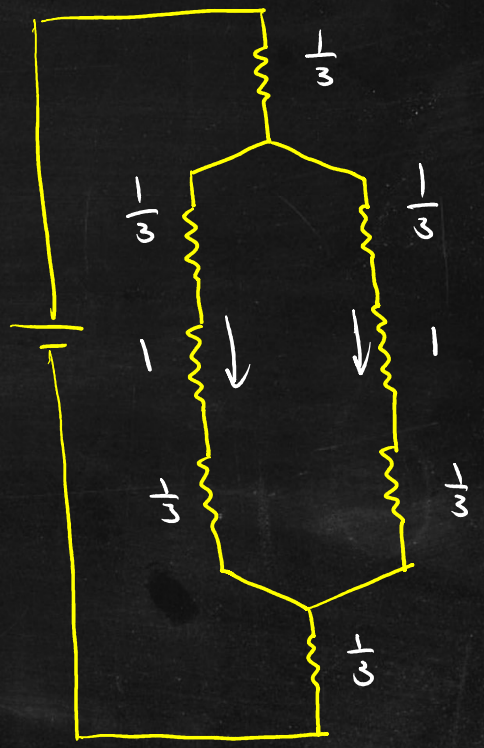
$i_2 = 3\,A \quad i_3 = 1.5\,A \quad i_4 = 10\,A \quad i_1 = i_2 + i_4 = 13\,(A)$

$I_5 \cdot R_5 = i_5 \cdot R_6$

$$\frac{I_5}{i_5} = \frac{R_6}{R_5} = \frac{2}{6} = \frac{1}{3} \qquad i_5 = 7.5\,(A)$$

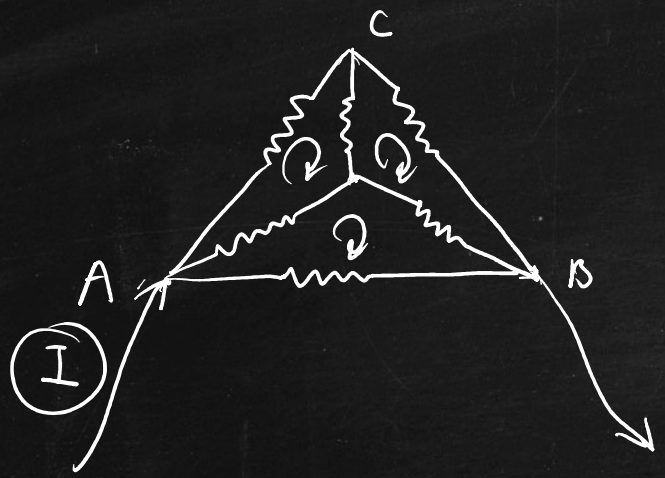


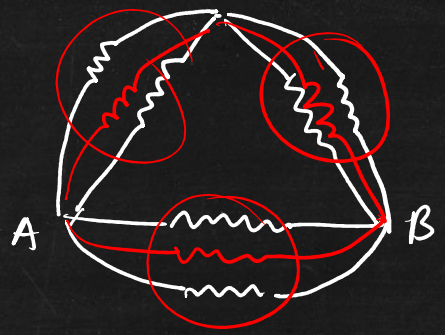




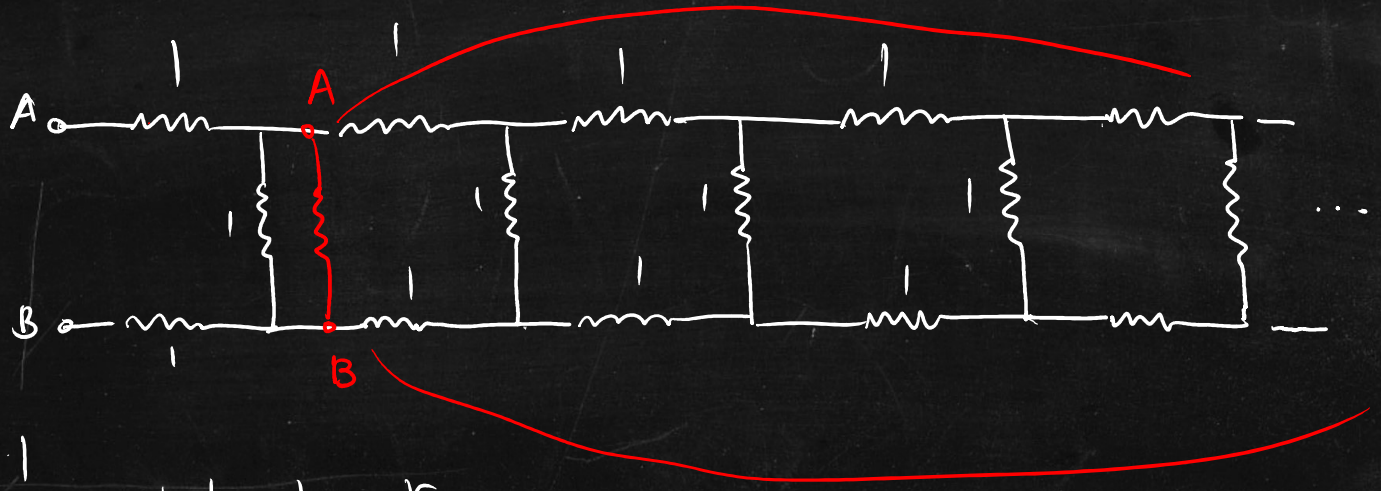
$$R_{12} = R_{23} = R_{31} = 1$$

$$r_1 = \frac{R_{12} R_{31}}{R_{12} + R_{23} + R_{31}} = \frac{1 \times 1}{1 + 1 + 1} = \frac{1}{3} \quad \cdots$$





ex.



$$\frac{r_{AB} \cdot 1}{r_{AB} + 1} + 1 + 1 = r_{AB}$$