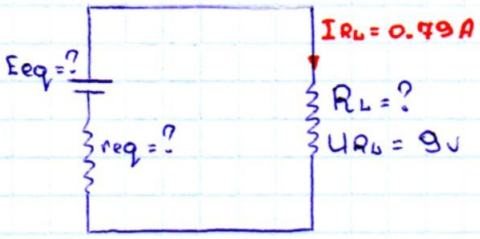


נתון:

$U_{R_L} = 9V$

$I_{R_L} = 790mA = 0.79A$

$E_1 = 1.5V$

$r_1 = 1.9\Omega$

$Q_1 = 0.3Ah$

נדרש:

א.

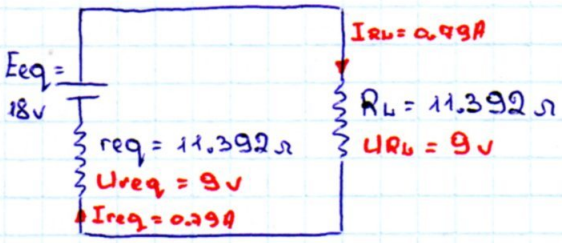
$$R_L = \frac{U_{R_L}}{I_{R_L}} = \frac{9}{0.79} = 11.392\Omega$$

ב.

$$P_{R_L} = I_{R_L}^2 \cdot R_L = 0.79^2 \cdot 11.392 = 7.109W \approx \boxed{7.11W}$$

ג.

$R_L = req = 11.392\Omega$ ⇐ נסמן ב-"req"



$$\left.\begin{aligned} R_L &= req \\ I_{R_L} &= I_{req} \end{aligned}\right\} \Rightarrow U_{R_L} = U_{req} = 9V$$

$$\Downarrow$$

$$E_{eq} = U_{R_L} + U_{req} = 9 + 9 = 18V$$

$$E_{eq} = E \cdot n$$

$$18 = 1.5n$$

$$\boxed{n = 12}$$

$$req = \frac{n}{m} \cdot r$$

$$11.392 = \frac{22.8}{m}$$

$$11.392m = 22.8$$

$$\boxed{m = 2.001 \approx 2}$$

(c)

$$Q_{eq} = m \cdot Q$$

$$Q_{eq} = 2 \cdot 0.3 = 0.6 Ah$$

$$t = \frac{0.6}{0.79} = 0.759h \cdot 60 = \boxed{45.54\ m}$$

שאלה 8

נתון:

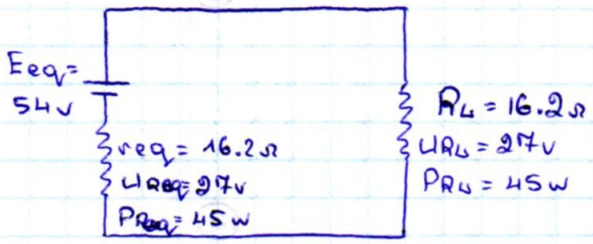
$E_1 = 3V$

$r_1 = 1.8\Omega$

$Q_1 = 0.3Ah$

$U_{R_L} = 27V$

$P_{R_L} = 45W$



פתרון:

(א)

$$R_L = \frac{U_{R_L}^2}{P_{R_L}} = \frac{27^2}{45} = 16.2\Omega$$

$R_L = req$ ⇐ נכון מהציור

$$E_{eq} = U_{R_L} + U_{req} = 27 + 27 = 54V$$

$$E_{eq} = E \circ n$$

$$54 = 3n$$

$$\boxed{n = 18}$$

$$req = \frac{n}{m} \circ r$$

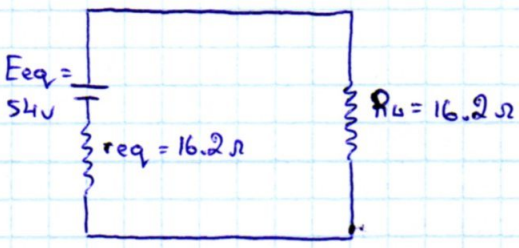
$$16.2 = \frac{18}{m} \circ 1.8$$

$$16.2 = \frac{32.4}{m}$$

$$16.2m = 32.4$$

$$\boxed{m = 2}$$

(ב)



$$I_{eq} = \frac{E_{eq}}{R_L + req} = \frac{54}{32.4} = 1.666\Omega \approx 1.67\Omega$$

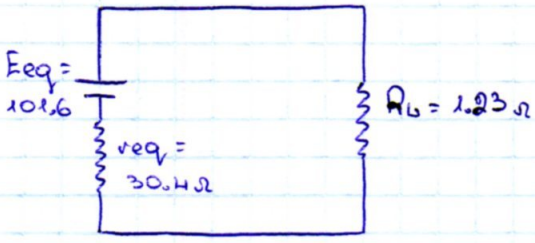
$$U_{R_L} = I_{eq} \circ R_L = 1.67 \cdot 16.2 = \boxed{27V}$$

$P_{eq} = P_{RL} + P_{req} = 45 + 45 = 90\,W$ ③

$\eta_{RL} = \frac{45}{90} \cdot 100\% = \boxed{50\%}$

$Q_{eq} = m \cdot Q = 2 \cdot 0.3 = 0.6\,Ah$ ②

$t = \frac{Q_{eq}}{I_{eq}} = \frac{0.6}{1.67} = 0.359 \cdot 60 = \boxed{21.54\,m}$



$m = 1$

$n = 80$

$E_{eq} = n \cdot E = 80 \cdot 1.27 = 101.6\,V$

$r_{eq} = \frac{n}{m} \cdot r$

$r_{eq} = \frac{80}{1} \cdot 0.38 = 30.4\,\Omega$

$R_{eq} = R_L + r_{eq} = 1.23 + 30.4 = 31.63\,\Omega$

$I_{eq} = \frac{E_{eq}}{R_{eq}} = \frac{101.6}{31.63} = \boxed{3.212\,A}$

$m = 80$

$n = 1$

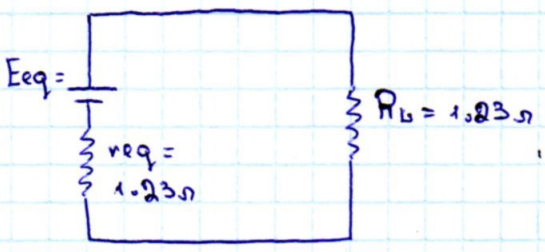
$E_{eq} = n \cdot E = 1 \cdot 1.27 = 1.27\,V$

$r_{eq} = \frac{1}{80} \cdot 0.38 = 0.00475\,\Omega$

$R_{eq} = R_L + r_{eq} = 1.23 + 0.00475 = 1.23475\,\Omega$

$I_{eq} = \frac{E_{eq}}{R_{eq}} = \frac{1.27}{1.23475} = \boxed{1.028\,A}$

$R_L = r_{eq}$ ⇐ נותן מקסימום



ג)

$E_1 = 1.27\,V$

$r_1 = 0.38\,\Omega$

$Q_1 = 2.2\,Ah$

$R_L = 1.23\,\Omega$

$m \cdot n = 80$

$\Downarrow$

$n = \frac{80}{m}$

ד)

$E_1 = 1.27\,V$

$r_1 = 0.38\,\Omega$

$Q_1 = 2.2\,Ah$

$R_L = 1.23\,\Omega$

בדיקה:

ב)

ה)

$$r_{eq} = \frac{n}{m} \cdot r_1$$

$$1.23 = \frac{\frac{80}{m}}{m} \cdot 0.38$$

$$1.23 = \frac{80}{m^2} \cdot 0.38$$

$$1.23 = \frac{30.4}{m^2}$$

$$1.23\, m^2 = 30.4$$

$$m = \pm\sqrt{24.715}$$

$$\boxed{m_1 = 4.97 \approx 5}$$

$m_2 = -4.97$ ← يرفض لانه سالب

$$r_{eq} = \frac{n}{m} \cdot r$$

$$1.23 = \frac{n}{5} \cdot 0.38$$

$$1.23 = \frac{0.38n}{5}$$

$$6.15 = 0.38n$$

$$\boxed{n = 16.18 \approx 16}$$

$$E_{eq} = E \cdot n = 1.27 \cdot 16 = 20.32\ v$$

$$I_{eq} = \frac{E_{eq}}{r_{eq} + R_L} = \frac{20.32}{2.46} = \boxed{8.26A}$$

②

$$Q_{eq} = m \cdot Q = 5 \cdot 2.2 = 11Ah$$

$$t = \frac{Q_{eq}}{I_{eq}} = \frac{11}{8.26} = 1.331h \cdot 60min = \boxed{79.86min}$$

שאלה 8

$E_1 = 1.27\,v$

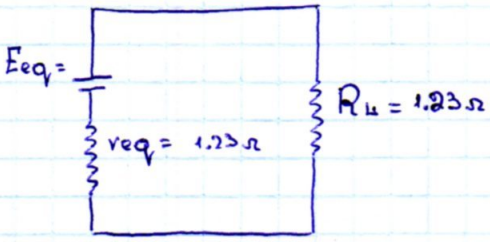
$r_1 = 0.38\,\Omega$

$Q_1 = 2.2\,Ah$

$R_L = 1.23$

$\left.\begin{matrix} K = n \\ L = m \end{matrix}\right\} \; n \cdot m = 80$

סעיף א'



$n \cdot m = 80 \Rightarrow n = \frac{80}{m}$

$req = \frac{\frac{80}{m}}{m} \cdot 0.38 = \frac{80}{m^2} \cdot 0.38 = \frac{30.4}{m^2}$

$req = R_L = 1.23\Omega$ ← נוסחת מוליכים

$1.23 = \frac{30.4}{m^2}$

$1.23m^2 = 30.4$

$m^2 = 24.715$

$m = \pm\sqrt{24.715} = \begin{cases} +4.971 \approx 5 \\ -4.971 \end{cases}$ ← פתרון שלילי

$\boxed{m = 5}$

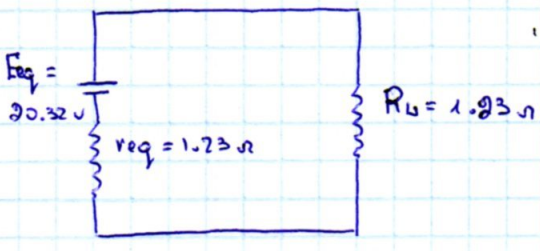
$req = \frac{n}{m} \cdot 0.38 = \frac{n}{5} \cdot 0.38 = \frac{0.38n}{5}$

$1.23\Omega = \frac{0.38n}{5}$

$6.15 = 0.38n$

$n = 16.184 \approx 16$

$\boxed{n = 16}$



סעיף ב'

(2)

סעיף ג'

(3)

$n = 16$

$m = 5$

$E_1 = 1.27\,v$

$r_1 = 0.38\,\Omega$

$Q_1 = 2.2\,Ah$

$$E_{eq} = n \cdot E_1 = 16 \cdot 1.27 = 20.32\,V$$

$$I_{eq} = \frac{E_{eq}}{r_{eq} + R_L} = \frac{20.32}{2.46} = 8.26\,A$$

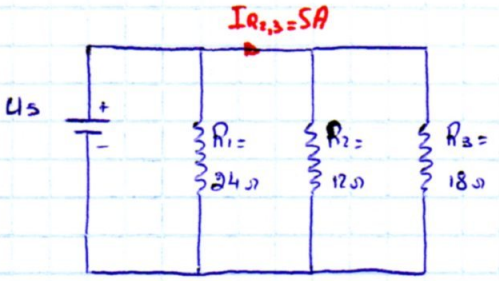
$$U_{R_L} = I_{eq} \cdot R_L = 8.26 \cdot 1.23 = \boxed{10.1598\,V}$$

$$P_{R_L} = I_{eq}^2 \cdot R_L = 8.26^2 \cdot 1.23 = \boxed{83.919\,W}$$

$$Q_{eq} = m \cdot Q_1 = 5 \cdot 2.2 = 11\,Ah$$

$$t = \frac{Q_{eq}}{I_{eq}} = \frac{11}{8.26} = 1.33\,h \cdot 60\,m = \boxed{79.8\,m}$$

(2)



פתרון:

$$R_{2,3} = R_2 \,||\, R_3 = \frac{12 \cdot 18}{12+18} = 7.2\,\Omega$$

$$I_{R_{2,3}} = I_T \frac{R_1}{R_1 + R_{2,3}}$$

$$5 = I_T \frac{24}{24+7.2}$$

$$5 = \frac{24 I_T}{31.2}$$

$$156 = 24 I_T$$

$$I_T = 6.5A$$

$$I_{R_1} = I_T - I_{R_{2,3}} = 6.5 - 5 = \boxed{1.5A}$$

$$U_{R_1} = I_{R_1} \cdot R_1 = 1.5 \cdot 24 = \boxed{36V}$$

$$I_{R_2} = I_{R_{2,3}} \frac{R_3}{R_2 + R_3}$$

$$I_{R_2} = 5 \frac{18}{18+12} = \cancel{5}\,\frac{18}{\cancel{30}\,6} = \boxed{3A}$$

$$I_{R_3} = I_{R_{2,3}} - I_{R_2} = 5 - 3 = \boxed{2A}$$

סיכום:

$I_{R_1} = 1.5A$

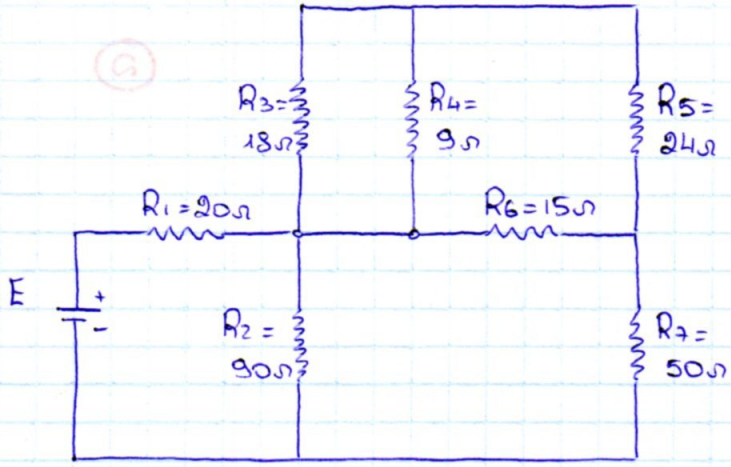
$I_{R_2} = 3A$

$I_{R_3} = 2A$

$U_S = 36V$

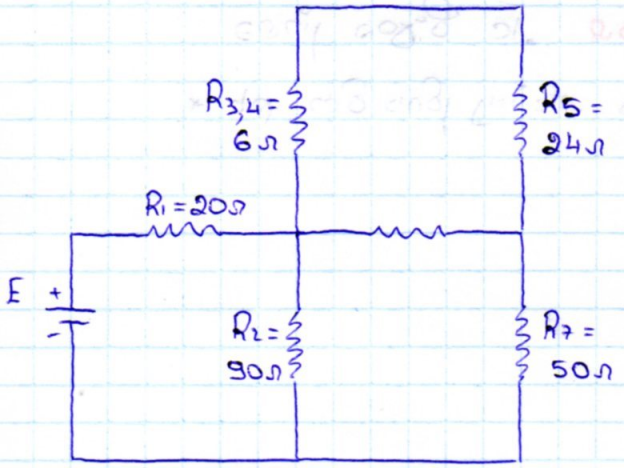
③

ⓒ



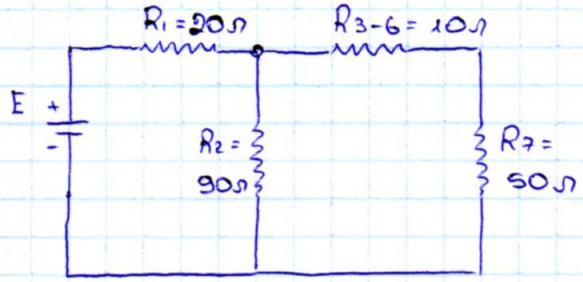
פתרון:

$$R_{3,4} = R_3 \parallel R_4 = \frac{18 \cdot 9}{18+9} = 6\Omega$$



$$R_{3-5} = R_{3,4} + R_5 = 6 + 24 = 30\Omega$$

$$R_{3-6} = R_{3-5} \parallel R_6 = \frac{30 \cdot 15}{30+15} = 10\Omega$$

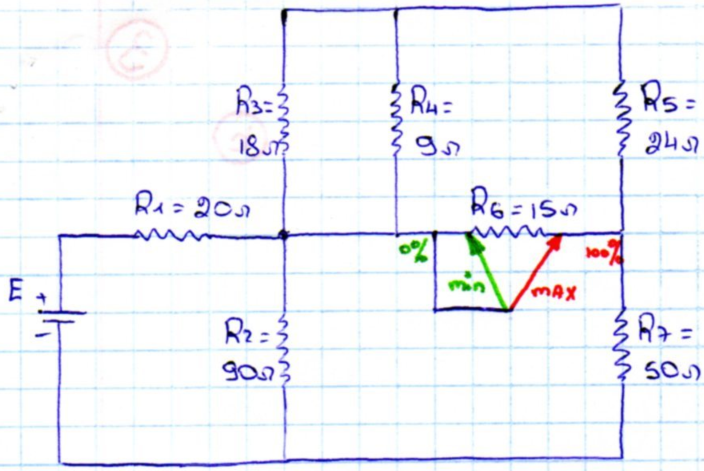


$$R_{3-7} = R_{3-6} + R_7 = 10 + 50 = 60\Omega$$

$$R_{2-7} = R_2 \parallel R_{3-7} = \frac{90 \cdot 60}{90+60} = 36\Omega$$

$$R_T = R_1 + R_{2-7} = 20 + 36 = \boxed{56\ \Omega}$$

ב

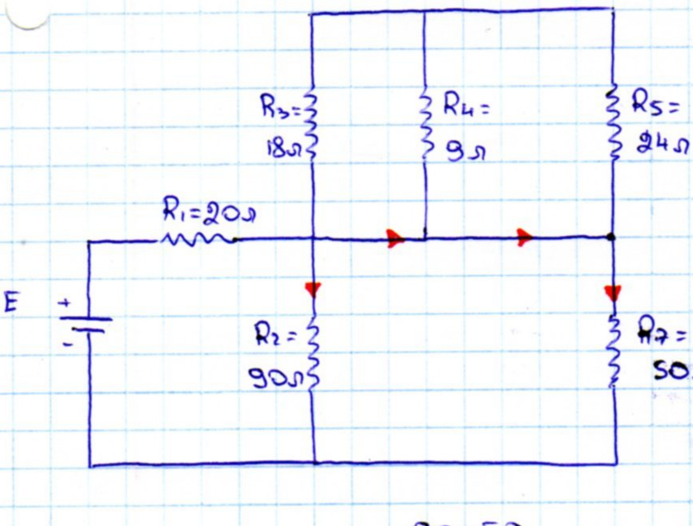


פתרון:

* אם רגל מחוון נמצאת בנק' מקסימום, אז מעגל עובר רגיל.

פתרון בסעיף א'. $R_T = 56\Omega = R_{Tmax} = 56\Omega$

* אם רגל מחוון נמצאת בנק' מינימום אז:



$$R_{2,7} = R_2 \parallel R_7 = \frac{90 \cdot 50}{90+50} = 32.142\,\Omega$$

$$R_T = R_1 + R_{2,7} = 20 + 32.142 = 52.142\,\Omega$$

$$\boxed{R_{Tmin} = 52.142\,\Omega}$$