1. Na neki svitak namotana je bakrena žica otpora $R=1120\Omega$ i promjera 0.22 mm. Izračunajte duljinu žice ako je specifični otpor bakra 0.0175 $\frac{\Omega mm^2}{m}$.

$$d = 0.22mm = 2.2\cdot10^{-4}m$$

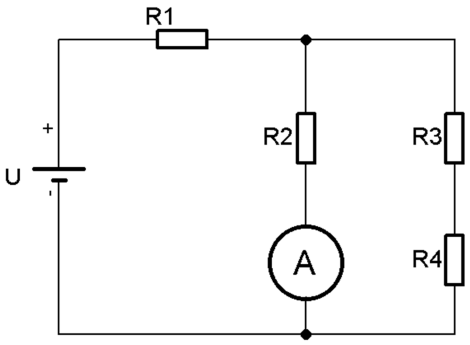
$$S = \frac{d^2\cdot\pi}{4} = \frac{\left(2.2\cdot10^{-4}m\right)^2\cdot\pi}{4} = 3.8\cdot10^{-8}m^2$$ 1

$$R = \rho\frac{l}{S} \Rightarrow l = \frac{R\cdot S}{\rho} = \frac{1200\Omega\cdot3.8\cdot10^{-8}m^2}{0.0175\cdot10^{-6}\Omega m} = 2605.71m$$

1 1 1

4 boda

2. Za strujni krug prema slici izračunajte iznos otpora R1 ako idealni ampermetar pokazuje struju 1.5 A. Zadano je: $R_2=10\Omega, R_3=20\Omega, R_4=30\Omega, U=42V$.



$$U_{R2} = U_{R34} = I_A\cdot R_2 = 1.5A\cdot10\Omega = 15V$$ 1

$$I_{R34} = \frac{U_{R34}}{R_{34}} = \frac{U_{R34}}{R_3+R_4} = \frac{15V}{50\Omega} = 0.3A$$ 1

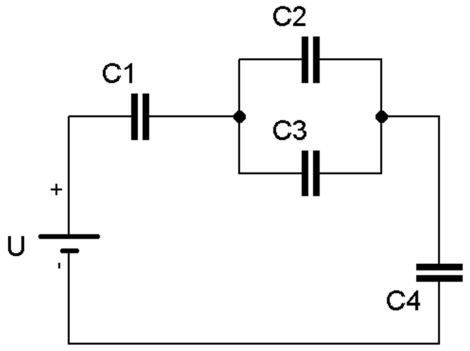
$$I_{R1} = I_A + I_{R34} = 1.5A + 0.3A = 1.8A$$ 1

$$U_{R1} = U - U_{R2} = 42V - 15V = 27V$$ 1

$$R_1 = \frac{U_{R1}}{I_{R1}} = \frac{27V}{1.8A} = 15\Omega$$ 1

5 bodova

3. Kondenzatori $C_1=40\mu F, C_2=5\mu F, C_3=15\mu F, C_4=20\mu F$ spojeni su prema slici na istosmjerni napon $U=24V$. Izračunajte naboje, napone i energije na svim kondenzatorima.



$$C_{23} = C_2 + C_3 = 20\mu F$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_{23}} + \frac{1}{C_4} = \frac{1}{8}\frac{1}{F}$$

$$C = 8\mu F$$ 1

$$Q = Q_1 = Q_{23} = Q_4 = C\cdot U = 8\mu F\cdot24V = 192\mu C$$ 1

$$U_{C1} = \frac{Q}{C_1} = \frac{192\mu C}{40\mu F} = 4.8V$$

$$U_{C2} = U_{C3} = \frac{Q}{C_{23}} = \frac{192\mu C}{20\mu F} = 9.6V$$ 1

$$U_{C4} = \frac{Q}{C_4} = \frac{192\mu C}{20\mu F} = 9.6V$$

$$Q_2 = C_2\cdot U_{C2} = 5\mu F\cdot9.6V = 48\mu C$$

$$Q_3 = C_3\cdot U_{C3} = 15\mu F\cdot9.6V = 144\mu C$$ 1

$$W_{C1} = \frac{1}{2}C_1\cdot U_{C1}^2 = 460.8\mu J$$

$$W_{C2} = \frac{1}{2}C_2\cdot U_{C2}^2 = 230.4\mu J$$

$$W_{C3} = \frac{1}{2}C_3\cdot U_{C3}^2 = 691.2\mu J$$ 1

$$W_{C4} = \frac{1}{2}C_4\cdot U_{C4}^2 = 230.4\mu J$$

5 bodova

4. Kroz prstenastu zavojnicu s 3600 zavoja, srednjom duljinom silnice 20 cm i poprečnim presjekom 7 cm^2 zatvara se magnetski tok $6.5 \cdot 10^{-5} Wb$. Izračunajte jakost magnetskog polja, magnetsku indukciju i jakost struje.

$$B = \frac{\Phi}{S} = \frac{6.5 \cdot 10^{-5} Wb}{7 \cdot 10^{-4} m^2} = 92.86 mT \quad \boxed{1}$$

$$B = \mu_0 \cdot H \Rightarrow H = \frac{B}{\mu_0} = \frac{92.86 mT}{4\pi \cdot 10^{-7} \frac{H}{m}} = 73895.64 \frac{A}{m} \quad \boxed{1} \quad \boxed{1}$$

$$H = \frac{I \cdot N}{l_{sr}} \Rightarrow I = \frac{H \cdot l_{sr}}{N} = \frac{73895.64 \frac{A}{\cancel{m}} \cdot 0.2 \cancel{m}}{3600} = 4.1 A \quad \boxed{1} \quad \boxed{1}$$

5 bodova

5. Zavojnica sa željeznom jezgrom ima 500 zavoja i magnetski tok $0.4 mWb$. Kroz koje vrijeme se taj magnetski tok mora smanjiti na $0.1 mWb$ da se u zavojnici inducira napon $20 V$.

$$\Delta\Phi = \Phi_2 - \Phi_1 = 0.1 mWb - 0.4 mWb = -0.3 mWb \quad \boxed{1}$$

$$u_i = -N \frac{\Delta\Phi}{\Delta t} \Rightarrow \Delta t = \frac{-N \cdot \Delta\Phi}{u_i} = \frac{\cancel{-}500 \cdot (\cancel{-}0.3 mWb)}{20 V} = 7.5 ms \quad \boxed{1} \quad \boxed{1}$$

3 boda

Ukupan broj bodova: 22