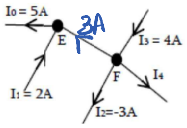
Correction TD4

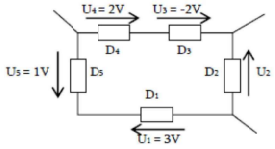
QCM

1) Que vaut l'intensité I_4 ?



- ❑ a. 7A
- ☒ b. 4A
- ❑ c. -4A

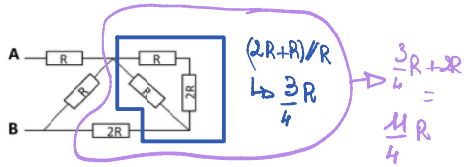
2) Quelle est la valeur de la tension U_2 ?



- ❑ a. 6V
- ❑ b. 8V
- ☒ c. 2V

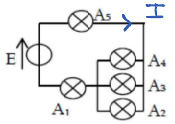
3) Quelle est la résistance équivalente entre A et B ?

$R_{eq} = R + \frac{R \times 11/4\,R}{15/4\,R}$



- ❑ a. 8R
- ☒ b. 26R/15
- ❑ c. 11R/4

4) La luminosité d'une lampe est d'autant plus importante que l'intensité du courant qui la traverse est grande. Dans les montages suivants, composés de lampes identiques, on compare leur luminosité à l'intérieur de chacun des circuits :

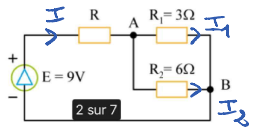


- ❑ a. Les lampes A_2, A_3 et A_4 brillent plus que A_5 et A_1.
- ☒ b. Les lampes A_2, A_3 et A_4 brillent moins que A_5 et A_1.

division du courant

$I \Rightarrow I_2, I_3$ et $I_4 < I$

5) Quelle doit être la valeur de la résistance R pour que la puissance dissipée dans la résistance R_1 soit égale à 12 W ?



- ☒ a. 1 Ω
- ❑ b. 2 Ω
- ❑ c. 3 Ω

$12\,W \Rightarrow I_1 = 2A$

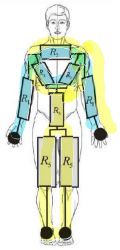
$R_2 = 2R_1 \Rightarrow I_2 = \frac{I_1}{2} = 1A$

$I = 3A = \frac{9}{R+2}$

$R = 1\,\Omega$

$R_1 // R_2 \Leftrightarrow R_{eq} = 2\,\Omega$

Exercice 1



1) Schéma équivalent $\Rightarrow R_{eq} = R_1 + \frac{2R_3R_2}{2R_3+R_2} + R_1$

$i = \frac{230}{979} = 0,235\,A$

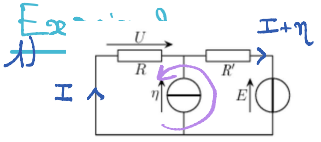
2) Schéma équivalent $\Rightarrow R_{eq} = R_1 + \frac{R_3(R_2+R_3)}{2R_3+R_2} + R_4 + \frac{R_5}{2}$

$i = \frac{230}{973} = 0,236\,A$

3) Dans chaque cas $i > 30\,mA \rightarrow$ il y a tétanisation des muscles

Exercice 2

1)



$RI + E + R'(I+\eta) = 0 \qquad I = -\frac{E+\eta R'}{R+R'}$

$U = -RI = R\frac{E+\eta R'}{R+R'}$

2)

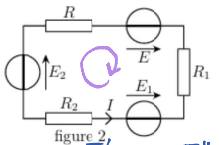
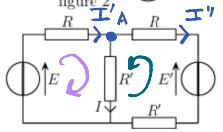


figure 2

$E_2 + RI + E + R_1I - E_1 + R_2I = 0 \qquad I = \frac{E_1 - E_2 - E}{R + R_1 + R_2}$

3)



- loi des nœuds en A : $I' = I'' + I$
- loi des mailles : (1) $E - RI' - R'I = 0$
  (2) $E' + (R+R')I'' - R'I = 0$

On garde I et on choisit I' ou I'' comme 2° inconnue.

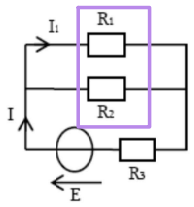
Gardons I et I'. $I'' = I' - I$

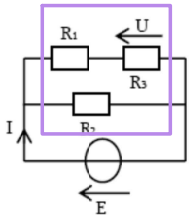
(2) devient $E' + (R+R')I' - (R+R')I - R'I = 0$

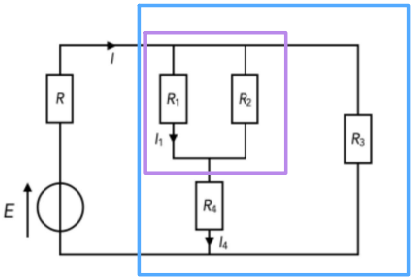
$$\begin{cases} E - RI' - R'I = 0 \rightarrow I' = \frac{E - R'I}{R} \\ E' + (R+R')I' - (2R'+R)I = 0 \end{cases} \rightarrow E' + \frac{R+R'}{R}E - \left(R+R'\right)\frac{R'}{R}I - (2R'+R)I = 0$$

$$\Rightarrow I = \frac{E' + \frac{R'+R}{R}E}{3R' + R + \frac{R'^2}{R}}$$

Exercice 3







$R_{eq} = \dfrac{R_1 R_2}{R_1+R_2}$ $(R_1 /\!/ R_2)$

$I = \dfrac{E}{R_3 + R_{eq}}$

$I_1 = I \dfrac{R_2}{R_1+R_2}$

$U = E \dfrac{R_3}{R_1+R_3}$

$(R_1+R_3) /\!/ R_2$:

$R_{eq} = \dfrac{(R_1+R_3)R_2}{R_1+R_2+R_3}$

$I = \dfrac{E}{R_{eq}}$

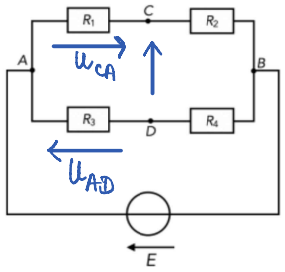
$R_1 /\!/ R_2$: $R_{eq_1} = \dfrac{R_1 R_2}{R_1+R_2}$

$(R_4+R_{eq_1}) /\!/ R_3$: $R_{eq} = \dfrac{(R_4+R_{eq_1})R_3}{R_4+R_{eq_1}+R_3}$

$I = \dfrac{E}{R+R_{eq}}$ $\quad I_4 = I \dfrac{R_3}{R_3+R_4+R_{eq_1}}$

$I_1 = I_4 \dfrac{R_2}{R_1+R_2}$

Exercice 4



⚠ au signe

1) $U_{CD} = U_{AD} + U_{CA} = E\left(\dfrac{R_3}{R_3+R_4} - \dfrac{R_1}{R_1+R_2}\right)$

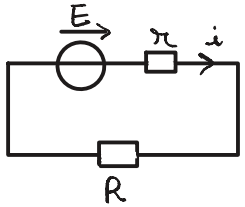
2) $U_{CD} = 0 \iff \dfrac{R_3}{R_3+R_4} = \dfrac{R_1}{R_1+R_2}$

$\iff R_3R_1 + R_2R_3 = R_1R_3 + R_1R_4$

$\iff R_2R_3 = R_1R_4$ $\quad R_1 = \dfrac{R_2R_3}{R_4}$

3) AN : $R_1 = \dfrac{100 \times 1827}{5000} = 36{,}5\,\Omega$

Exercice 5



1) $i = \dfrac{E}{r+R}$

2) $\mathcal{P}_R = Ri^2 = R\dfrac{E^2}{(r+R)^2}$

3) $\dfrac{dP}{dR} = 0 \iff \dfrac{E^2}{(r+R)^2} + RE^2 \dfrac{-2}{(r+R)^3} = 0$

$\iff 1 - 2\dfrac{R}{r+R} = 0 \iff r+R = 2R \iff r = R \quad \Rightarrow \mathcal{P}_{max} = \dfrac{E^2}{4R}$

Exercice 6

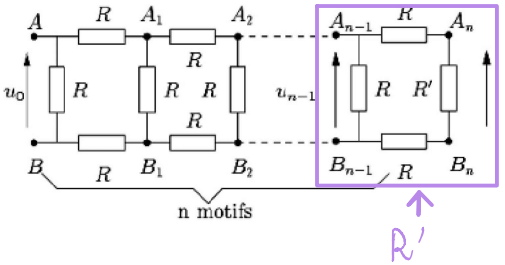
1) $R_{AB} = \dfrac{(2R+R')R}{3R+R'}$

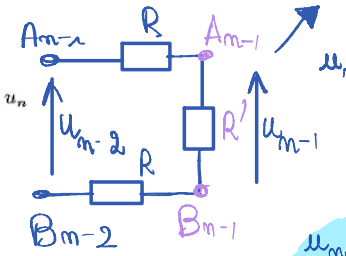
$R_{AB} = R' \iff (3R+R')R' = (2R+R')R$

$\iff R'^2 + 2RR' - 2R^2 = 0 \qquad \Delta = 4R^2 + 8R^2 = 12R^2$

$R' = \dfrac{-2R + 2\sqrt{3}R}{2} = (\sqrt{3}-1)R$ (seule solution >0)

2) pont diviseur de tension : $u_n = \dfrac{R'}{2R+R'} u_{n-1}$ ou $u_{n-1} = \dfrac{R'}{2R+R'} u_{n-2}$





$u_n = \left(\dfrac{R'}{2R+R'}\right) u_0$

$u_n = u_0 \left(\dfrac{\sqrt{3}-1}{\sqrt{3}+1}\right)^n$

3) $R_{AB} = R' = (\sqrt{3}-1)R$