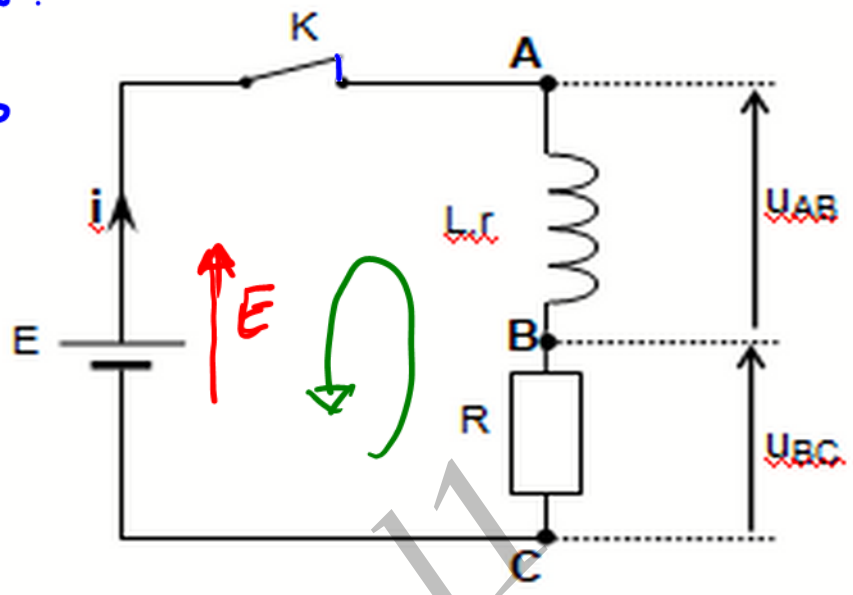
Corrigé Exercice 4:

1. Loi des mailles :

$$u_{BC} + u_{AB} - E = 0$$

$$Ri + ri + L\frac{di}{dt} = E$$



$$(R+r)i + L\frac{di}{dt} = E$$

$$i + \frac{L}{R+r}\frac{di}{dt} = \frac{E}{R+r} \quad (1)$$

2. a. $i(t) = Ae^{-\alpha t} + B$

$$\frac{di}{dt} = -\alpha A e^{-\alpha t}$$

(1) donne : $Ae^{-\alpha t} + B - \alpha A \frac{L}{R+r} e^{-\alpha t} = \frac{E}{R+r}$

$$Ae^{-\alpha t}\left[1 - \alpha\frac{L}{R+r}\right] + B = \frac{E}{R+r}$$

Ce qui est vrai $\forall t$ si $\boxed{B = \frac{E}{R+r}}$

$1 - \alpha \frac{L}{R+r} = 0 \Leftrightarrow \boxed{\alpha = \frac{1}{\frac{L}{R+r}} = \frac{1}{\tau}}$

à $t=0 \quad i = A + B = 0 \Leftrightarrow \boxed{A = -B = -\frac{E}{R+r}}$

b. $\boxed{i = \frac{E}{R+r}\left(1 - e^{-t/\tau}\right)}$

* $u_{BC} = R i = \boxed{\frac{RE}{R+r}\left(1 - e^{-t/\tau}\right)}$

* $u_{AB} = E - u_{BC} = \boxed{E - \frac{RE}{R+r}\left(1 - e^{-t/\tau}\right)}$

$u_{AB} = E - \frac{RE}{R+r} + \frac{RE}{R+r} e^{-t/\tau}$.

$\boxed{u_{AB} = \frac{rE}{R+r} + R\frac{E}{R+r} e^{-t/\tau}}$

3.

a. En régime permanent $\boxed{i = I = \frac{E}{R+r}}$

b.

$\boxed{u_{BC} = \frac{RE}{R+r} = RI}$

$\boxed{u_{AB} = r\frac{E}{R+r} = rI}$

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a. En régime permanent :

$u_{BC} = RI \Leftrightarrow I = \frac{U_{BC}}{R}$

AN $I = \frac{7}{35} = 0,2A$

* $u_{AB} = rI \Leftrightarrow r = \frac{U_{AB}}{I} = \frac{2}{0,2} = 10\Omega$

$I = \frac{E}{R+r} \Leftrightarrow E = (R+r)I$

AN $E = (35+10) \times 0,2 = 9V.$

Rq : $E = U_{AB} + U_{BC} = 9V$

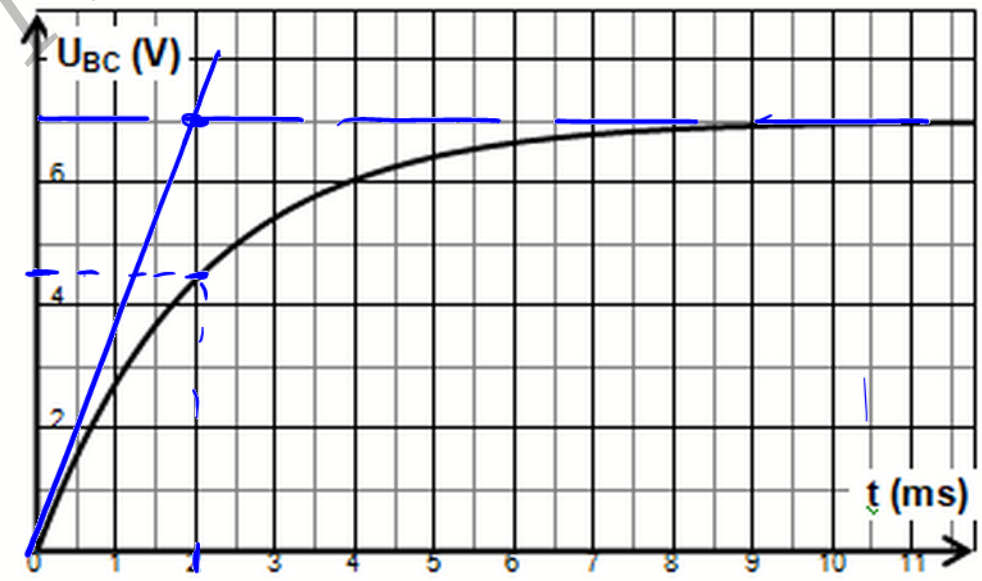
b.

$At = \tau$

$u_{BC} = 0,63\,RI$

$U_{BC} = 0,63 \times 7$

$U_{BC} = 4,47V$



$\Rightarrow \tau = 2ms$

τ

$$\tau = \frac{L}{R+r} \Rightarrow L = \tau(R+r)$$

$$L = 2.10^{-3}(35+10) = 9.10^{-2}\ H$$

Rq : $u_{AB} = E - \frac{RE}{R+r}(1 - e^{-t/\tau})$

à $t = \tau \Rightarrow u_{AB} = E + \frac{RE}{R+r} \times 0,63 \neq 0,37E$

$$u_{AB} = 9 - 4,47 = 4,53\ V.$$

$$\Rightarrow \tau = 2\ ms.$$