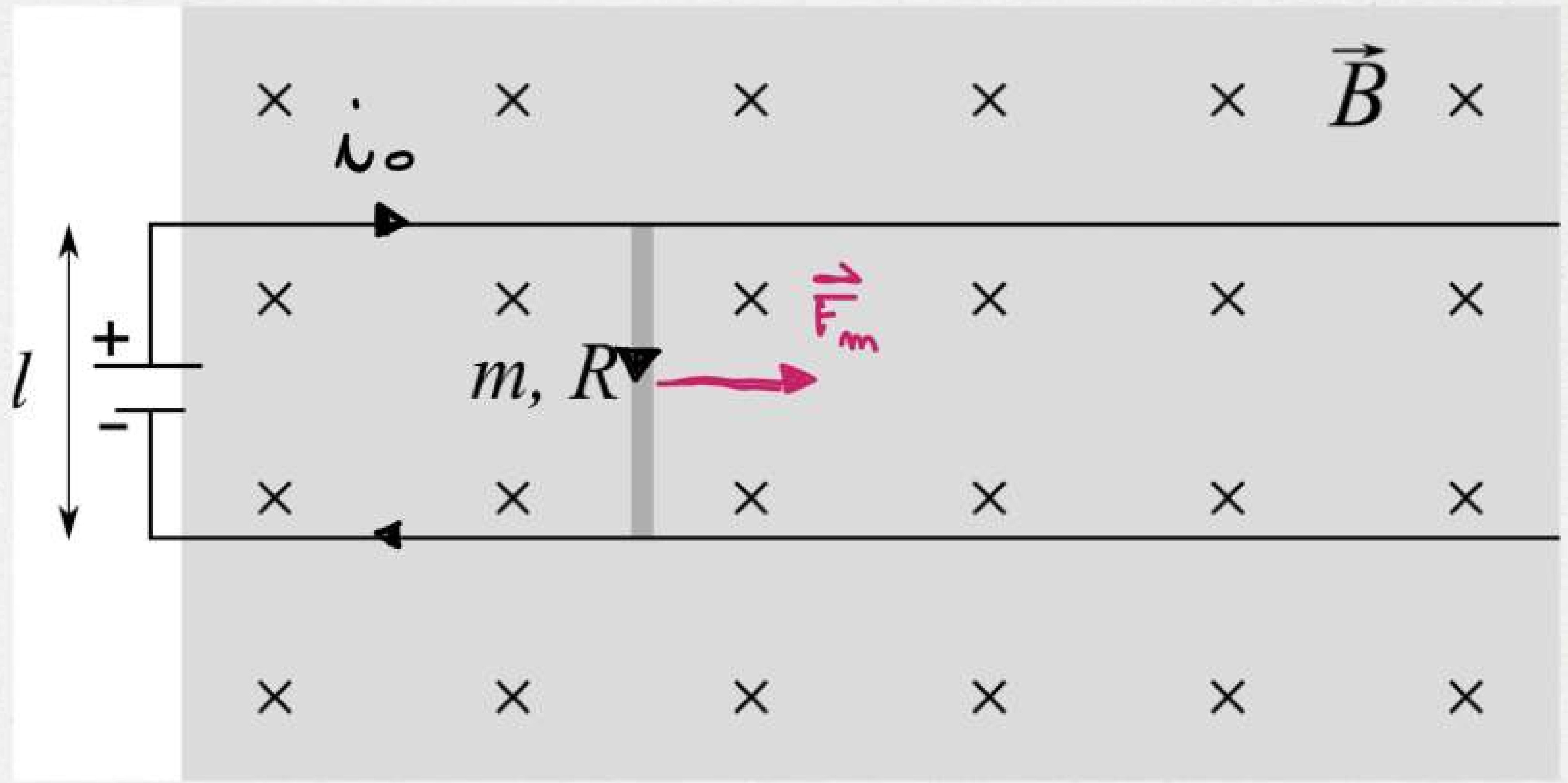


$m = 100\ g$, $R = 500\ \Omega$

$\ell = 40\ cm$, $B = 0.8\ T$

A il generatore fornisce una corrente <u>costante</u>

$i_0 = 0.2\ A$

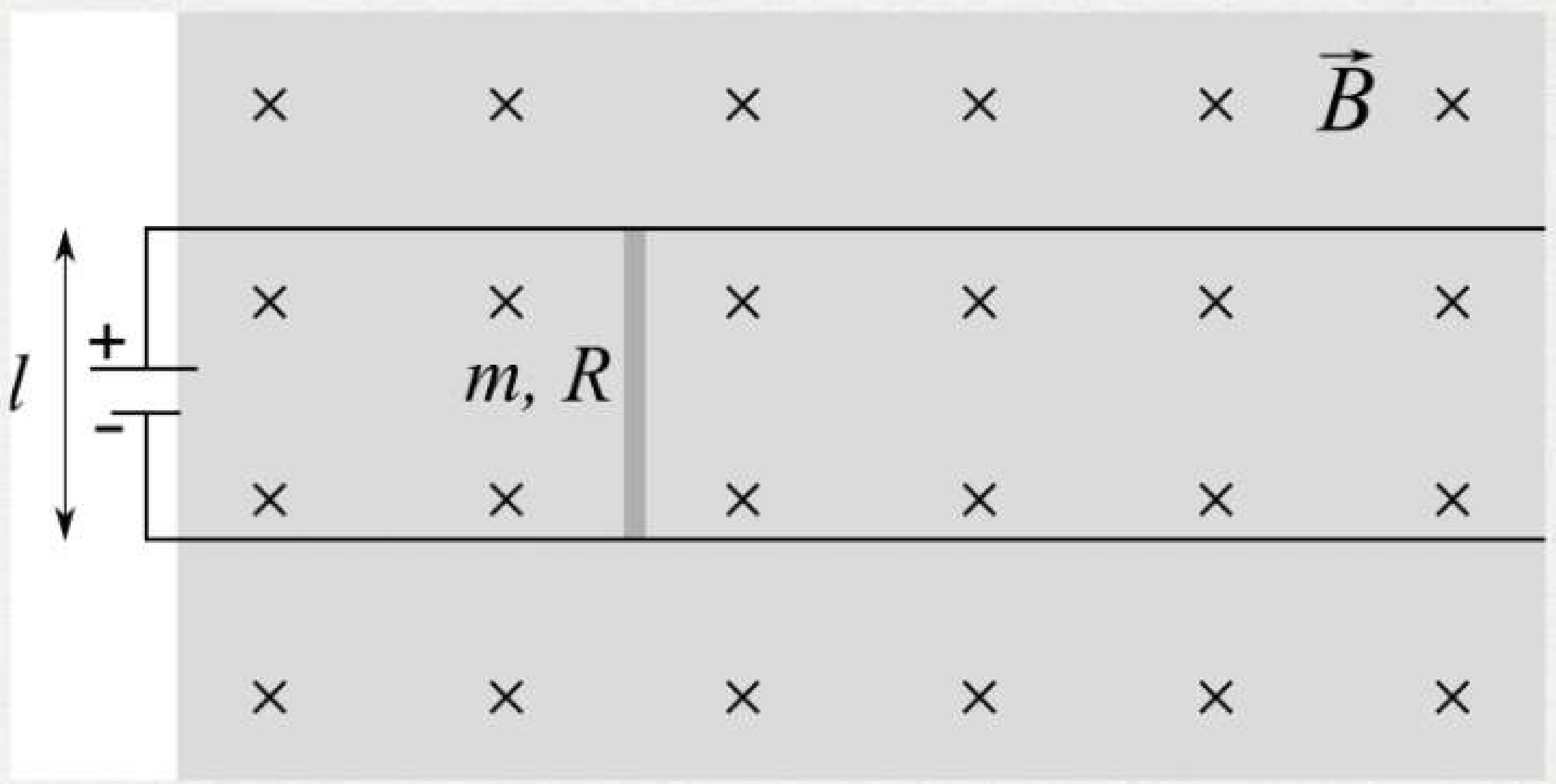
- 1 direzione di moto
- 2 v al tempo $t_1 = 15\ s$
- 3 il lavoro del generatore da $t = 0$ a $t = t_1$

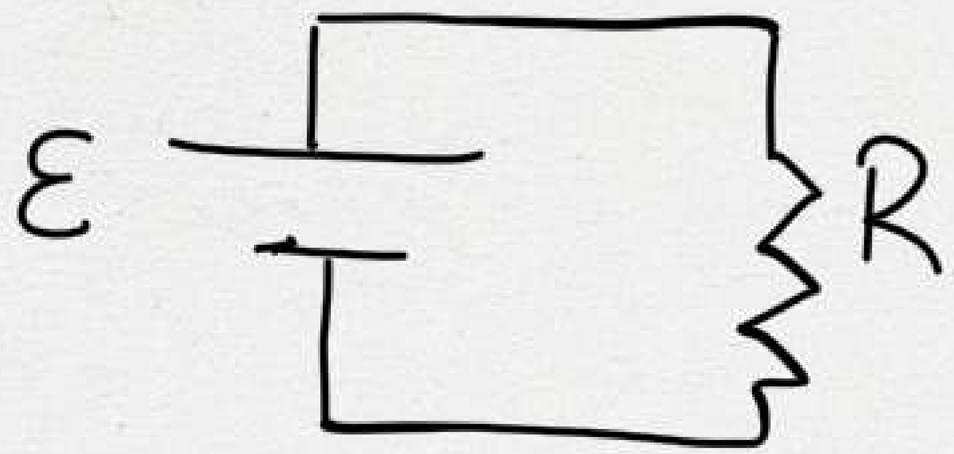
$F_m = i_0 \ell B$

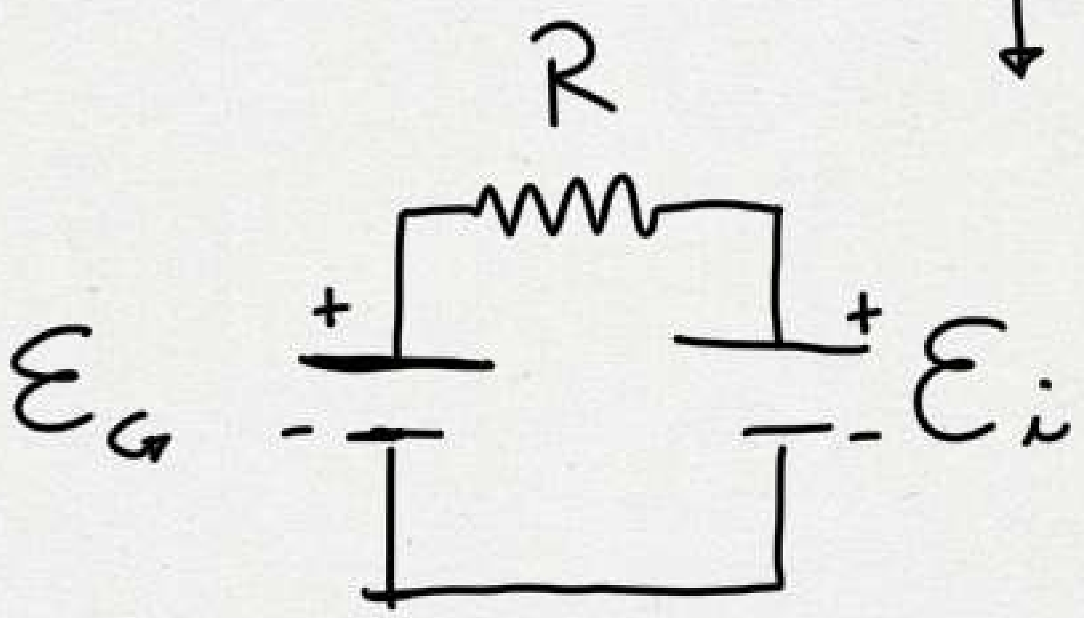
$v(t) = a t = \frac{i_0 \ell B}{m} t \Rightarrow$

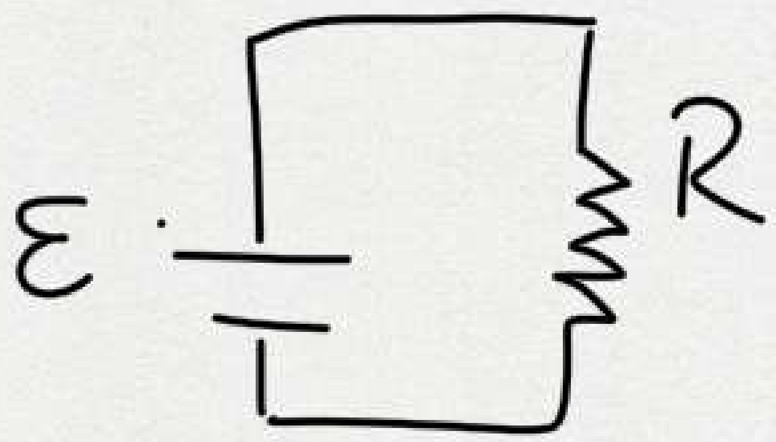
$v(t_1) = \frac{i_0 \ell B}{m} t_1 = 9.6\ m/s$

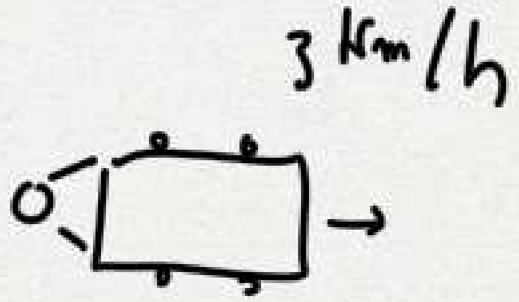
$$\boxed{i_0 = \frac{\mathcal{E}}{R}} \Rightarrow \mathcal{E} = i_0 R$$











$$\mathcal{E} = |\mathcal{E}_G| - |\mathcal{E}_i| \Rightarrow |\mathcal{E}_G| = \mathcal{E} + |\mathcal{E}_i|$$

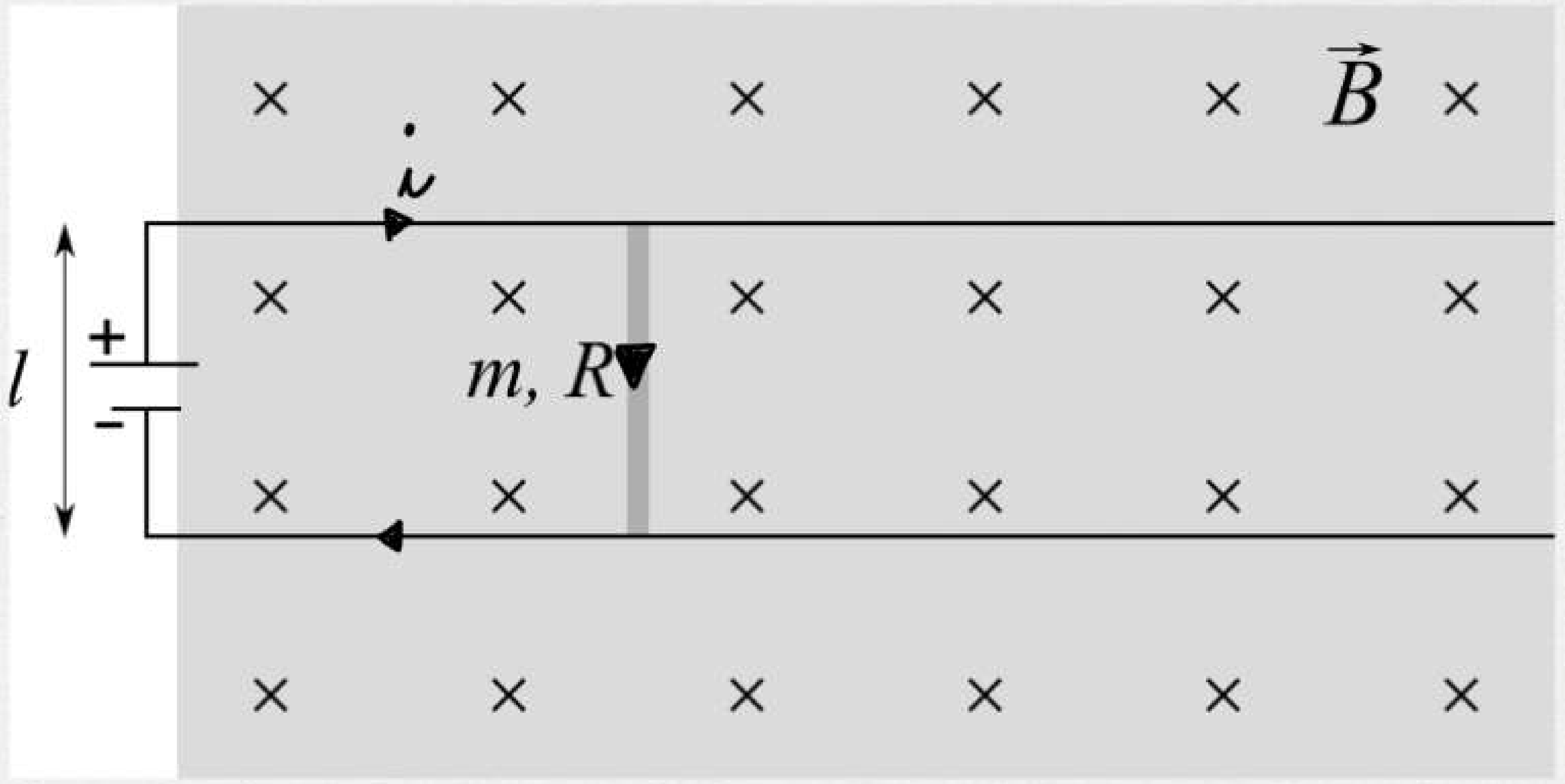
$$\mathcal{E}_i = -\frac{d\Phi}{dt} = -v(t)\,l B = -\frac{i_0 l^2 B^2 \boxed{t}}{m} \Rightarrow \mathcal{E}_G = i_0 R + \frac{i_0 l^2 B^2 t}{m}$$

$$P = \mathcal{E}_G i_0 = R i_0^2 + \frac{i_0^2 \ell^2 B^2 t}{m}$$

$$\Downarrow$$

$$W = \int_0^{t_1} P\,dt = R i_0^2 t_1 + \frac{i_0 \ell^2 B^2}{m} \int_0^{t_1} t\,dt = R i_0^2 t_1 + \boxed{\frac{1}{2} \frac{i_0 \ell^2 B^2}{m} t_1^2} =$$

$$= R i_0^2 t_1 + \boxed{\frac{1}{2} m v^2(t_1)}$$



Ⓑ il generatore fornisce una f. e. m costante

$\mathcal{E}_0 = 8V$

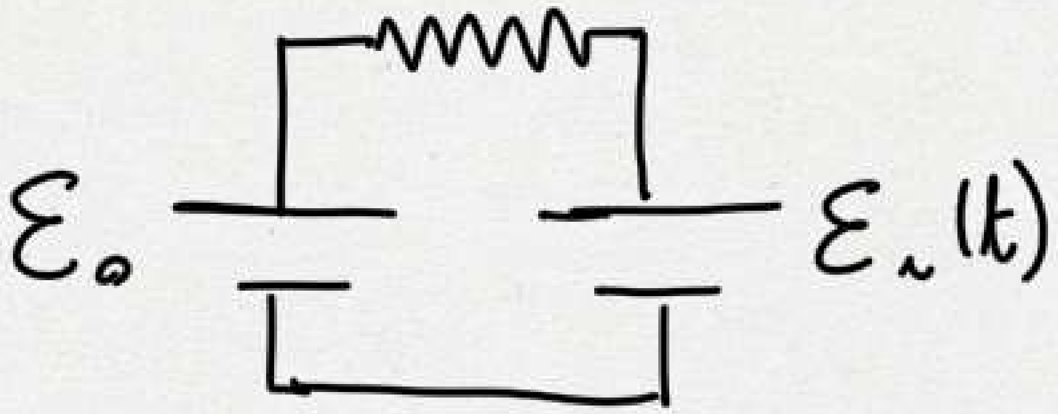
① la P erogata dal generatore quando $v = v_\infty$

② $v_\infty = ?$

$$F = i_{LIM} l B = 0 \Rightarrow i_{LIM} = 0$$

$$\downarrow$$

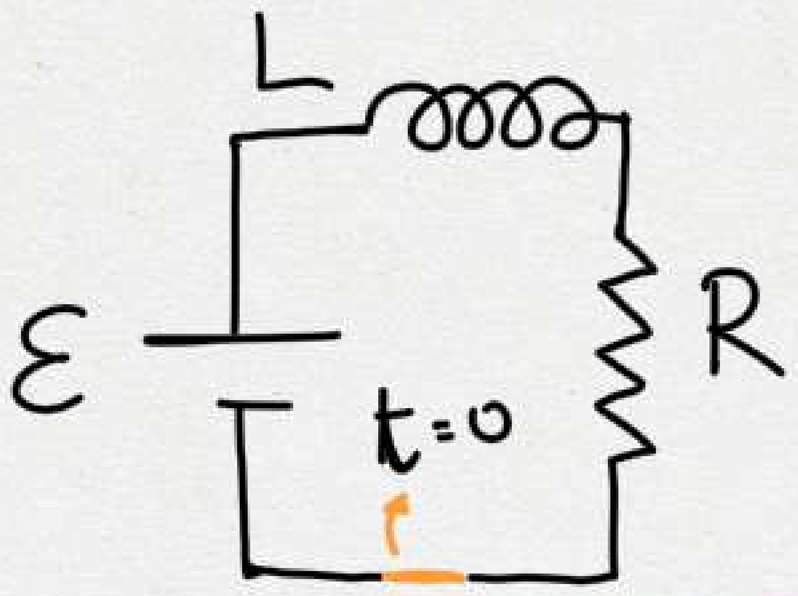
$\mathcal{E}_0 + \mathcal{E}_i = 0$ nel caso limite



$$\boxed{P_{LIM} = \mathcal{E}_0 i_{LIM} = 0}$$

$$\mathcal{E}_i = -\frac{d\Phi}{dt} = -v(t) B l \Rightarrow$$

$$\mathcal{E}_0 = v_{LIM} B l \Rightarrow v_{LIM} = \frac{\mathcal{E}_0}{lB}$$



$R = 0.1\ \Omega$, $L = 9.44\ H$

$i(0) = 1.16\ A$

$i(15) = 10.2\ mA$

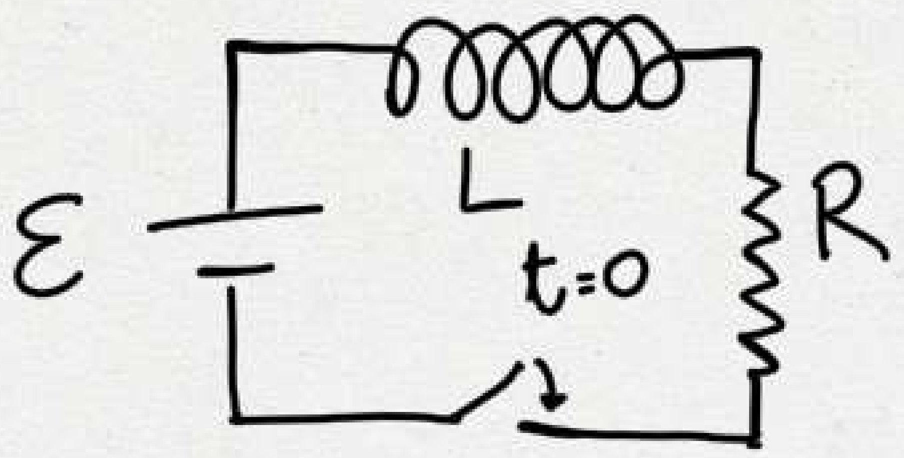
① $\mathcal{E} = ?$

② $R' = ?$ resistenza tra i poli dell'interruttore

① $\boxed{i(t) = i(0)\, e^{-t/\tau}}$, $\tau = \dfrac{L}{R'}$, $i(0) = \dfrac{\mathcal{E}}{R} \Rightarrow \mathcal{E} = i(0)R = 0.116\,V$

② $i(15) = i(0)\, e^{-15/\tau} \Rightarrow \log \dfrac{i(15)}{i(0)} = -\dfrac{15}{\tau} = -\dfrac{15R'}{L} \Rightarrow$

$$R' = -\frac{L}{15} \log \frac{i(15)}{i(0)}$$



$L = 4 \cdot 10^{-4}\,H, \quad R = 5\,\Omega, \quad \mathcal{E} = 200\,V$

① determinate t^*: $i(t^*) = 0.6\, i(\infty)$

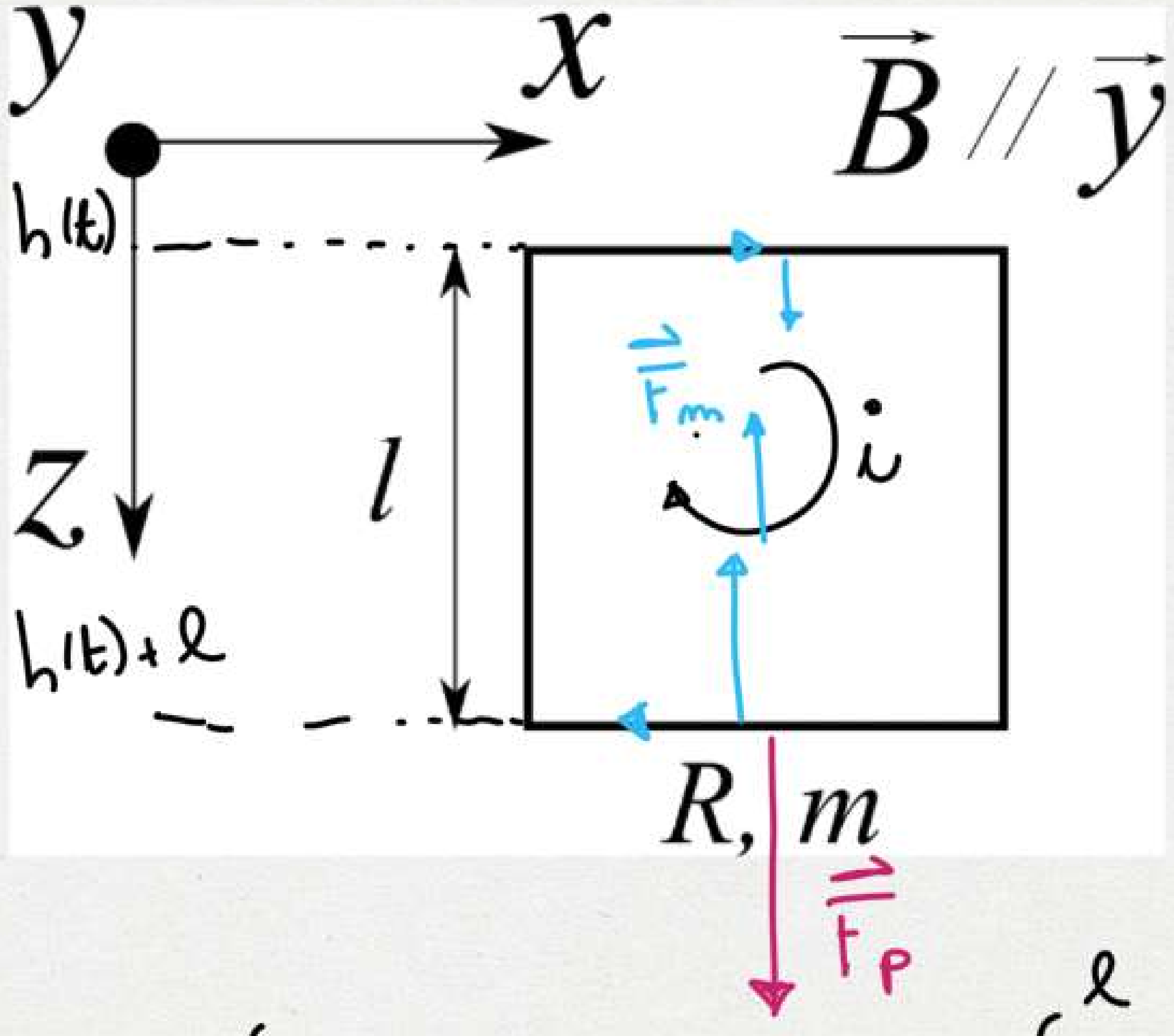
② l'energia accumulata nel campo magnetico quando $i(t) = i(\infty)$

$$i(t) = i(\infty)\left(1 - e^{-t/\tau}\right) = \frac{\mathcal{E}}{R}\left(1 - e^{-t/\tau}\right)$$

① $$0.6\,\cancel{\frac{\mathcal{E}}{R}} = \cancel{\frac{\mathcal{E}}{R}}\left(1 - e^{-t^*/\tau}\right) \Rightarrow 0.4 = e^{-t^*/\tau} \Rightarrow$$

$$-\log 0.4 = \frac{t^*}{\tau} \Rightarrow -\tau \log 0.6 = t^*$$

② $$U = \frac{1}{2} L\, i^2(\infty)$$



$R = 10^{-3}\,\Omega$, $m = 10\,g$, $l = 20\,cm$

$B_y(z) = B_0 z$, $B_0 = 2T/m$

① intensità e verso della corrente?

② $v_{LIM} = ?$

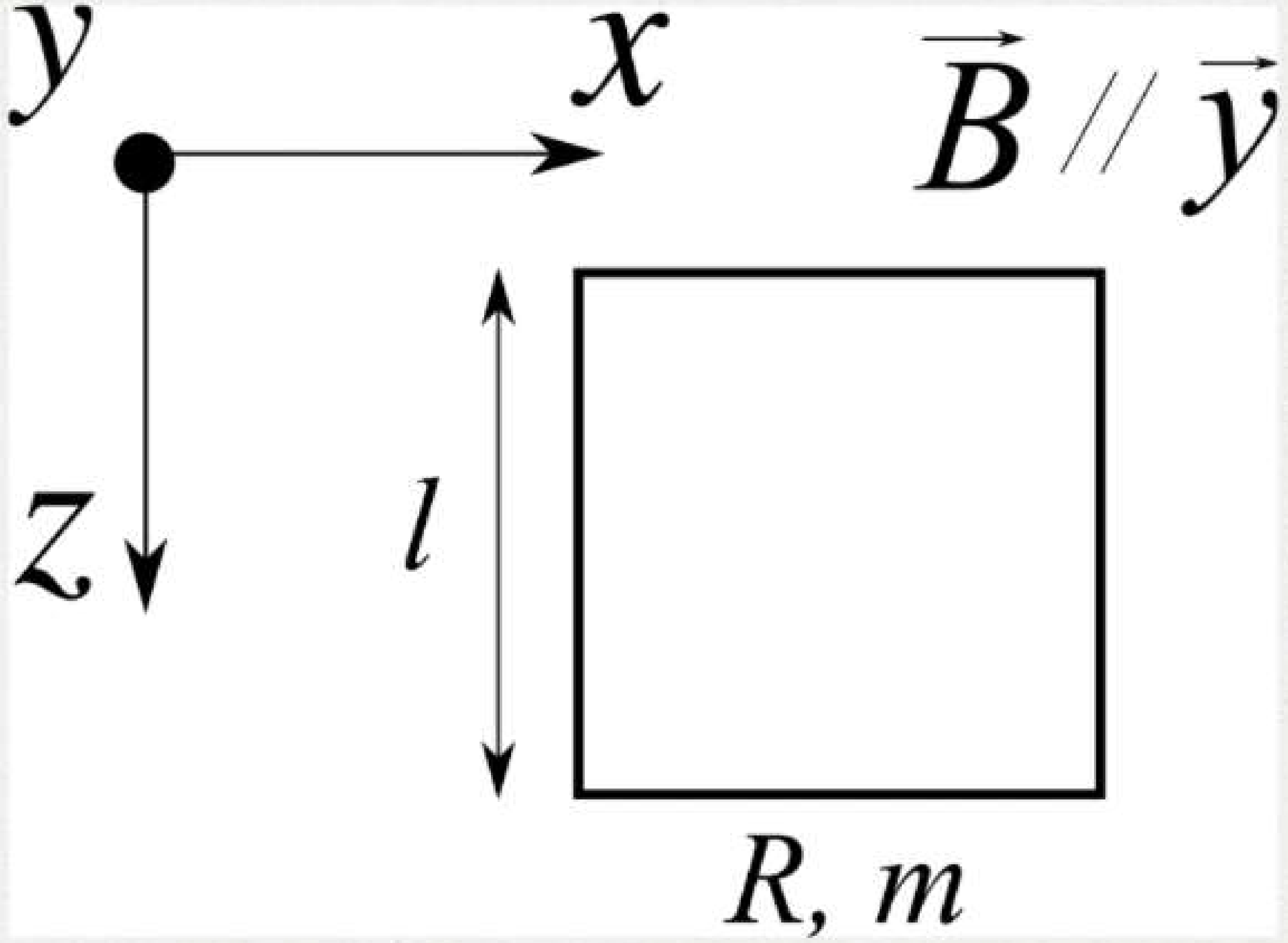
③ $i_{LIM} = ?$

$$i = \frac{\mathcal{E}_i}{R} = -\frac{1}{R}\frac{d\Phi}{dt}$$

$$\Phi = \int_\Sigma \vec{B}\cdot\hat{n}\,d\Sigma = B_0\int_0^l dx\int_{h(t)}^{h(t)+l} z\,dz = B_0 l\left[\frac{1}{2}(h(t)+l)^2 - \frac{1}{2}h^2(t)\right] =$$

$$= B_0 l\left[\frac{1}{2}l^2 + l\,h(t)\right] \Rightarrow$$

$$\frac{d\Phi}{dt} = B_0 l^2 v(t) \Rightarrow i = -\frac{B_0 l^2 v(t)}{R}$$



② $v_{LIM} = ?$

$$F_p = mg = F_m$$

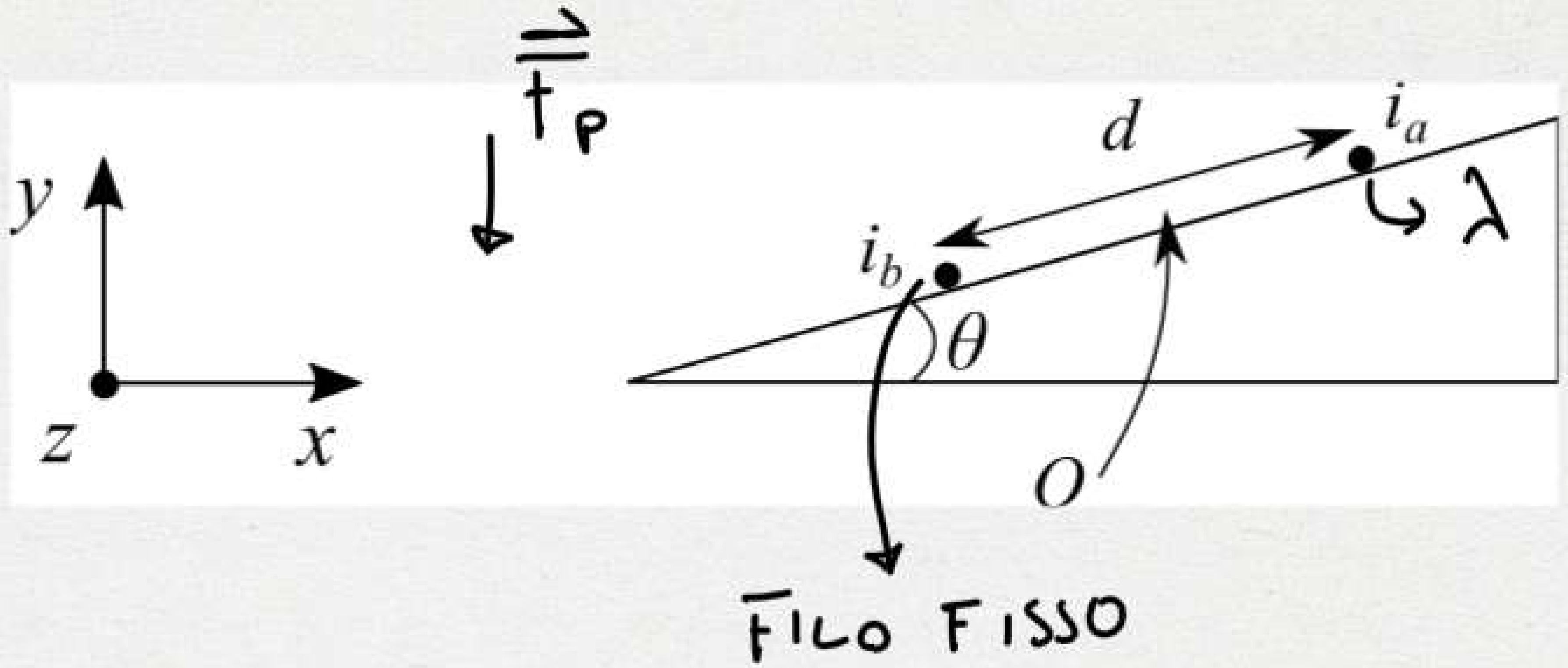
$$F_m = i\ell B(h(t)+\ell) - i\ell B(h(t)) =$$

$$= i\ell B_0(h(t)+\ell) - i\ell B_0 h(t) = i\ell B_0 \ell = iB_0\ell^2 =$$

$$= \frac{\ell^2 B_0 v(t)}{R} B_0 \ell^2 = \frac{\ell^4 B_0^2 v(t)}{R} \Rightarrow$$

$$mg = \frac{\ell^4 B_0^2 v_{LIM}}{R} \Rightarrow v_{LIM} = \frac{Rmg}{\ell^4 B_0^2}$$

③ i_{LIM}, $\quad i(t) = \dfrac{\ell^2 B_0 v(t)}{R} \Rightarrow i_{LIM} = \dfrac{v_{LIM}\,\ell^2 B_0}{R} = \dfrac{\cancel{R}mg}{\ell^{4\,2} B_0^{\cancel{2}}} \dfrac{\ell^{\cancel{2}} \cancel{B_0}}{\cancel{R}} = \dfrac{mg}{\ell^2 B_0}$



$\theta = 10°$, $i_b = 20\,A$, $i_b \parallel \hat{z}$

$\lambda = 0.01\ kg/m$, se $d = 1$ cm, il filo non si muove

1. calcolare verso e intensità di i_a
2. $\vec{B}(O) = ?$
3. aggiungiamo un campo esterno $\vec{B}_{ext} = -B_0 \hat{z}$, $B_0 = 0.1\,T$.
   Determinare il valore di i_a necessario affinché il sistema resti in equilibrio.