Question 1 — Août 2015

Total consommé = 3 × 3 MJ = 9 MJ.

Total dépensé musculaire : 900 kJ.

$\Delta J = 900\ 10^3 = \Delta h \times m \times g.$

$\Delta h = \dfrac{900\ 10^3}{45 \times g} = \dfrac{900\ 10^3}{450}$

$= 2000\ m$

Puissance métabolique du corps humain : $\dfrac{3\ MJ}{3600\ s} = 833\ W.$

Puissance musculaire du corps humain : ~ 83 W.

août 2015

Question 1

Q. Ex 1

a. $34\ kV/cm \times 1\ cm = 34\ kV.$

b1 $Q = CV$ où $C = 4\pi\varepsilon_0 \frac{R^2}{d} = \frac{1}{9 10^9} \frac{(10^{-2})^2}{10^{-2}}$

$= \frac{10^{-2}}{9 10^9}$

$Q = \frac{10^{-2}}{9 10^9} 34\ 10^3 = 3.78\ 10^{-8}\ C$ ou $Q = E \times d \times 4\pi\varepsilon_0 \frac{R^2}{d}$

b2. $E = 2 \times \frac{Q}{4\pi\varepsilon_0 \left(\frac{d}{2}\right)^2} \rightarrow Q = E \times \left(\frac{d^2}{2}\right) 4\pi\varepsilon_0 \times \frac{1}{2}$

$= E \times d \times 4\pi\varepsilon_0 \times \frac{d}{8} = 4.72\ 10^{-9}$ C

ou $E = 34\ 10^3 \times 10^2$ V/m

$= 3.4\ 10^6$ V/m.

Examen de Physique août 2012 première candidature en informatique Partie I

b3. $Q = E \times d \times 4\pi\varepsilon_0 \frac{(\alpha d)^2}{d} = E \times d \times 4\pi\varepsilon_0 \times \alpha^2 d$

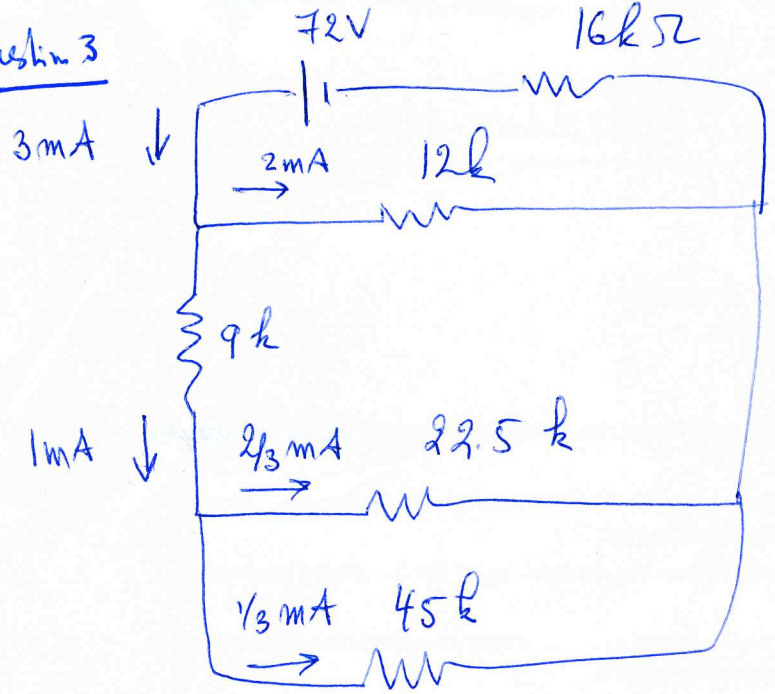
$Q = E \times d \times 4\pi\varepsilon_0 \times \frac{d}{8}$

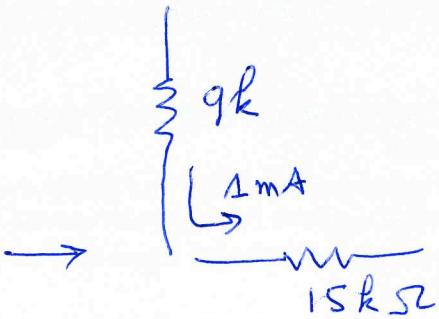
soit $\alpha^2 = \frac{1}{8}$ soit $\alpha = \frac{1}{\sqrt{8}}$

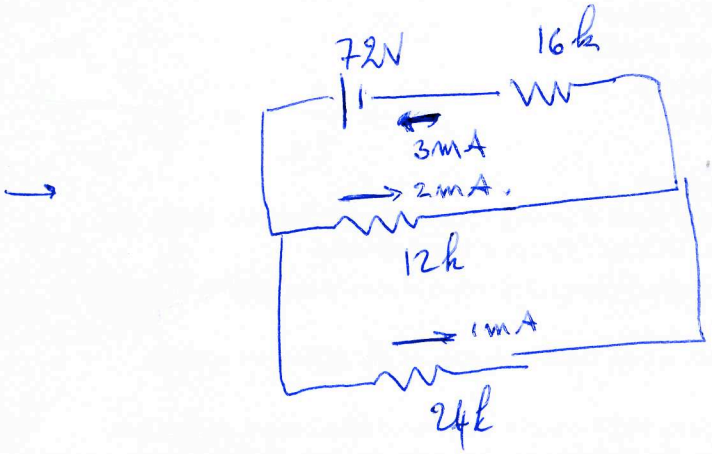
c. $U = \frac{1}{2} Q V = \frac{1}{2} 3.78\ 10^{-8}\ 34.000 = 6.43\ 10^{-4}$ J.

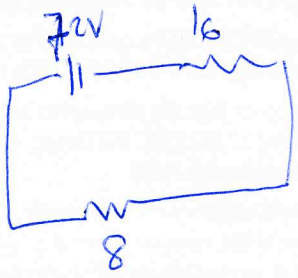
d. $P = \frac{U}{\Delta t} = \frac{6.43\ 10^{-4}\ J}{0.1\ sec} = 6.43\ 10^{-3}$ W. $= 6.43$ mW

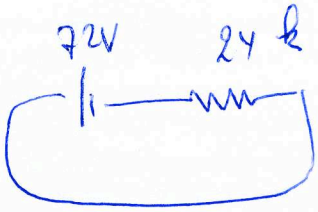
Question 3





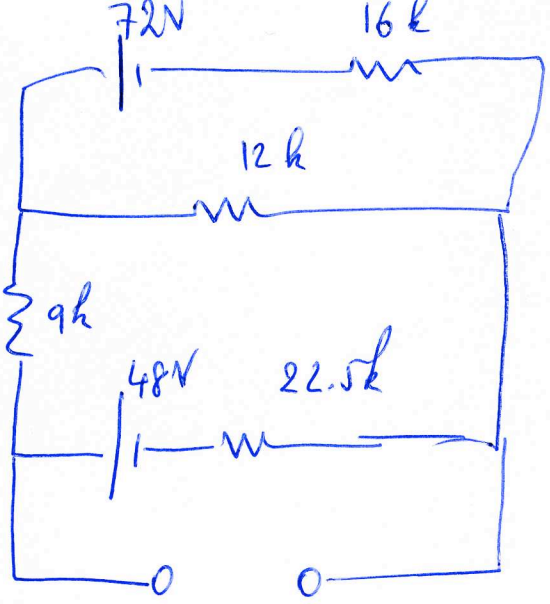






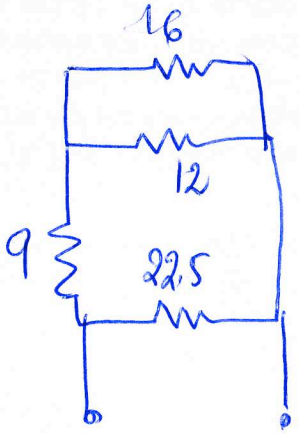
$$i = \frac{72}{24} = \frac{9 \times 8}{3 \times 8} = 3 \text{ mA}.$$

Reponse 1/3 mA



Thévenin

- R_{Th} : on court circuite les sources



$$\frac{1}{16}+\frac{1}{12}=\frac{1}{4\times4}+\frac{1}{3\times4}=\frac{3+4}{3\times4\times4}$$

$$=\frac{7}{48} \Rightarrow R=\frac{48}{7}$$

$$=6.86\ k.$$

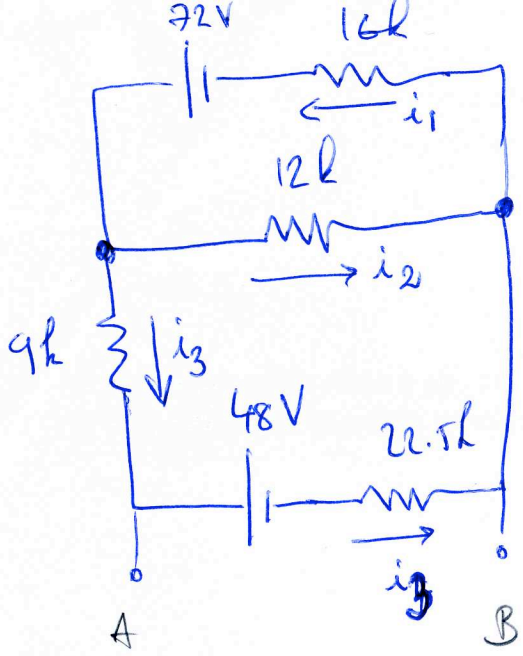
$$R' = 6.86 + 9$$

$$= 17.86\ k$$

$$R'' = \frac{1}{\frac{1}{22.5}+\frac{1}{17.86}}$$

$$= 9.96\ k.$$

- V_{Th} : circuit ouvert.



$$i_1 = i_2 + i_3$$

$$72 = 12k\, i_2 + 16k\, i_1$$

$$48 = -9k\, i_3 - 22.5k\, i_3 - 12k\, i_2$$

$$= -31.5k\, i_3 - 12k\, i_2$$

$$72 = 12k\, i_2 + 16k\,(i_2 + i_3)$$

$$= 28k\, i_2 + 16k\, i_3.$$

$$\frac{48}{31.5k} = -i_3 - \frac{12}{31.5} i_2$$

$$\frac{72}{16k} = i_3 + \frac{28}{16} i_2$$

$$\Rightarrow \frac{48}{31.5k} + \frac{72}{16k} = \left(-\frac{12}{31.5} + \frac{28}{16}\right) i_2$$

$$6\,10^{-3} = 1.369\, i_2$$

$$i_2 = 0.0044 \text{ A}.$$

$$\frac{48}{12k} = -\frac{31.5}{12} i_3 - i_2$$

$$\frac{72}{28k} = \frac{16k}{28k} i_3 + i_2$$

$$\Rightarrow \frac{48}{12k} + \frac{72}{28k} = \left(\frac{16k}{28k} - \frac{31.5}{12}\right) i_3$$

$$0.0066 = -2.05\, i_3.$$

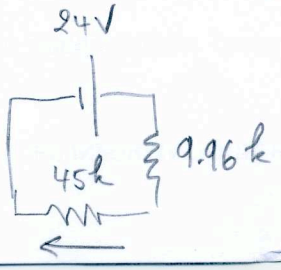
$$i_3 = -3.2 \text{ mA}.$$

→ Tension A et B: $V_A - V_B = 48 - 3.2\,10^{-3} \times 22.5\,10^{3}$

$= 48 - 72$

$= -24 \text{ V}$

→ Circuit equivalent:

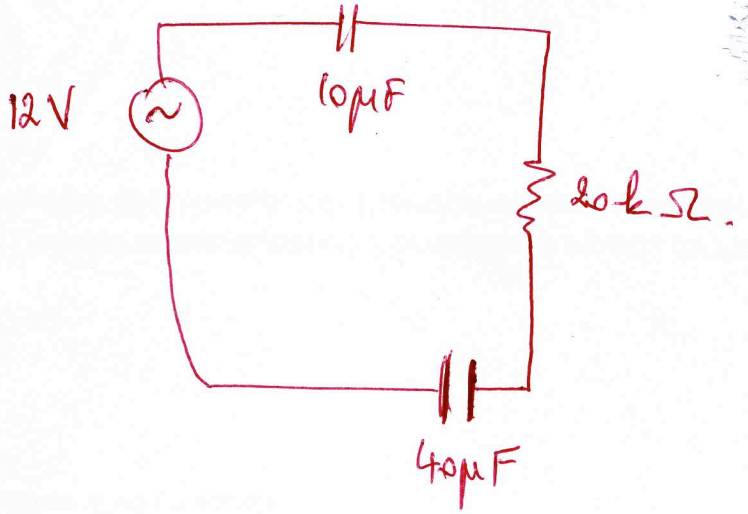


→ $i = \frac{24}{55k} = 0.43 \text{ mA}.$

Question 4

Août 2015

a)



$$\hat{v} = v_0 = 12V.$$

b) $$Z = Z_{C_1} + Z_R + Z_{C_2}$$

$$= \frac{1}{\omega C_1 j} + R + \frac{1}{\omega C_2 j}$$

$$= R - j\left(\frac{1}{\omega C_1} + \frac{1}{\omega C_2}\right)$$

c) $$\hat{i} = \frac{\hat{v}}{Z} = \frac{v_0}{R - j\left(\frac{1}{\omega C_1} + \frac{1}{\omega C_2}\right)}$$

$$= \frac{v_0}{R^2 + \left(\frac{1}{\omega C_1} + \frac{1}{\omega C_2}\right)^2}\left(R + j\left(\frac{1}{\omega C_1} + \frac{1}{\omega C_2}\right)\right)$$

d) $$i_{eff} = \frac{v_{eff}}{|Z|} = \frac{v_0}{\sqrt{2}\,|Z|}$$

$$|Z|^2 = R^2 + \left(\frac{1}{\omega C_1} + \frac{1}{\omega C_2}\right)^2$$