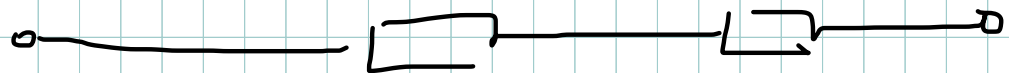
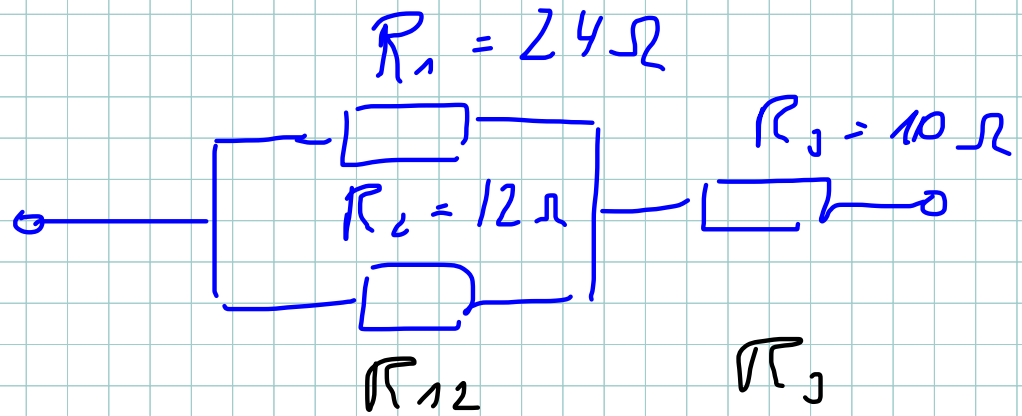
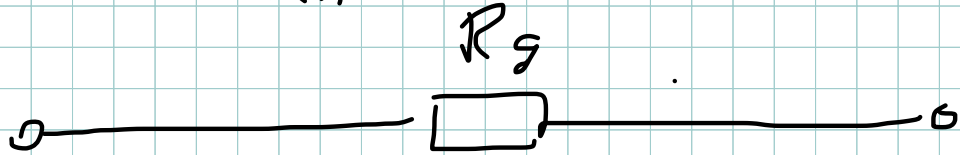


5.1

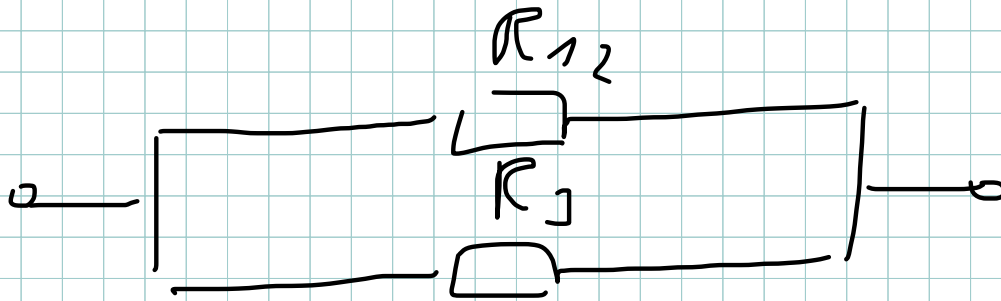
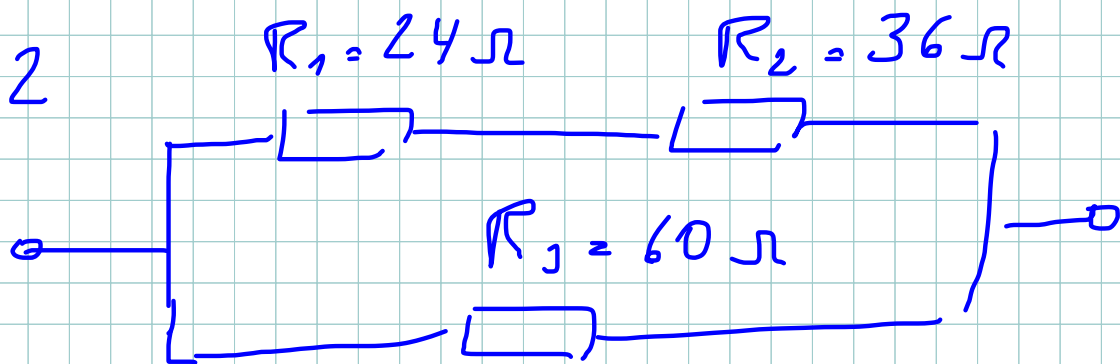


$$R_{12} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{24 \cdot 12}{24 + 12} = 8 \Omega$$

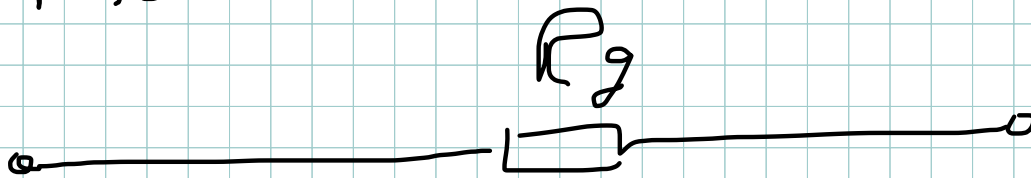


$$R_g = R_{12} + R_3 = 8 + 10 = 18 \Omega$$

5.2

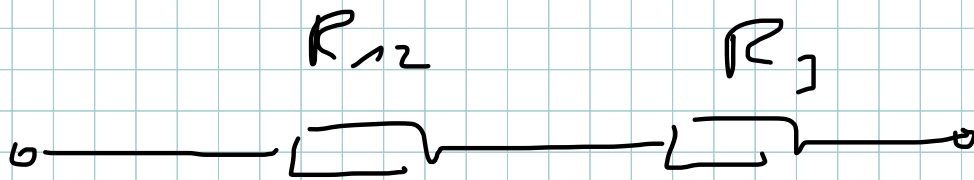
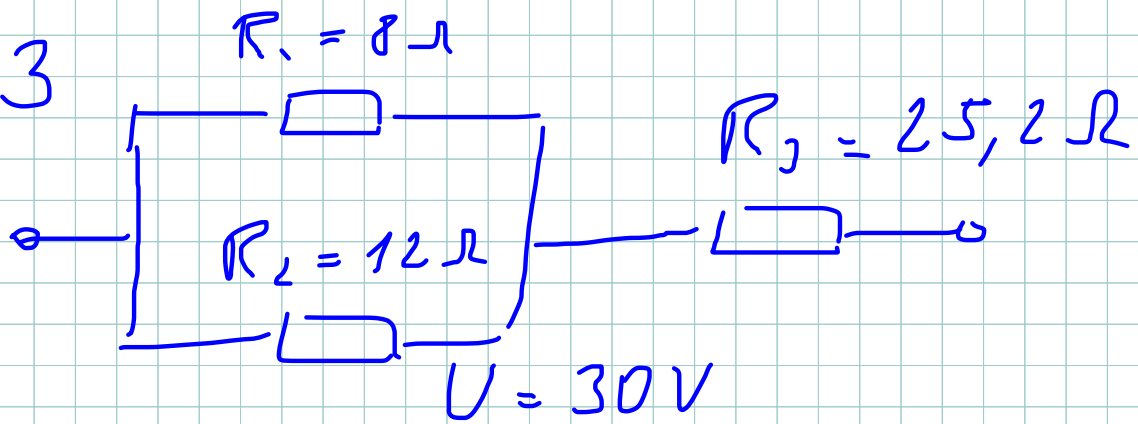


$$R_{12} = R_1 + R_2 = 24 + 36 = 60 \Omega$$

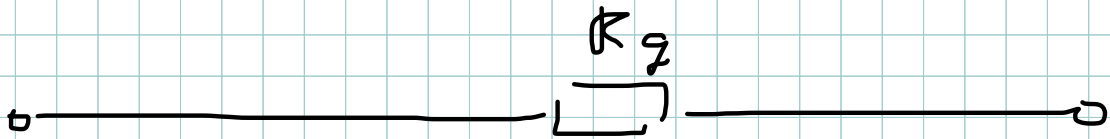


$$R_g = \frac{R_{12} \cdot R_3}{R_{12} + R_3} = \frac{60 \cdot 60}{60 + 60} = 30 \Omega$$

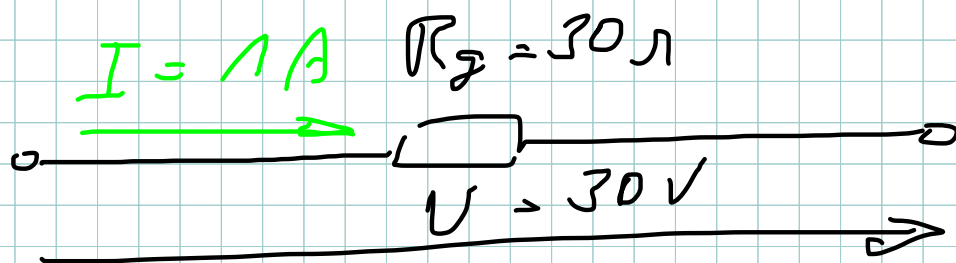
5.3



$$R_{12} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{8 \cdot 12}{8 + 12} = 4,8 \Omega$$

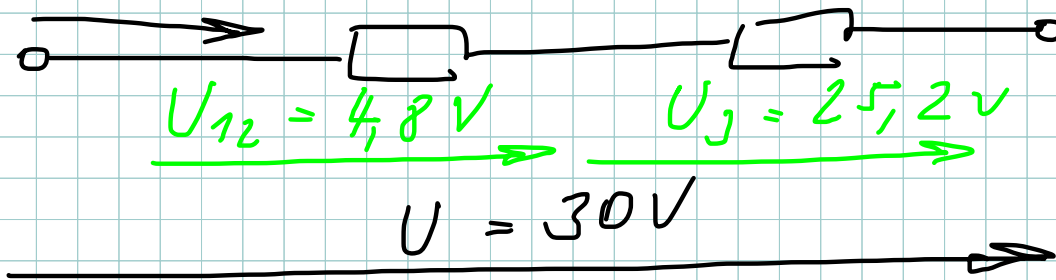


$$R_g = R_{12} + R_3 = 4,8 + 25,2 = 30 \Omega$$



$$I = \frac{U}{R} = \frac{30}{30} = 1 \text{ A}$$

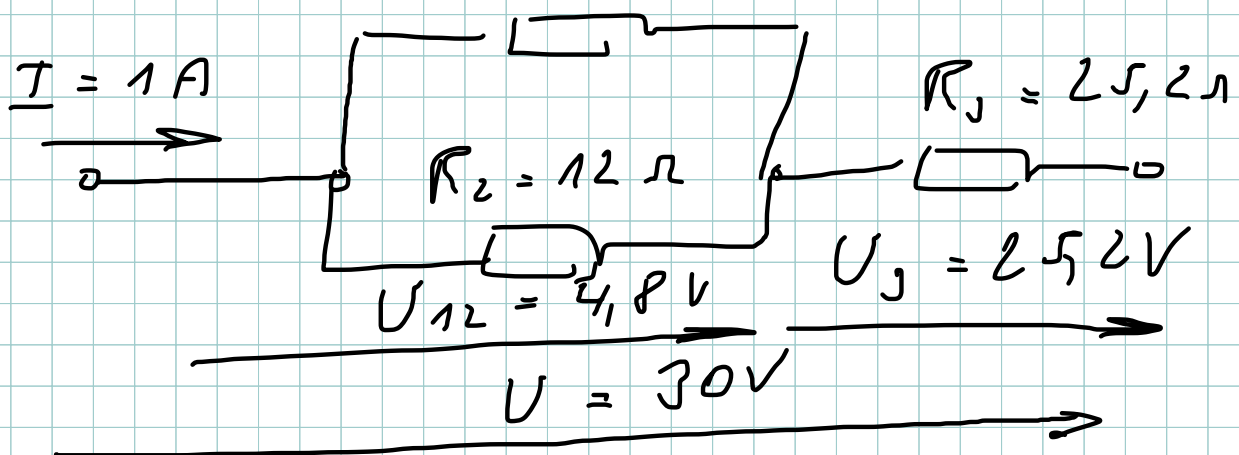
$$I = 1 \text{ A} \quad R_{12} = 4,8 \Omega \quad R_3 = 25,2 \Omega$$



$$U_{12} = I \cdot R_{12} = 1 \cdot 4,8 = 4,8 \text{ V}$$

$$U_3 = I \cdot R_3 = 1 \cdot 25,2 = 25,2 \text{ V}$$

$$R_1 = 8 \Omega$$



$$U_1 = U_2 = 4,8 \text{ V} \quad U_3 = 25,2 \text{ V}$$

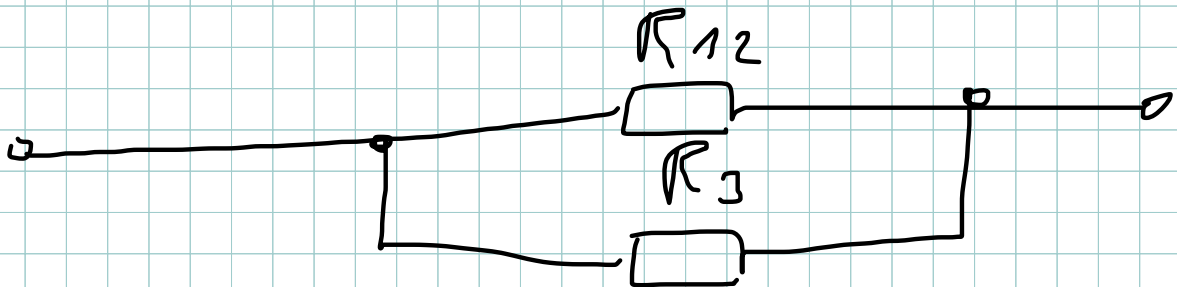
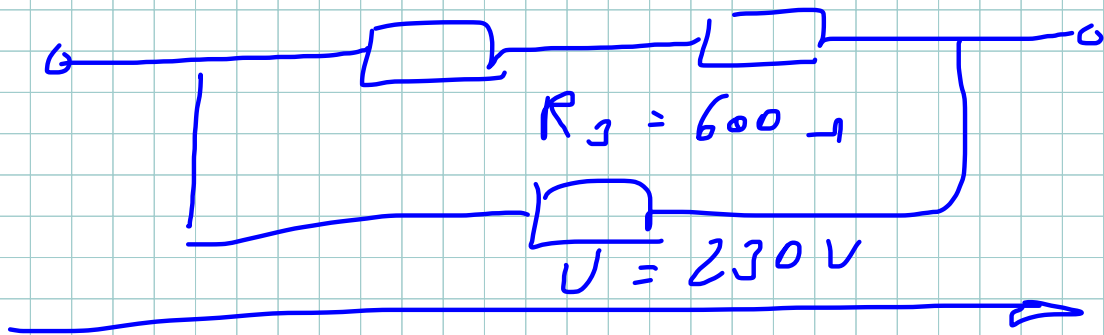
$$I_3 = 1 \text{ A}$$

$$I_1 = \frac{U_1}{R_1} = \frac{4,8}{8} = 0,6 \text{ A}$$

$$I_2 = \frac{U_2}{R_2} = \frac{4,8}{12} = 0,4 \text{ A}$$

5.4

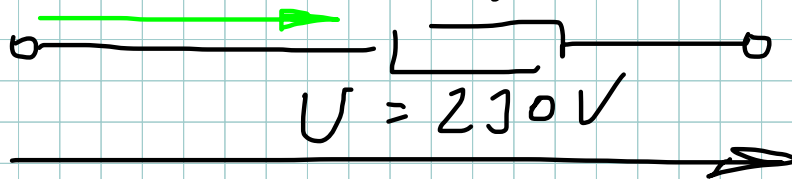
$$R_1 = 60 \Omega \quad R_2 = 240 \Omega$$



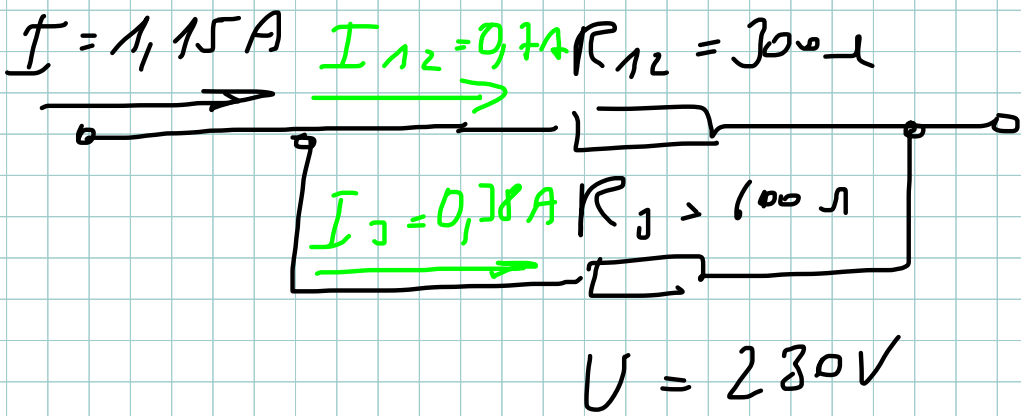
$$R_{12} = R_1 + R_2 = 60 + 240 = 300 \Omega$$

$$R_g = \frac{R_{12} \cdot R_3}{R_{12} + R_3} = \frac{300 \cdot 600}{300 + 600} = 200 \Omega$$

$$I = 1,15 \text{ A} \quad R_g = 200 \Omega$$



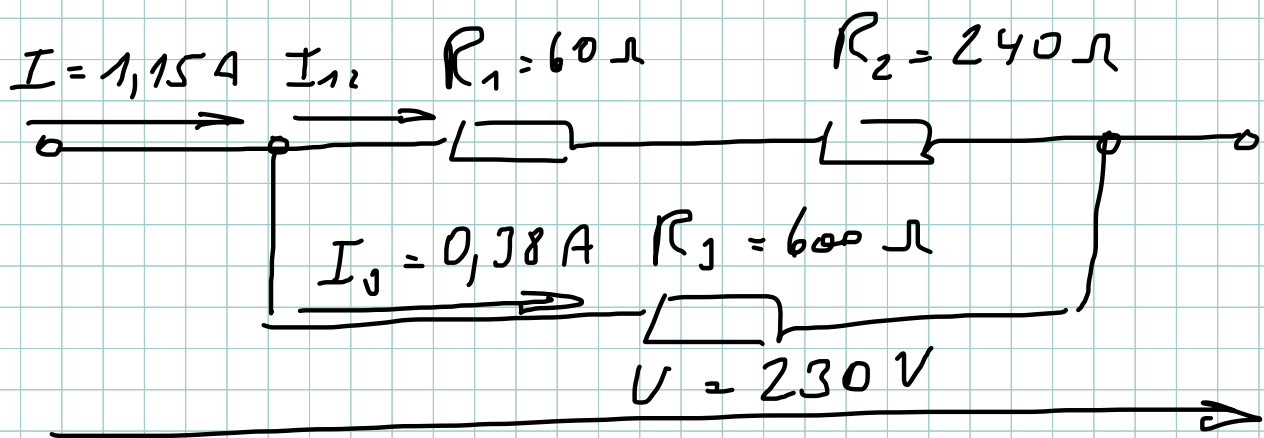
$$I = \frac{U}{R} = \frac{230}{200} = 1,15 \text{ A}$$



$$I_{12} = \frac{U}{R_{12}} = \frac{230}{300} = 0,76 \text{ A}$$

$$I_J = \frac{U}{R_J} = \frac{230}{600} =$$

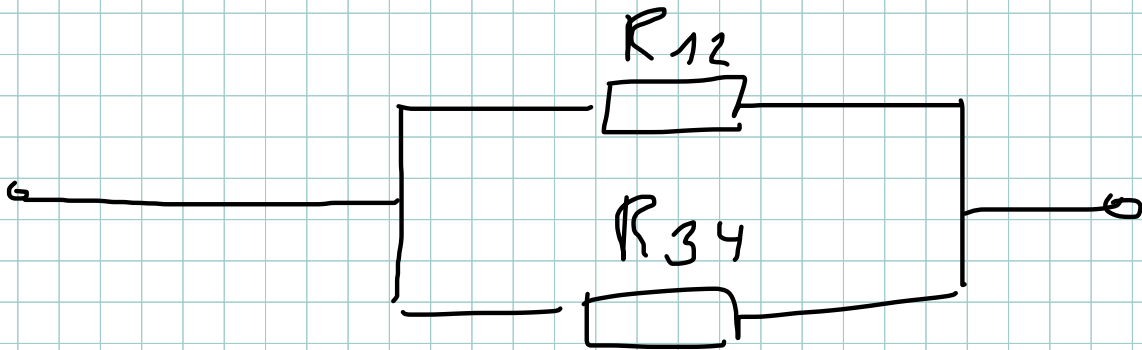
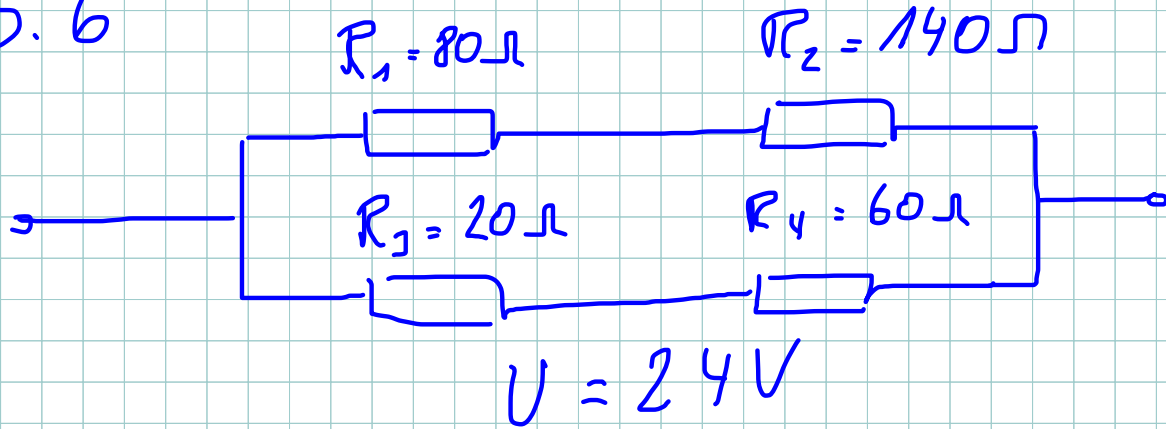
$$= I - I_{12} = 1,15 - 0,76 = 0,38 \text{ A}$$



$$U_1 = I_1 \cdot R_1 = 0,76 \cdot 60 = 45,6 \text{ V}$$

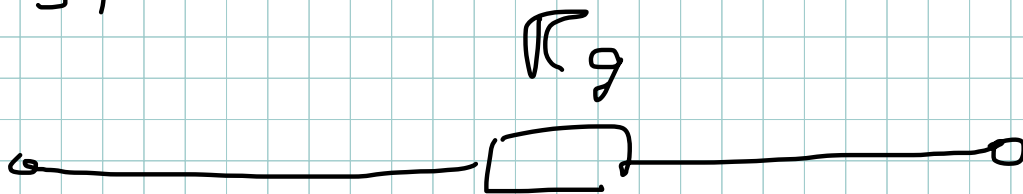
$$\begin{aligned}
 U_2 &= I_2 \cdot R_2 = 0,76 \cdot 240 = \\
 &= U - U_1 = 230 - 45,6 = 184,4 \text{ V}
 \end{aligned}$$

5.6



$$R_{12} = R_1 + R_2 = 80 + 140 = 220 \Omega$$

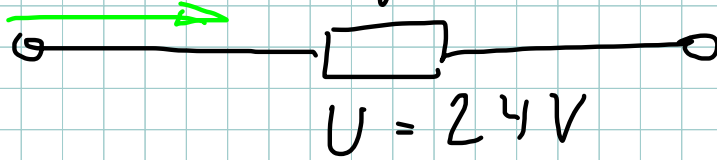
$$R_{34} = R_3 + R_4 = 20 + 60 = 80 \Omega$$



$$R_g = \frac{R_{12} \cdot R_{34}}{R_{12} + R_{34}} = \frac{220 \cdot 80}{220 + 80} = 58,7 \Omega$$

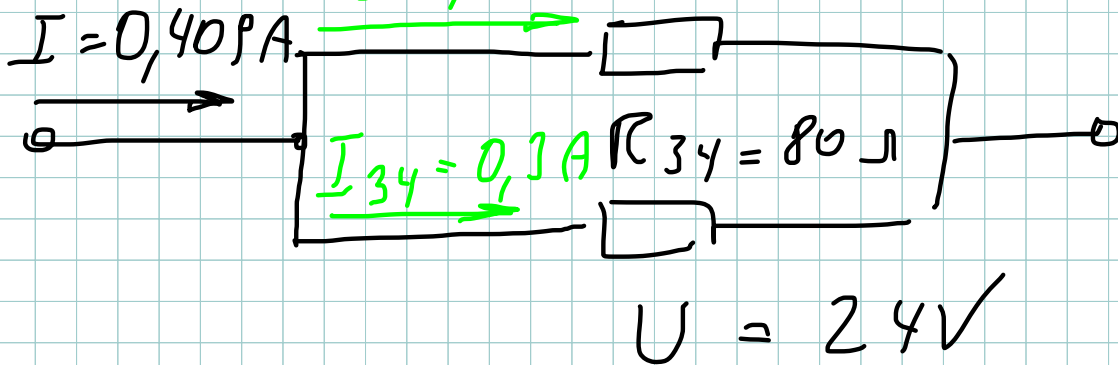


$$I = 0,40 \text{ A} \quad R_g = 58,7 \Omega$$



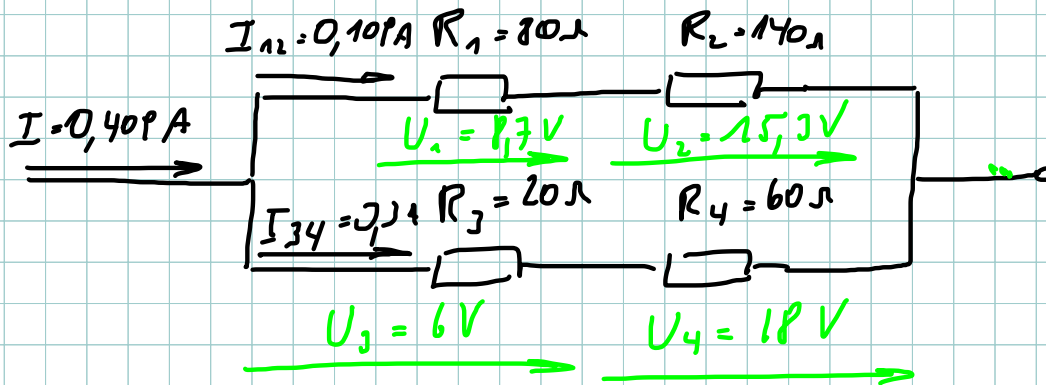
$$I = \frac{U}{R} = \frac{24}{58,7} = 0,40 \text{ A}$$

$$I_{12} = 0,10 \text{ A} \quad R_{12} = 220 \Omega$$



$$I_{12} = \frac{U}{R_{12}} = \frac{24}{220} = 0,10 \text{ A}$$

$$I_{34} = \frac{U}{R_{34}} = \frac{24}{80} = 0,3 \text{ A}$$



$$\underline{I}_1 = \underline{I}_2 = \underline{I}_{12} = 0,10 \text{ A}$$

$$\underline{I}_3 = \underline{I}_4 = \underline{I}_{34} = 0,3 \text{ A}$$

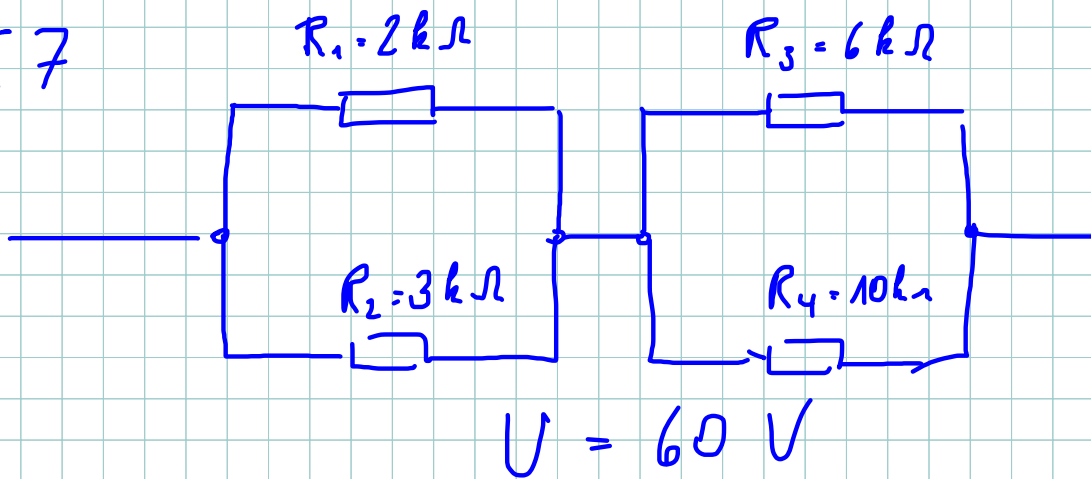
$$U_1 = \underline{I}_1 \cdot R_1 = 0,10 \text{ A} \cdot 80 = 8,72 \text{ V}$$

$$U_2 = \underline{I}_2 \cdot R_2 = 0,10 \text{ A} \cdot 140 = 15,3 \text{ V}$$

$$U_3 = \underline{I}_3 \cdot R_3 = 0,3 \cdot 20 = 6 \text{ V}$$

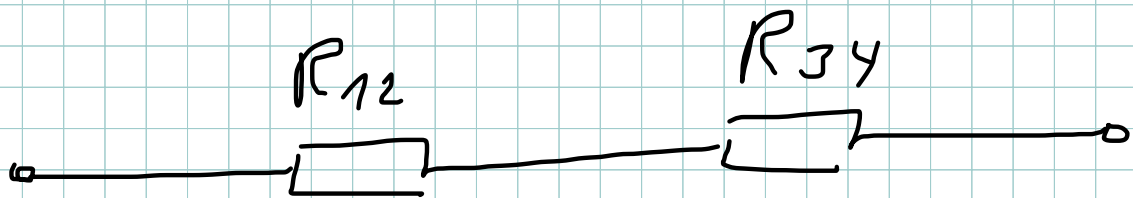
$$U_4 = \underline{I}_4 \cdot R_4 = 0,3 \cdot 60 = 18 \text{ V}$$

5.7



$$R_{12} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{2 \text{ k} \cdot 3 \text{ k}}{2 \text{ k} + 3 \text{ k}} = 1,2 \text{ k} \Omega$$

$$R_{34} = \frac{R_3 \cdot R_4}{R_3 + R_4} = \frac{6 \text{ k} \cdot 10 \text{ k}}{6 \text{ k} + 10 \text{ k}} = 3,75 \text{ k} \Omega$$



$$R_g = R_{12} + R_{34} = 1,2 \text{ k} + 3,75 \text{ k} = 4,95 \text{ k} \Omega$$

$$I = \frac{U}{R} = \frac{60}{4,95 \text{ k}} = 12,12 \text{ mA}$$

$$U_{12} = I \cdot R_{12} = 12,12 \text{ m} \cdot 1,2 \text{ k} = 14,5 \text{ V}$$

$$U_{34} = I \cdot R_{34} = 12,12 \text{ m} \cdot 3,75 \text{ k} = 45,5 \text{ V}$$

$$= U - U_{12} = 60 - 14,5 = 45,5 \text{ V}$$

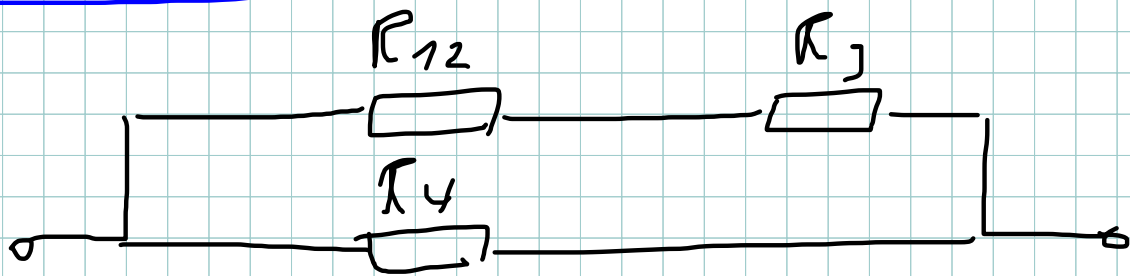
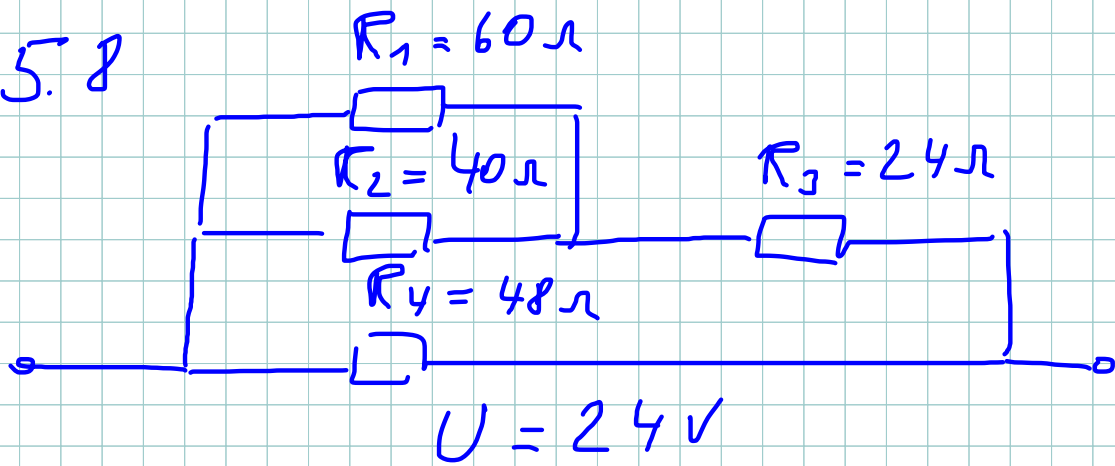
$$I_1 = \frac{U_1}{R_1} = \frac{14,5}{2 \text{ k}} = 7,27 \text{ m A}$$

$$I_2 = \frac{U_2}{R_2} = \frac{14,5}{3 \text{ k}} = 4,85 \text{ m A}$$

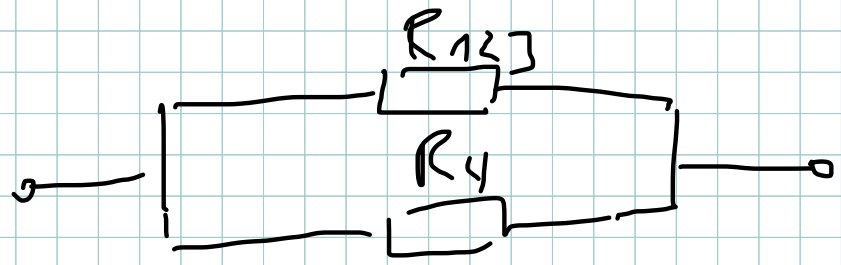
$$I_3 = \frac{U_3}{R_3} = \frac{45,5}{6 \text{ k}} = 7,58 \text{ m A}$$

$$I_4 = \frac{U_4}{R_4} = \frac{45,5}{10 \text{ k}} = 4,55 \text{ m A}$$

5.8

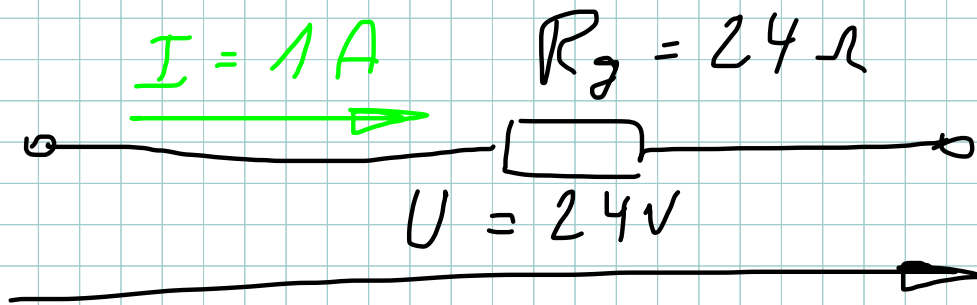


$$R_{12} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{60 \cdot 40}{60 + 40} = 24\ \Omega$$

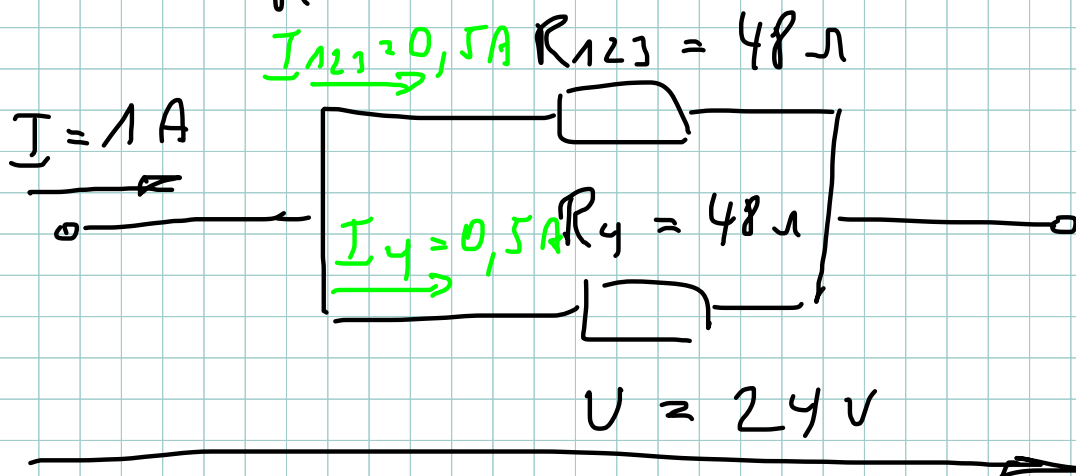


$$R_{123} = R_{12} + R_3 = 24 + 24 = 48\ \Omega$$

$$R_g = \frac{R_{123} \cdot R_4}{R_{123} + R_4} = \frac{48 \cdot 48}{48 + 48} = 24\ \Omega$$



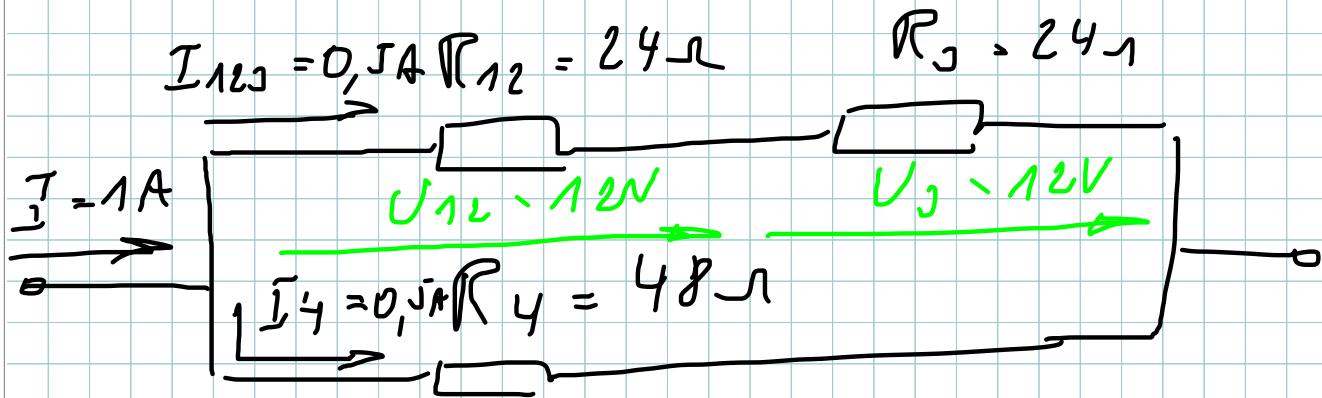
$$I = \frac{U}{R} = \frac{24}{24} = 1 \text{ A}$$



$$U_4 = U_{123} = U = 24 \text{ V}$$

$$I_4 = \frac{U_4}{R_4} = \frac{24}{48} = 0,5 \text{ A}$$

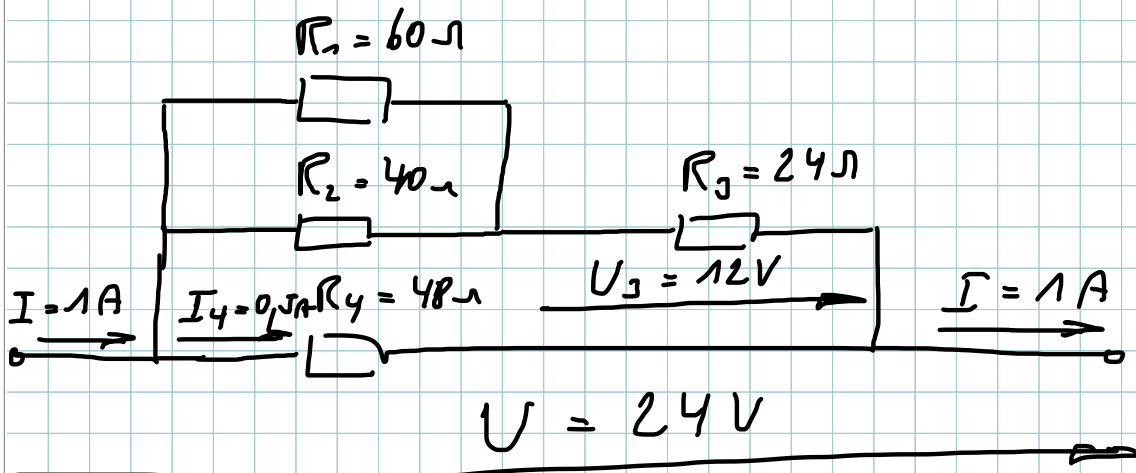
$$I_{123} = I_g - I_4 = 1 - 0,5 = 0,5 \text{ A}$$



$$U = 24V$$

$$U_{12} = I_{12} \cdot R_{12} = 0,5 \cdot 24 = 12V$$

$$U_3 = I_3 \cdot R_3 = 0,5 \cdot 24 = 12V$$



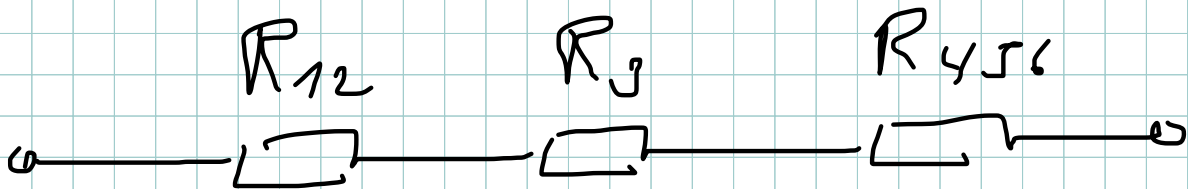
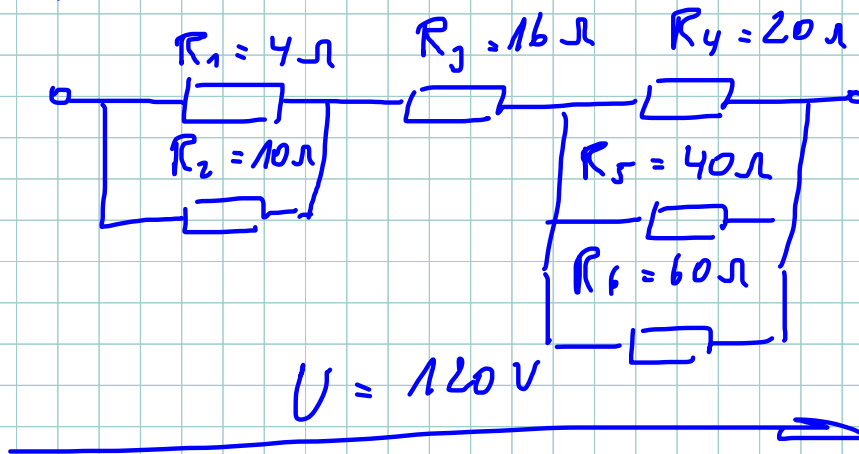
$$U_1 = U_2 = U_{12} = 12 \text{ V}$$

$$I_1 = \frac{U_1}{R_1} = \frac{12}{60} = 0,2 \text{ A}$$

$$I_2 = \frac{U_2}{R_2} = \frac{12}{40} = 0,3 \text{ A}$$



5.9



$$R_{12} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{4 \cdot 10}{4 + 10} = 2,857 \Omega$$

$$R_{456} = \frac{1}{\frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6}}$$

$$= \frac{1}{\frac{1}{20} + \frac{1}{40} + \frac{1}{60}} = 10,909 \Omega$$

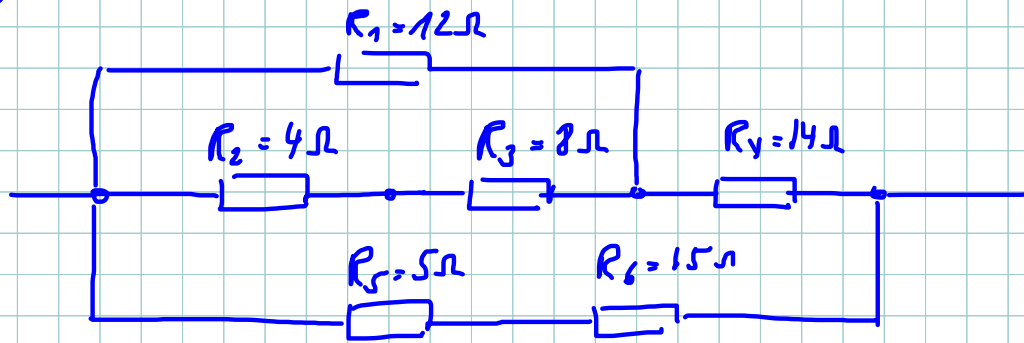
$$\begin{aligned} R_g &= R_{12} + R_3 + R_{456} = \\ &= 2,857 + 16 + 10,90 = \\ &= 29,77 \Omega \end{aligned}$$

$$I = \frac{U}{R} = \frac{120}{29,77} = 4,03 \text{ A}$$

$$U_3 = I \cdot R_3 = 4,03 \cdot 16 = 64,5 \text{ V}$$

$$U_{12} = I \cdot R_{12} = 4,03 \cdot 2,857 = 11,5 \text{ V}$$

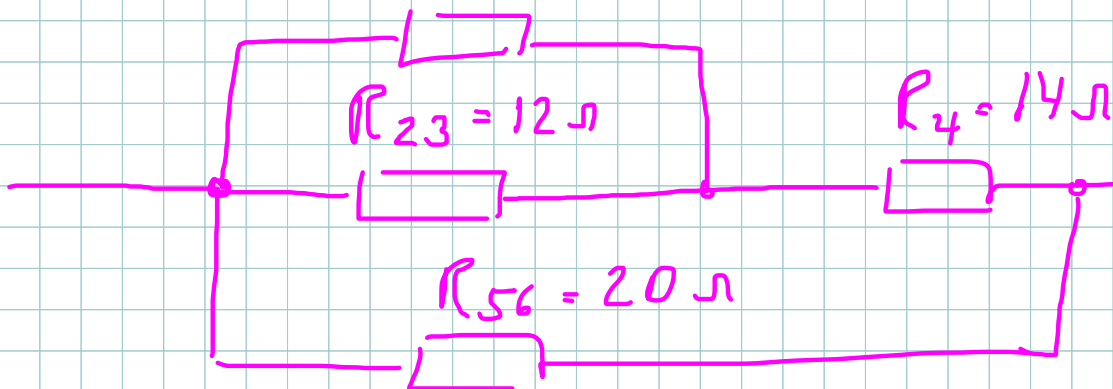
5.10



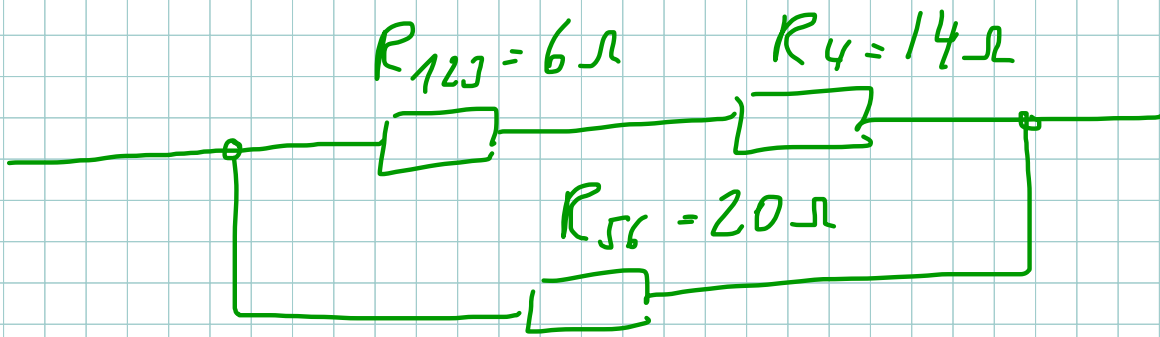
$$U = 24 \text{ V}$$

$$R_{23} = R_2 + R_3 = 4 + 8 = 12 \Omega$$

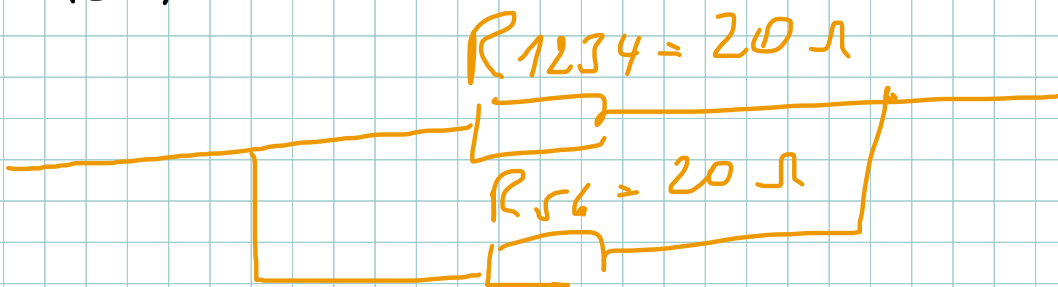
$$R_{56} = R_5 + R_6 = 5 + 15 = 20 \Omega$$



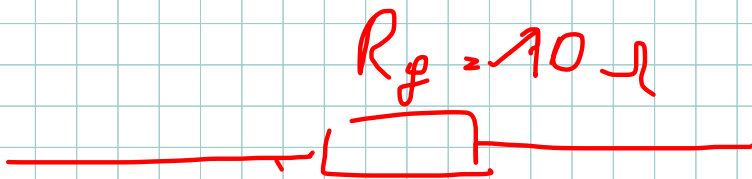
$$R_{123} = \frac{R_1 \cdot R_{23}}{R_1 + R_{23}} = \frac{12 \cdot 12}{12 + 12} = 6 \Omega$$



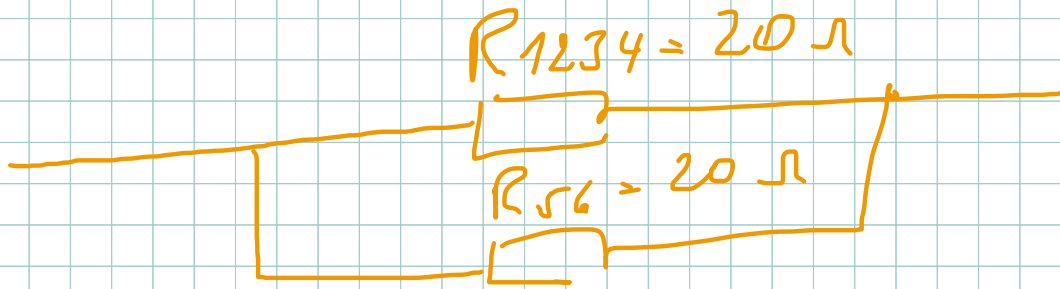
$$R_{1234} = R_{123} + R_4 = 6 + 14 = 20 \Omega$$



$$R_g = \frac{R_{1234} \cdot R_{56}}{R_{1234} + R_{56}} = \frac{20 \cdot 20}{20 + 20} = 10 \Omega$$



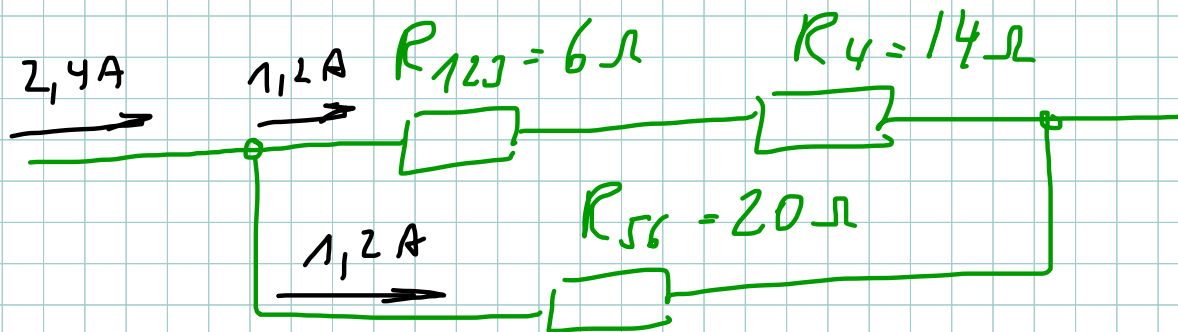
$$I = \frac{U}{R} = \frac{24}{10} = 2,4 \text{ A}$$



$$I_{1234} = \frac{U}{R_{1234}} = \frac{24}{20} = 1,2 \text{ A}$$

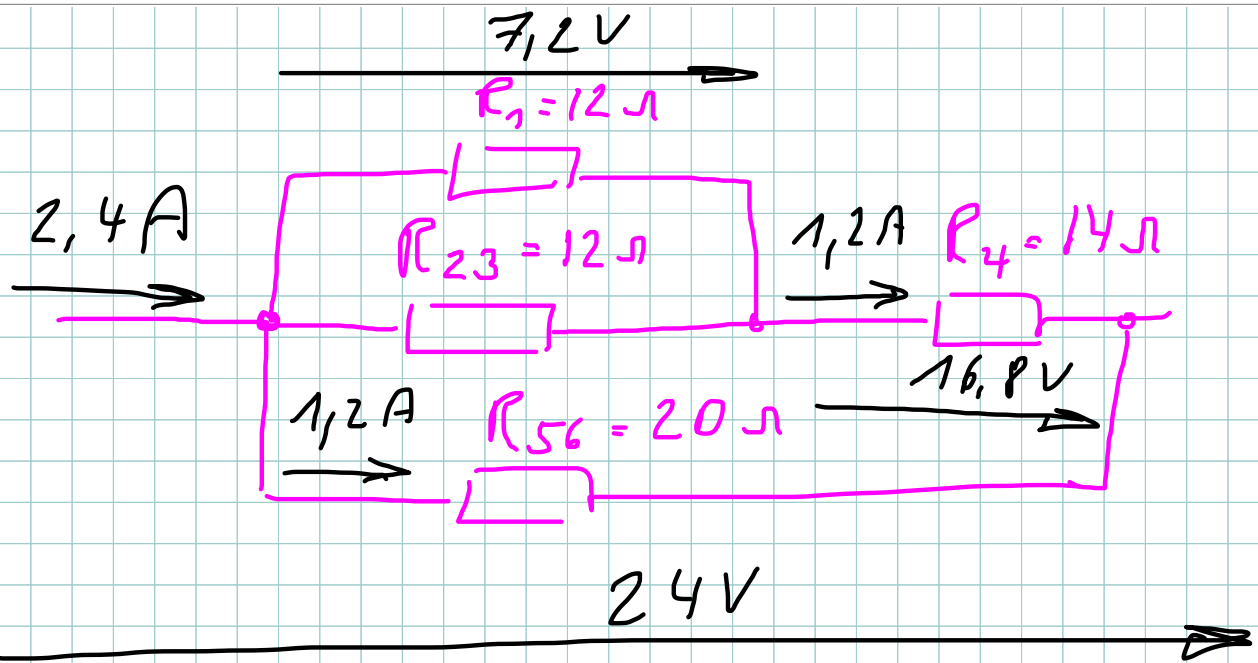
$$I_{56} = \frac{U}{R_{56}} = \frac{24}{20} = 1,2 \text{ A}$$

$$= I - I_{1234} = 2,4 - 1,2 = 1,2 \text{ A}$$



$$U_{123} = I_{123} \cdot R_{123} = 1,2 \cdot 6 = 7,2 \text{ V}$$

$$U_4 = I_4 \cdot R_4 = 1,2 \cdot 14 = 16,8 \text{ V}$$



$$I_1 = \frac{U_1}{R_1} = \frac{7,2}{12} = 0,6A$$

$$I_{23} = \frac{U_{23}}{R_{23}} = \frac{7,2}{12} = 0,6A$$

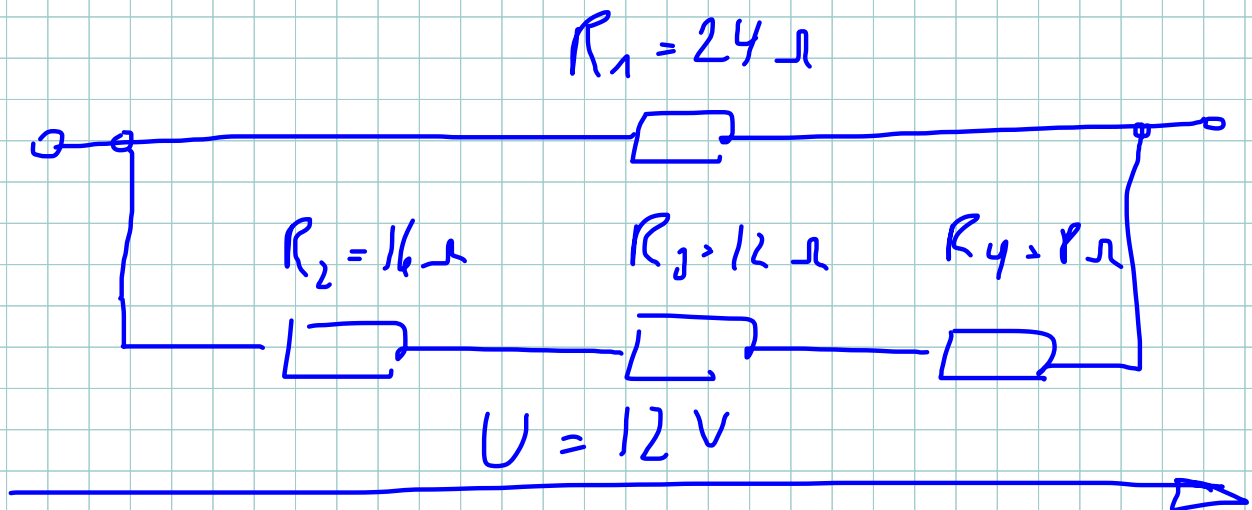
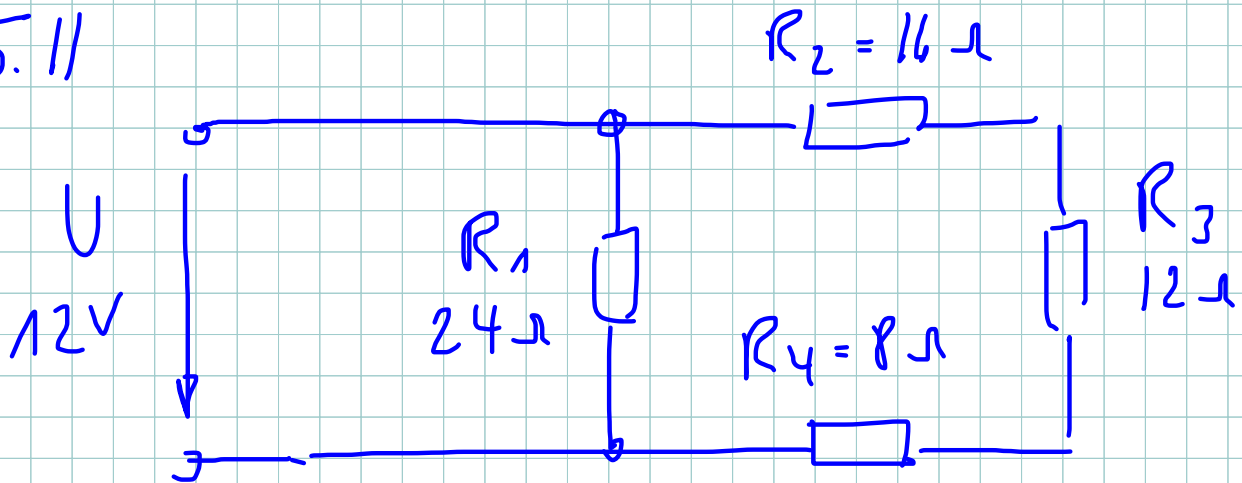
$$U_2 = I_2 \cdot R_2 = 0,6 \cdot 4 = 2,4V$$

$$U_3 = I_3 \cdot R_3 = 0,6 \cdot 8 = 4,8V$$

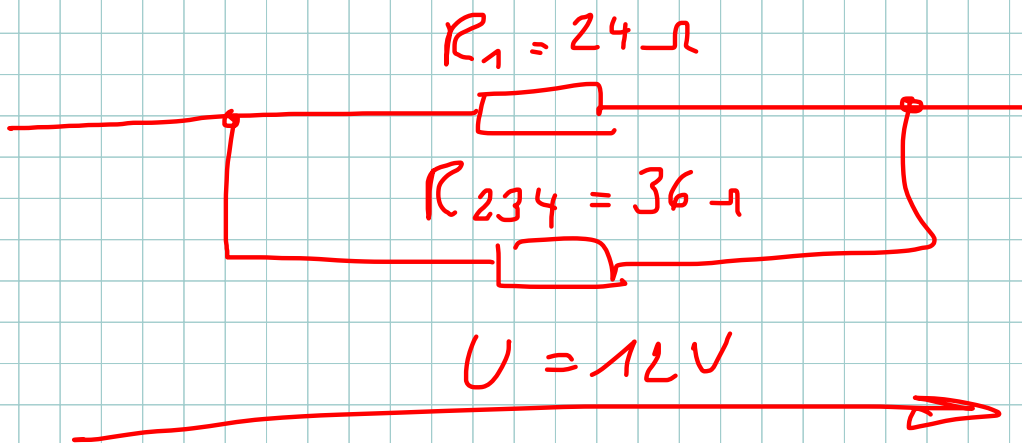
$$U_5 = I_5 \cdot R_5 = 1,2 \cdot 5 = 6V$$

$$U_6 = I_6 \cdot R_6 = 1,2 \cdot 15 = 18V$$

5.11



$$R_{234} = R_2 + R_3 + R_4 = 16 + 12 + 8 = 36\ \Omega$$



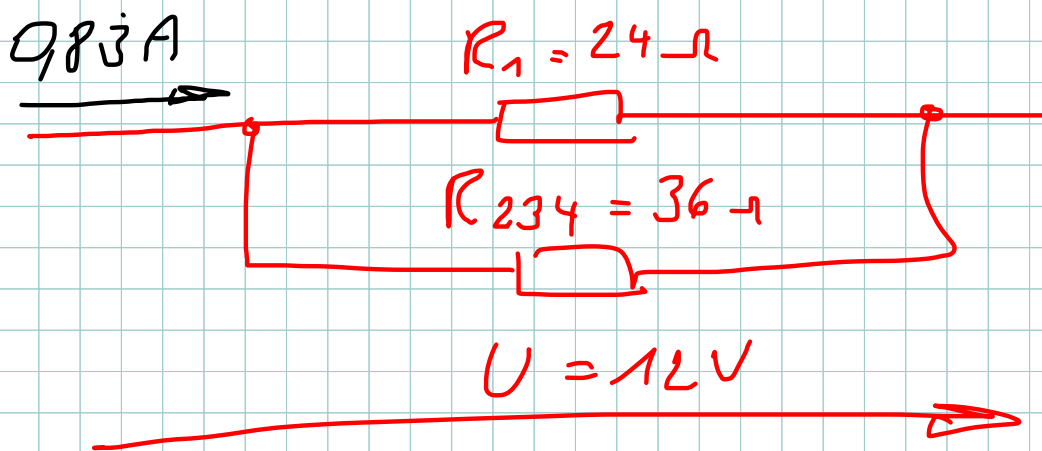
$$R = \frac{R_1 \cdot R_{234}}{R_1 + R_{234}} = \frac{24 \cdot 36}{24 + 36} = 14,4 \Omega$$

$$R_g = 14,4 \Omega$$



$$I = \frac{U}{R} = \frac{12}{14,4} = 0,83 \text{ A}$$





$$I_1 = \frac{U}{R_1} = \frac{12}{24} = 0,5 A$$

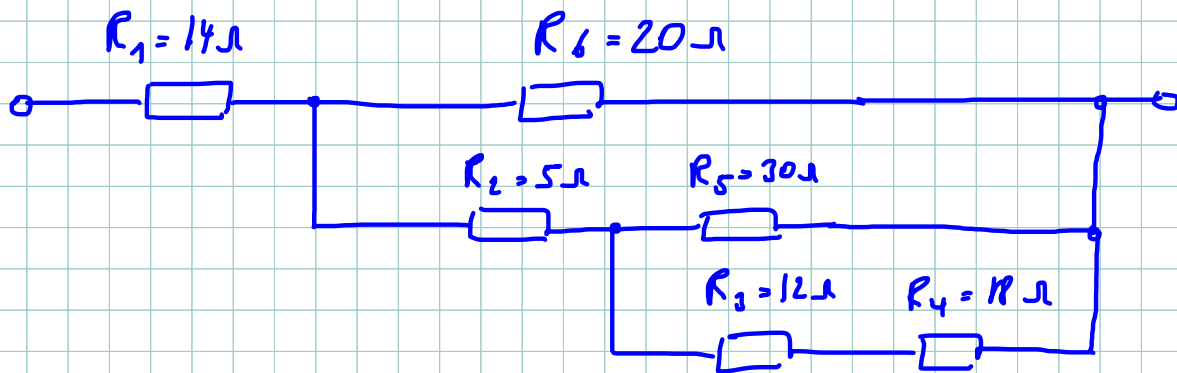
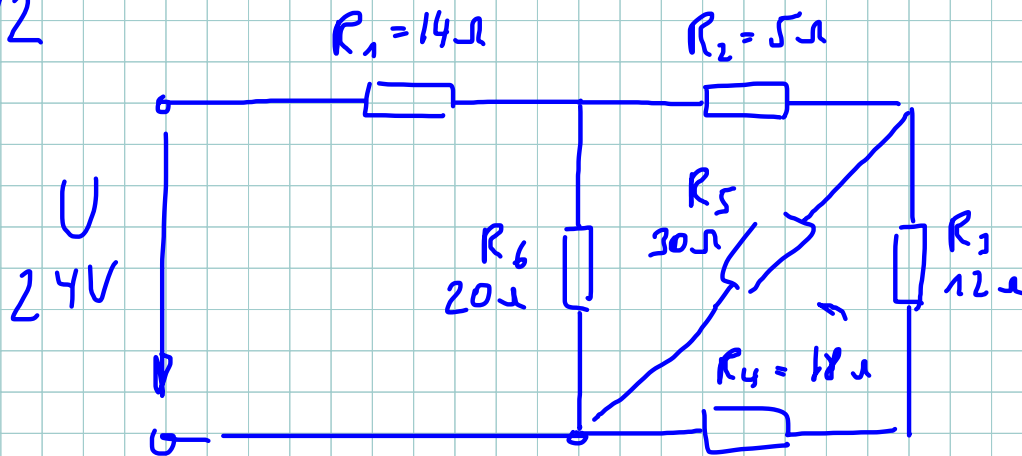
$$I_{234} = \frac{U}{R_{234}} = \frac{12}{36} = 0,33 A$$

$$U_2 = I_2 \cdot R_2 = 0,33 \cdot 16 = 5,3 V$$

$$U_3 = I_3 \cdot R_3 = 0,33 \cdot 12 = 4 V$$

$$U_4 = I_4 \cdot R_4 = 0,33 \cdot 8 = 2,6 V$$

5.12



$$R_{34} = R_3 + R_4 = 12 + 18 = 30 \Omega$$

$$R_{345} = R_{34} \parallel R_5 = 30 \parallel 30 = 15 \Omega$$

$$R_{2345} = R_2 + R_{345} = \quad = 20 \Omega$$

$$R_{23456} = R_{2345} \parallel R_6 = \quad = 10 \Omega$$

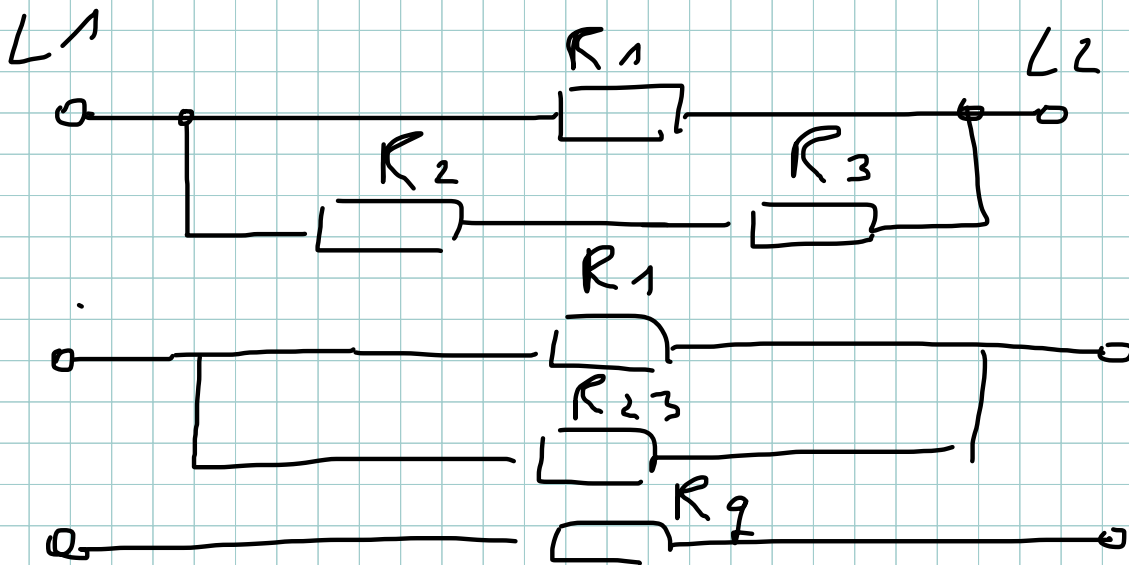
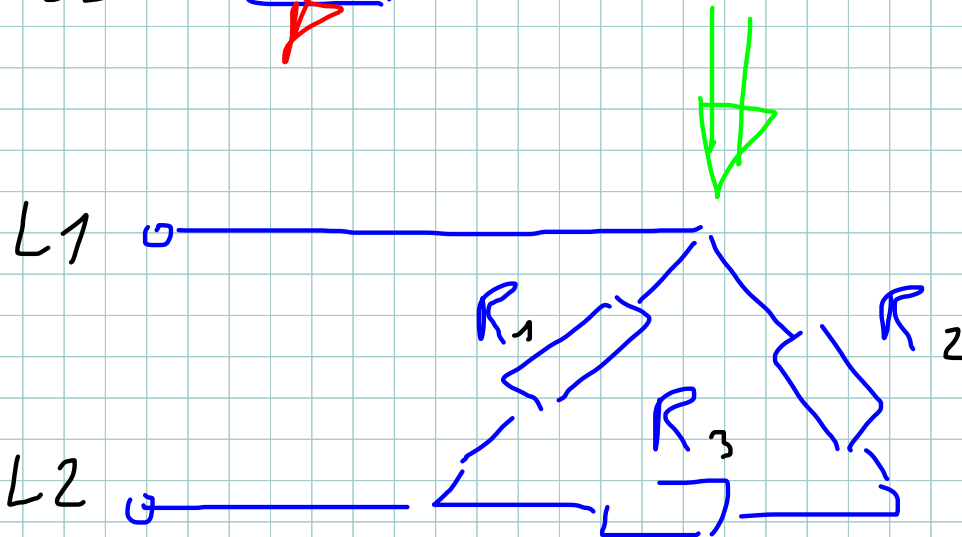
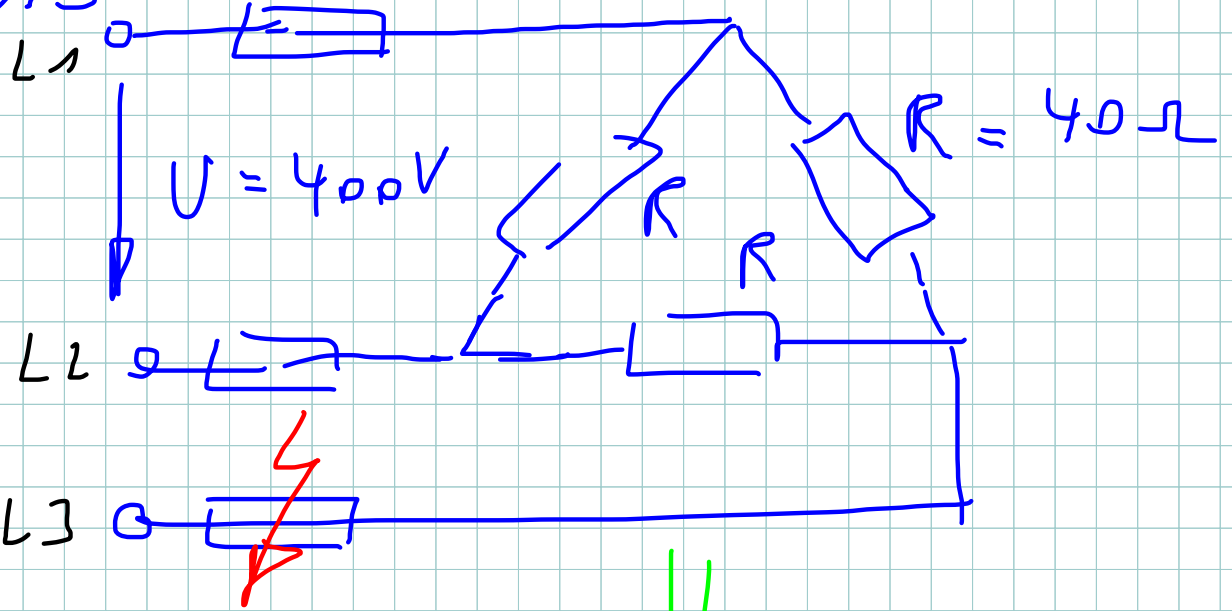
$$R = R_1 + R_{\dots} = 14 + 10 = 24 \Omega$$

$$I = \frac{U}{R} = \frac{24}{24} = 1 \text{ A}$$

$$U_1 = I \cdot R_1 = 1 \cdot 14 = 14 \text{ V}$$

$$U_{23456} = U - U_1 = 24 - 14 = 10 \text{ V}$$
$$= U_6$$

5.13

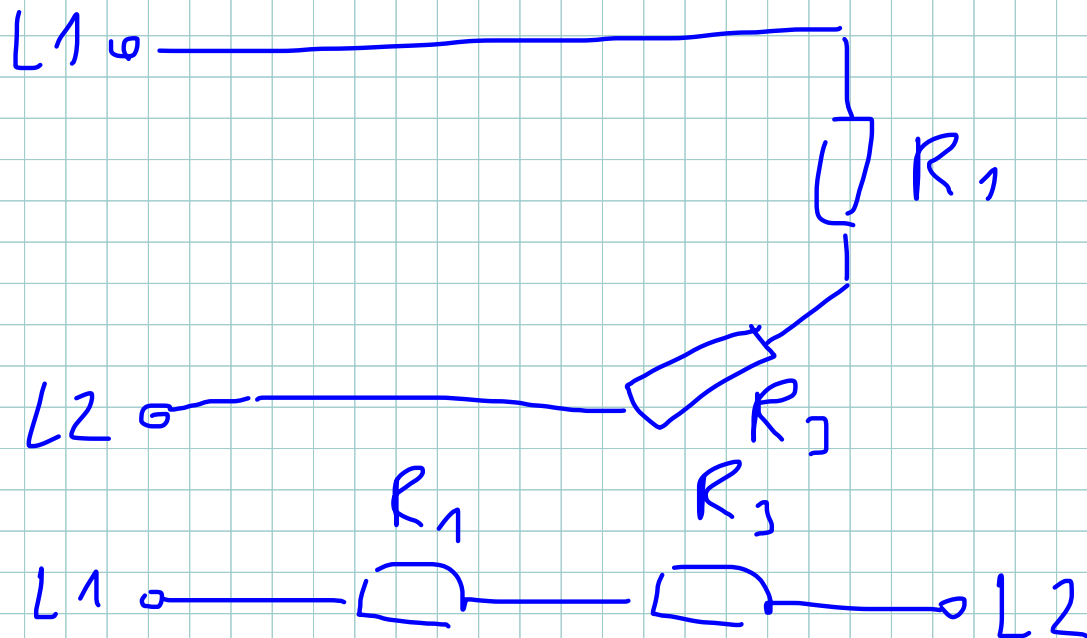
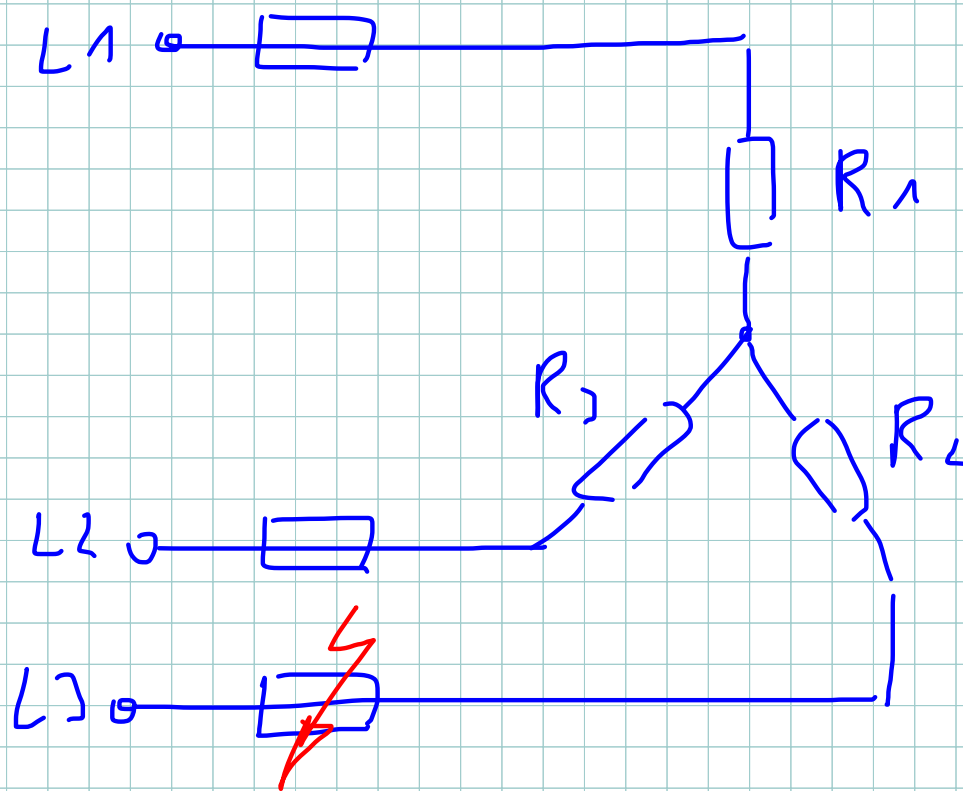


$$R_{23} = R_2 + R_3 = 40 + 40 = 80 \Omega$$

$$R_g = \frac{R_1 \cdot R_{23}}{R_1 + R_{23}} = \frac{40 \cdot 80}{40 + 80} = 26,6 \Omega$$

$$I = \frac{U}{R} = \frac{400}{26,6} = 15 \text{ A}$$

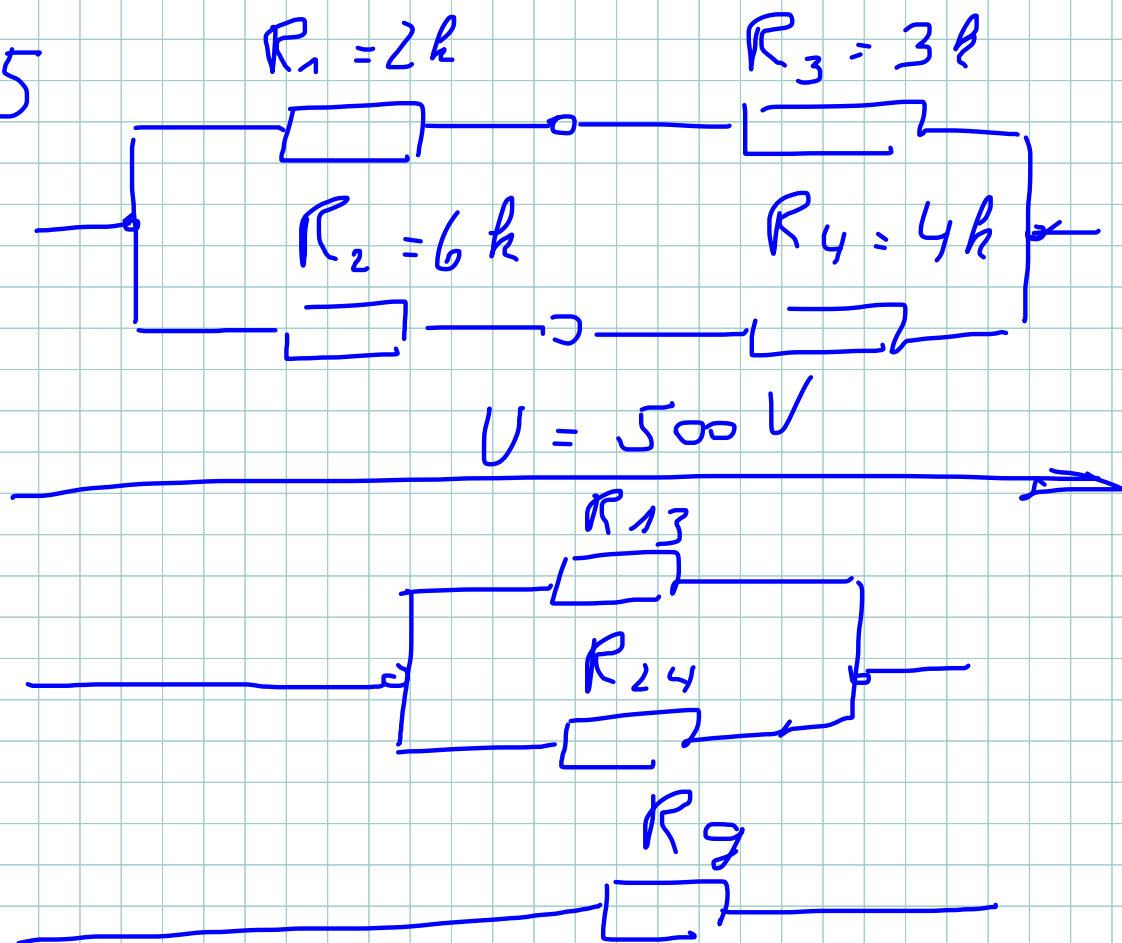
5.14



$$R_{12} = R_1 + R_2 = 48,5 + 48,5 = 97 \Omega$$

$$I = \frac{U}{R} = \frac{400}{97} = 4,124 \text{ A}$$

5.15



$$R_{13} = R_1 + R_3 = 2k + 3k = 5k \Omega$$

$$R_{24} = R_2 + R_4 = 6k + 4k = 10k \Omega$$

$$R = \frac{R_{13} \cdot R_{24}}{R_{13} + R_{24}} = \frac{5k \cdot 10k}{5k + 10k} = 3,3k \Omega$$



$$I_{13} = \frac{U}{R_{13}} = \frac{500}{5000} = 0,1 \text{ A}$$

$$I_{24} = \frac{U}{R_{24}} = \frac{500}{10 \text{ k}} = 50 \text{ mA}$$

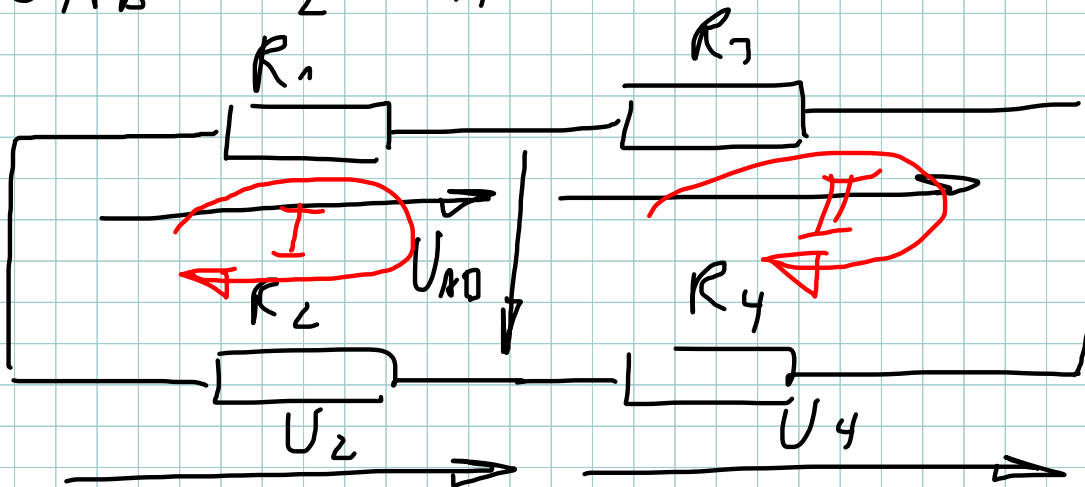
$$U_1 = I_1 \cdot R_1 = 0,1 \cdot 2 \text{ k} = 200 \text{ V}$$

$$U_3 = I_3 \cdot R_3 = 0,1 \cdot 3 \text{ k} = 300 \text{ V}$$

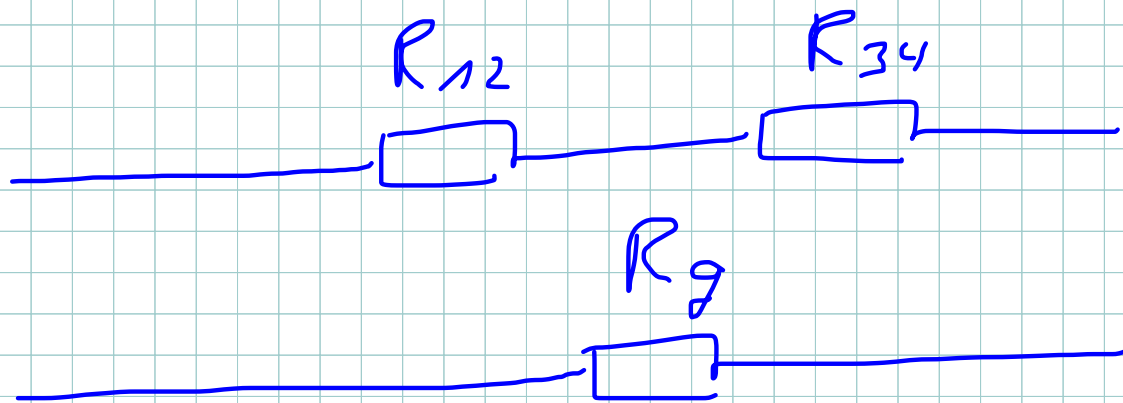
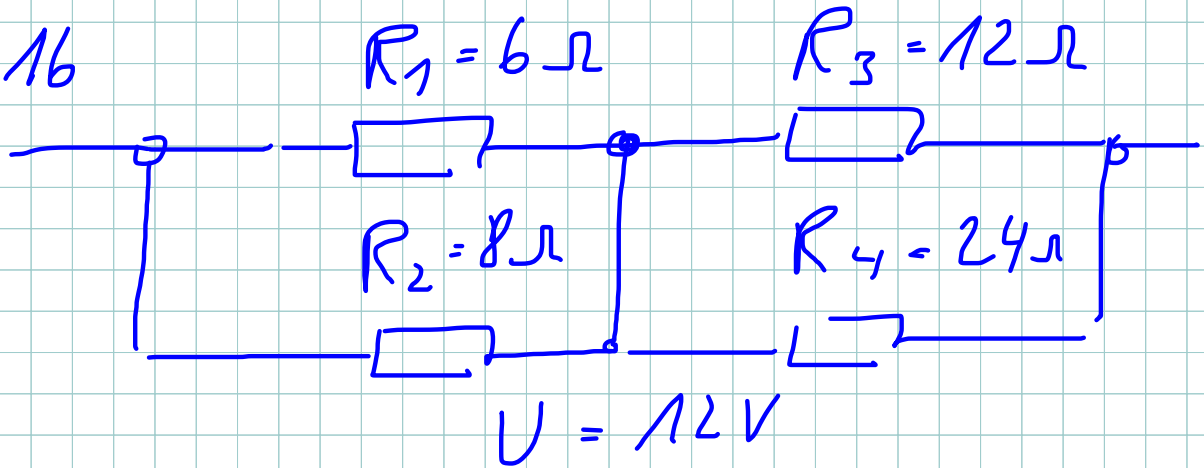
$$U_2 = I_2 \cdot R_2 = 0,05 \cdot 6000 = 300 \text{ V}$$

$$U_4 = I_4 \cdot R_4 = 0,05 \cdot 4000 = 200 \text{ V}$$

$$U_{AB} = U_2 - U'_1 = 300 - 200 = 100 \text{ V}$$



5.16



$$R_{12} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{6 \cdot 8}{6 + 8} = 3,43\ \Omega$$

$$R_{34} = \frac{R_3 \cdot R_4}{R_3 + R_4} = \frac{12 \cdot 24}{12 + 24} = 8\ \Omega$$

$$R = R_{12} + R_{34} = 3,43 + 8 = 11,43\ \Omega$$

$$I = \frac{U}{R} = \frac{12}{11,43} = 1,05 \text{ A}$$

$$U_{12} = I \cdot R_{12} = 1,05 \cdot 3,43 = 3,6 \text{ V}$$

$$U_{34} = I \cdot R_{34} = 1,05 \cdot 8 = 8,4 \text{ V}$$

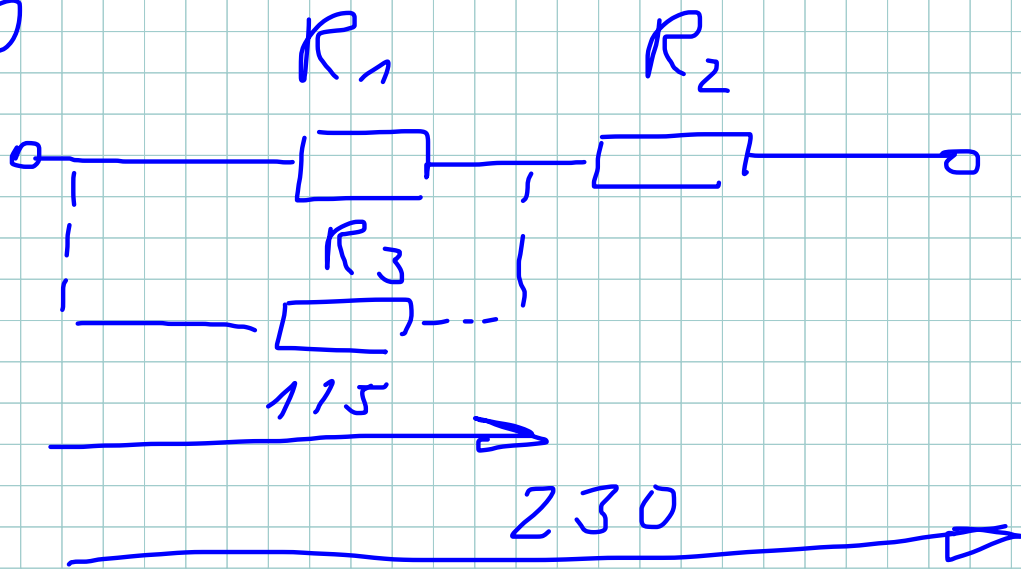
$$I_1 = \frac{U_1}{R_1} = \frac{3,6}{6} = 0,6 \text{ A}$$

$$I_2 = \frac{U_2}{R_2} = \frac{3,6}{8} = 0,45 \text{ A}$$

$$I_3 = \frac{U_3}{R_3} = \frac{8,4}{12} = 0,7 \text{ A}$$

$$I_4 = \frac{U_4}{R_4} = \frac{8,4}{24} = 0,35 \text{ A}$$

5.20



5.21

