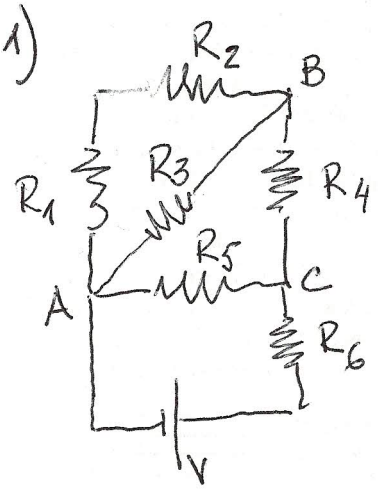
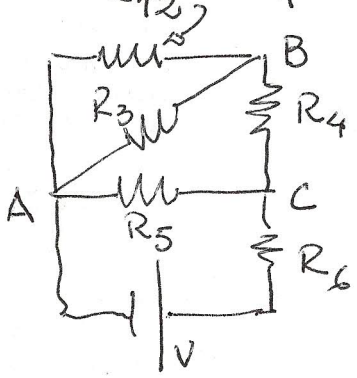
1)



(i) same current through R_1 & R_2

$\Rightarrow$ in series:

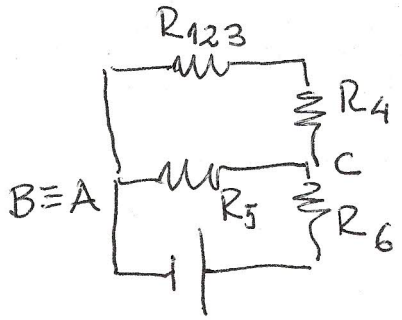
$$R_{12} = R_1 + R_2 = 2R$$



(ii) same voltage drop across R_3 & R_{12} $(= V_B - V_A)$

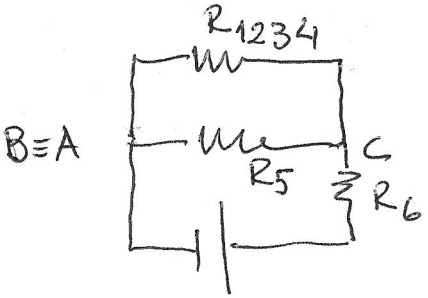
$\Rightarrow$ in parallel: $\frac{1}{R_{123}} = \frac{1}{R_{12}} + \frac{1}{R_3} = \frac{1}{2R} + \frac{1}{R} = \frac{3}{2R}$

$$\Rightarrow R_{123} = \frac{2R}{3}$$



(iii) same current through R_4 & R_{123} $\Rightarrow$ in series:

$$R_{1234} = R_4 + R_{123} = R + \frac{2R}{3} = \frac{5R}{3}$$

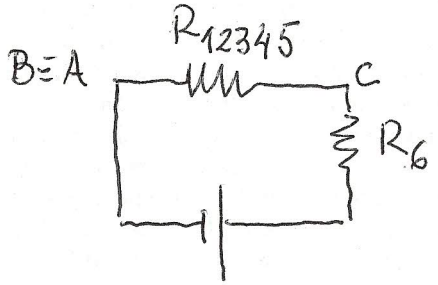


(iv) same voltage across R_5 & R_{1234} $(= V_C - V_B)$ $\Rightarrow$

in parallel: $\frac{1}{R_{12345}} = \frac{1}{R_5} + \frac{1}{R_{1234}} = \frac{1}{R} + \frac{1}{5R/3} = \frac{8}{5R}$

$$\Rightarrow R_{12345} = 5R/8$$

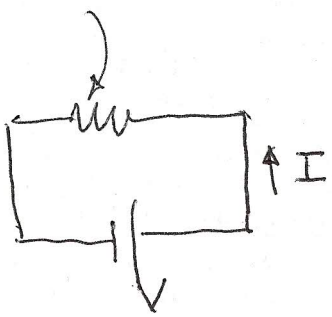
(next page)



(v) same current through R_6 & R_{12345} => in series:

$$R_{123456} = R_6 + R_{12345} = R + \frac{5R}{8} = \frac{13R}{8} = R_{eq}$$

(vi)



Ohm's law:

$$I = \frac{V}{R_{eq}} = \frac{V}{13R/8} = \frac{8V}{13R}$$

I is current through battery & $R_6 = I_6$

2) $$V_C = V_{battery} - I_6 R_6 = V - \frac{8V}{13R} \cdot R = \frac{5V}{13}$$

Ohm's law: current through R_5 is $I_5 = \frac{\Delta V_{AC}}{R_5}$

$V_A = 0$ (by choice!) $\Rightarrow I_5 = \frac{5V}{13R}$

charge conservation: at C, current in = current off

$\Rightarrow I_4$ (through R_4) $= I_6 - I_5 = \frac{8V}{13R} - \frac{5V}{13R} = \frac{3V}{13R}$

3) $$V_B = V_C - I_4 R_4 = \frac{5V}{13} - \frac{3V}{13R} \cdot R = \frac{2V}{13}$$

Ohm's law: current through R_3 is $I_3 = \frac{\Delta V_{AB}}{R_3} =$

$$= \frac{2V/13}{R} = \frac{2V}{13R}$$