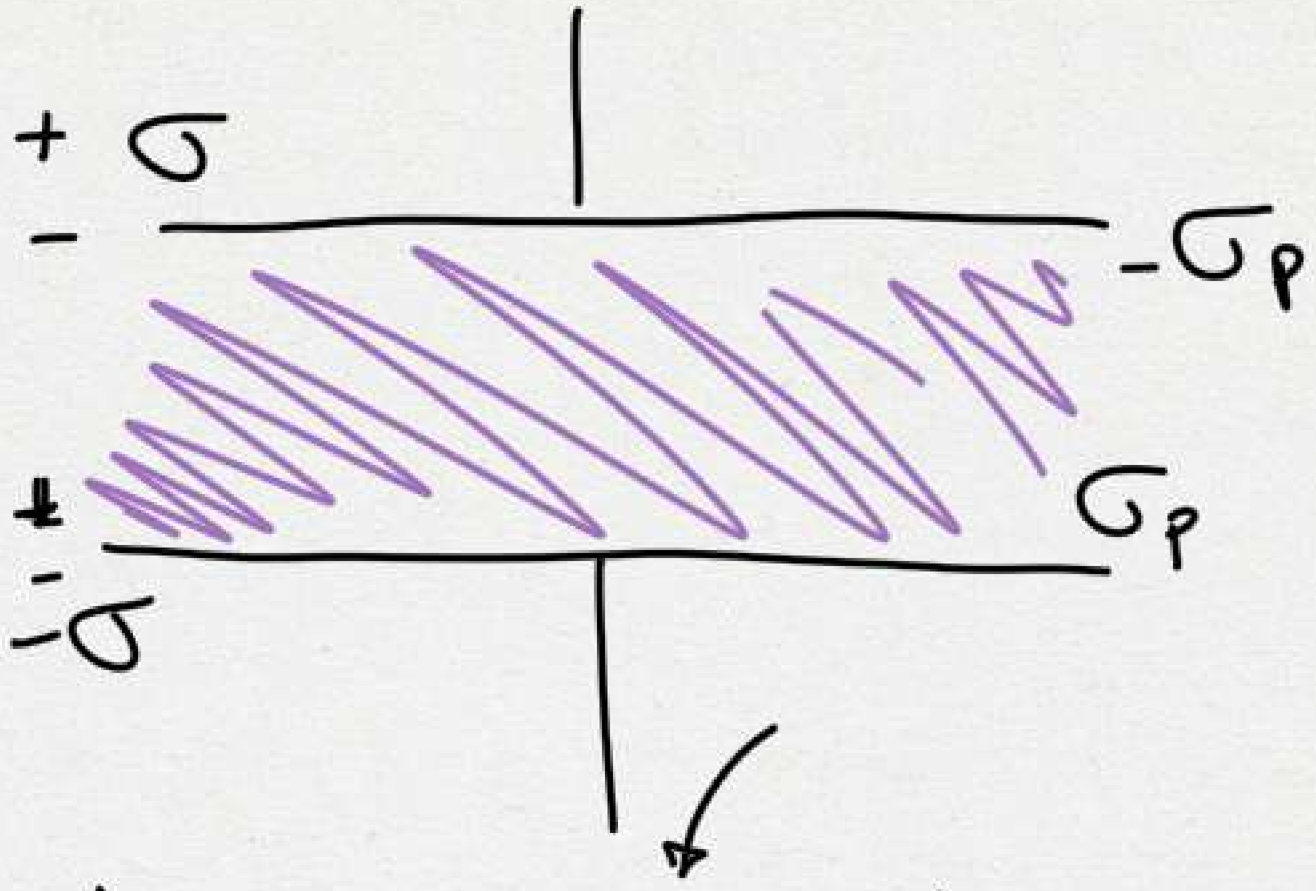
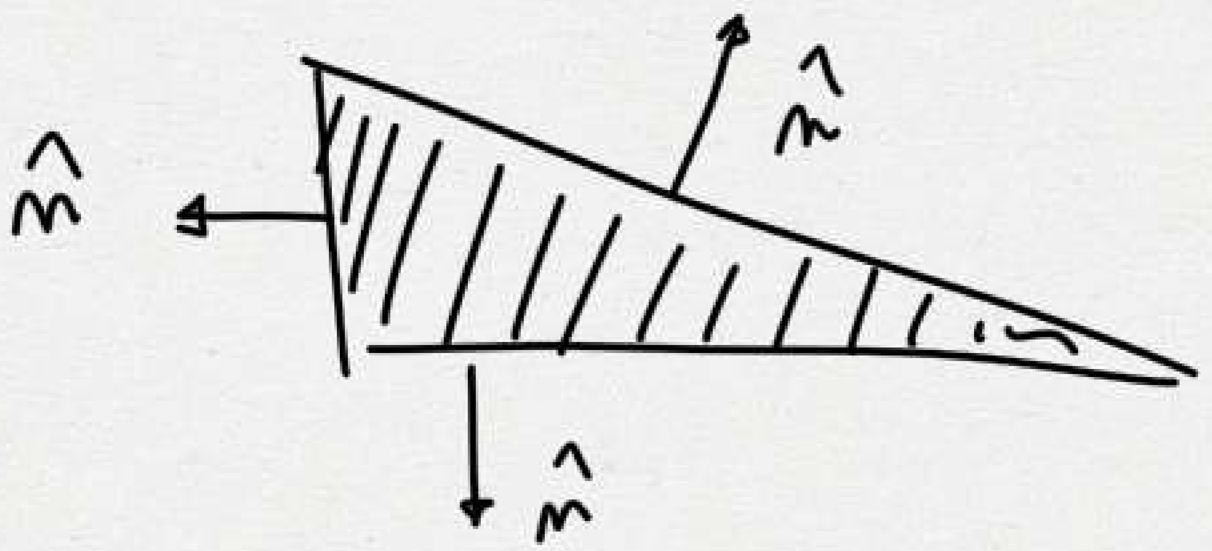


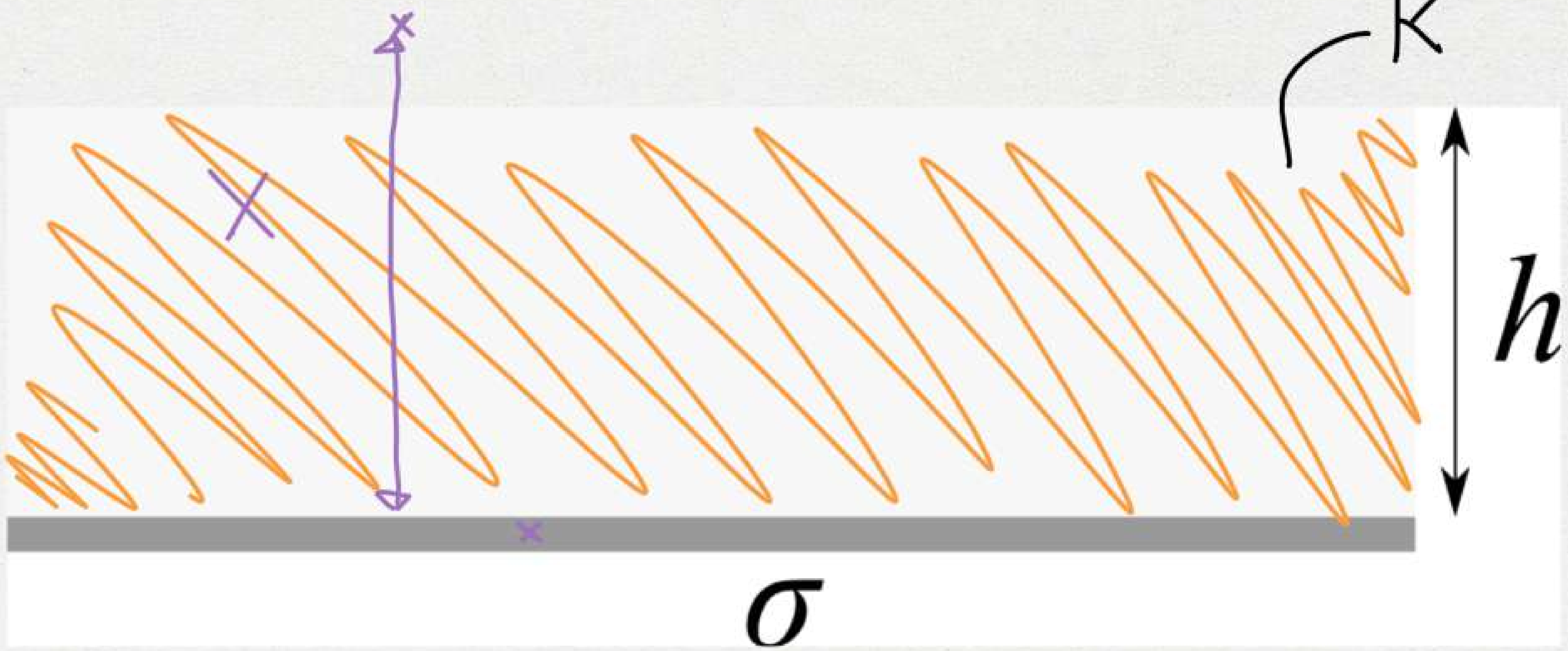
$$\sigma_p = \frac{K-1}{K}\sigma$$

$$\vec{P} = \varepsilon_0 (K-1)\vec{E} \neq 0$$ SOLO IN UN DIELETTRICO

$$\vec{D} = \varepsilon \vec{E} \longrightarrow \Phi_\Sigma(\vec{D}) = Q_\Sigma$$

$$\vec{P} \cdot \hat{n} = \sigma_p$$





① Calcolare σ_p sulle superfici del dielettrico

② calcolare la d.d.p. tra un punto sul conduttore e uno all'esterno del dielettrico

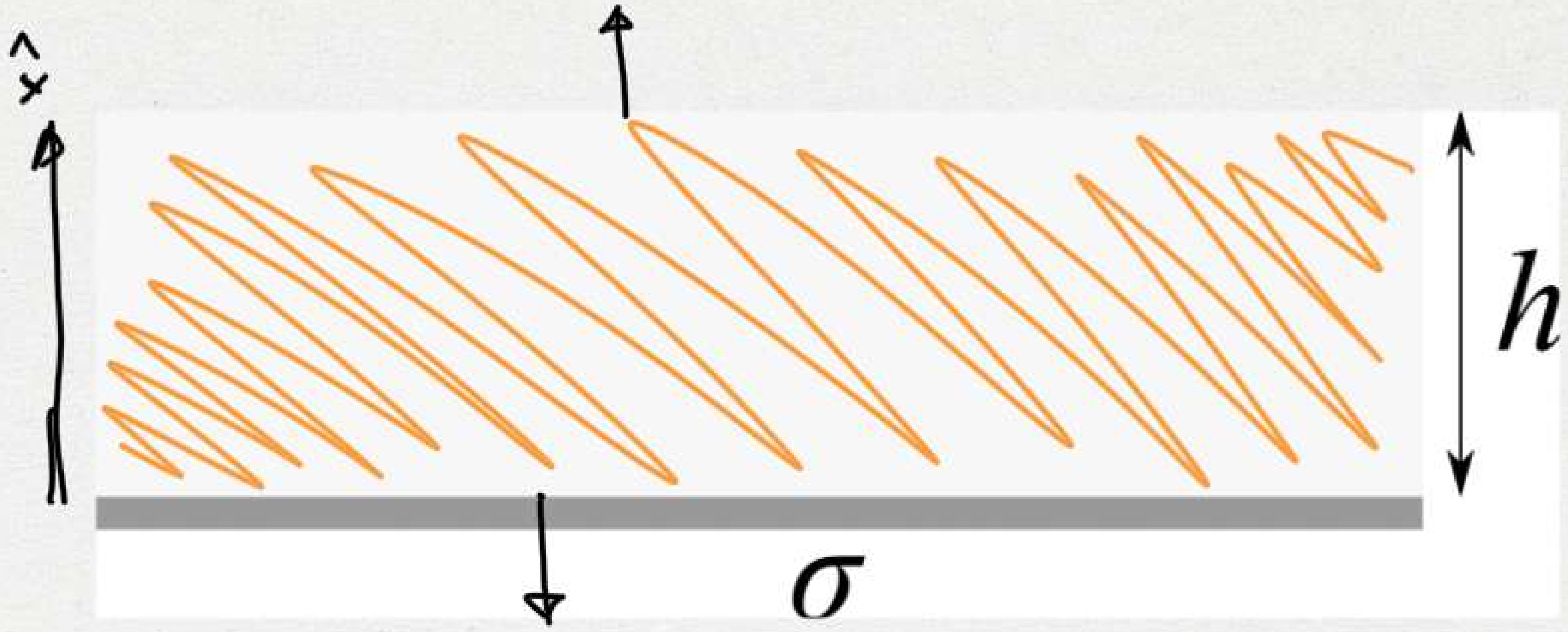
$$\vec{D} = \varepsilon \vec{E}$$

$$\boxed{\vec{D} = \frac{q}{4\pi} \frac{\hat{r}}{r^2} \quad \text{CARICA}}$$

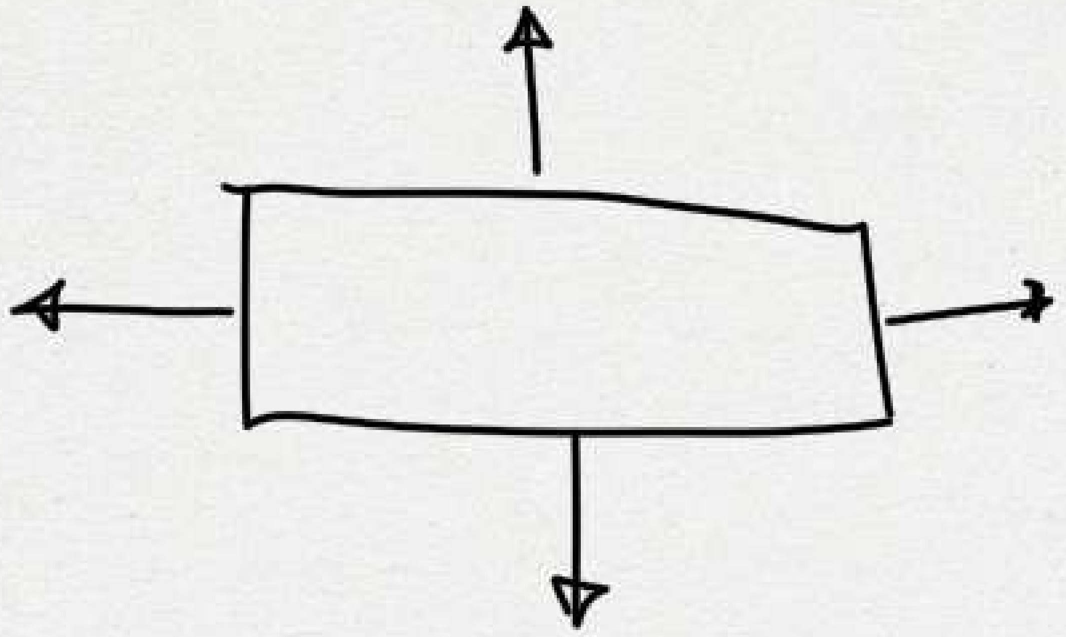
$$\vec{D} \rightarrow \vec{E} \rightarrow \vec{P} \rightarrow \sigma_p \quad \text{STRATEGIA}$$

$$\vec{D} = \sigma \hat{x} \quad \text{PIANO}$$

$$\vec{P} = \varepsilon_0 (K-1) \vec{E}$$



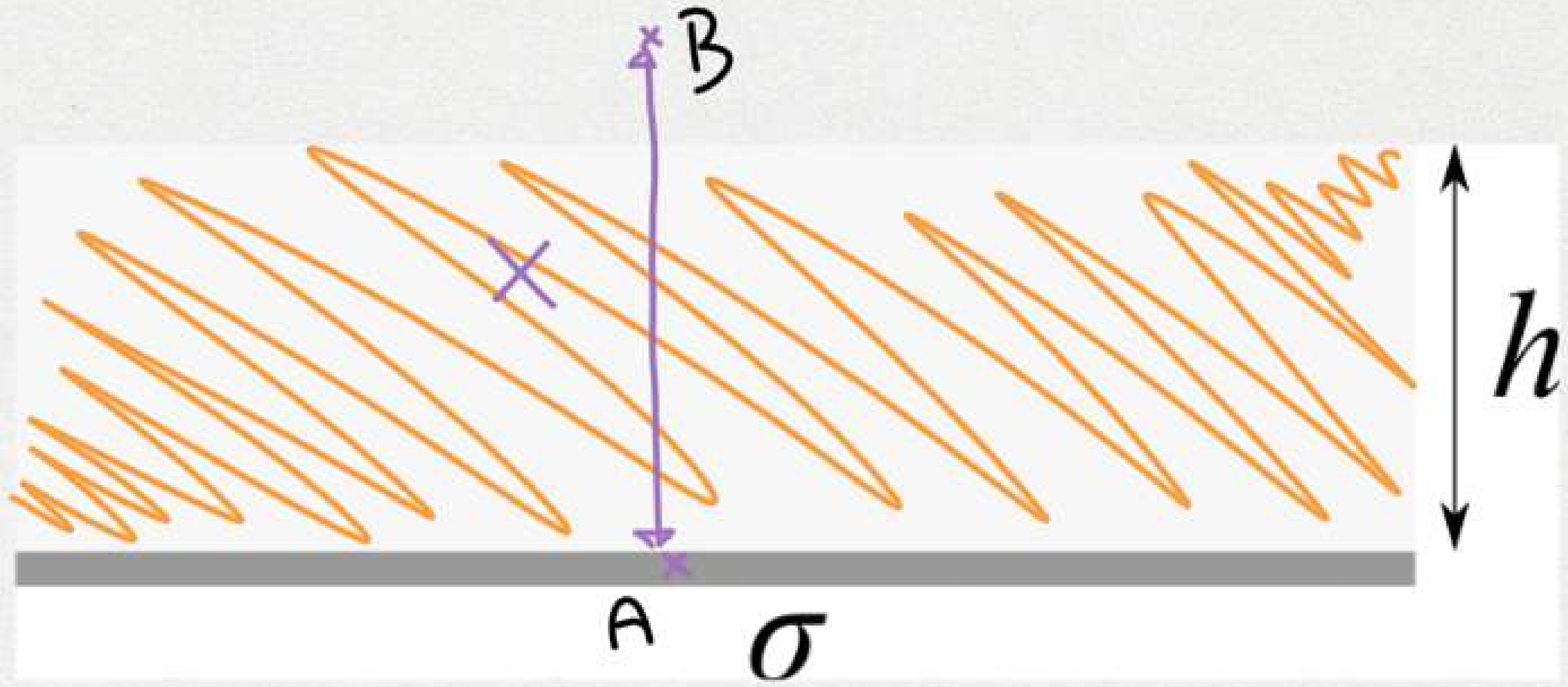
$\sigma_p(0) =$



$$\vec{D} = \sigma \hat{x} \rightarrow \vec{E}(x<h) = \frac{\vec{D}}{\varepsilon} = \frac{\sigma}{\varepsilon}\hat{x}, \quad \vec{E}(x \geq h) = \frac{\vec{D}}{\varepsilon_0} = \frac{\sigma}{\varepsilon_0}\hat{x}$$

$$\vec{P} = \varepsilon_0(\kappa - 1)\vec{E} = \varepsilon\vec{E} - \vec{E}\varepsilon_0 = \frac{\kappa - 1}{\kappa}\sigma\hat{x}$$

$$\begin{cases} \sigma_p(0) = \vec{P}\cdot\hat{n} = -\frac{\kappa-1}{\kappa}\sigma \\ \sigma_p(h) = \vec{P}\cdot\hat{n} = +\frac{\kappa-1}{\kappa}\sigma \end{cases}$$

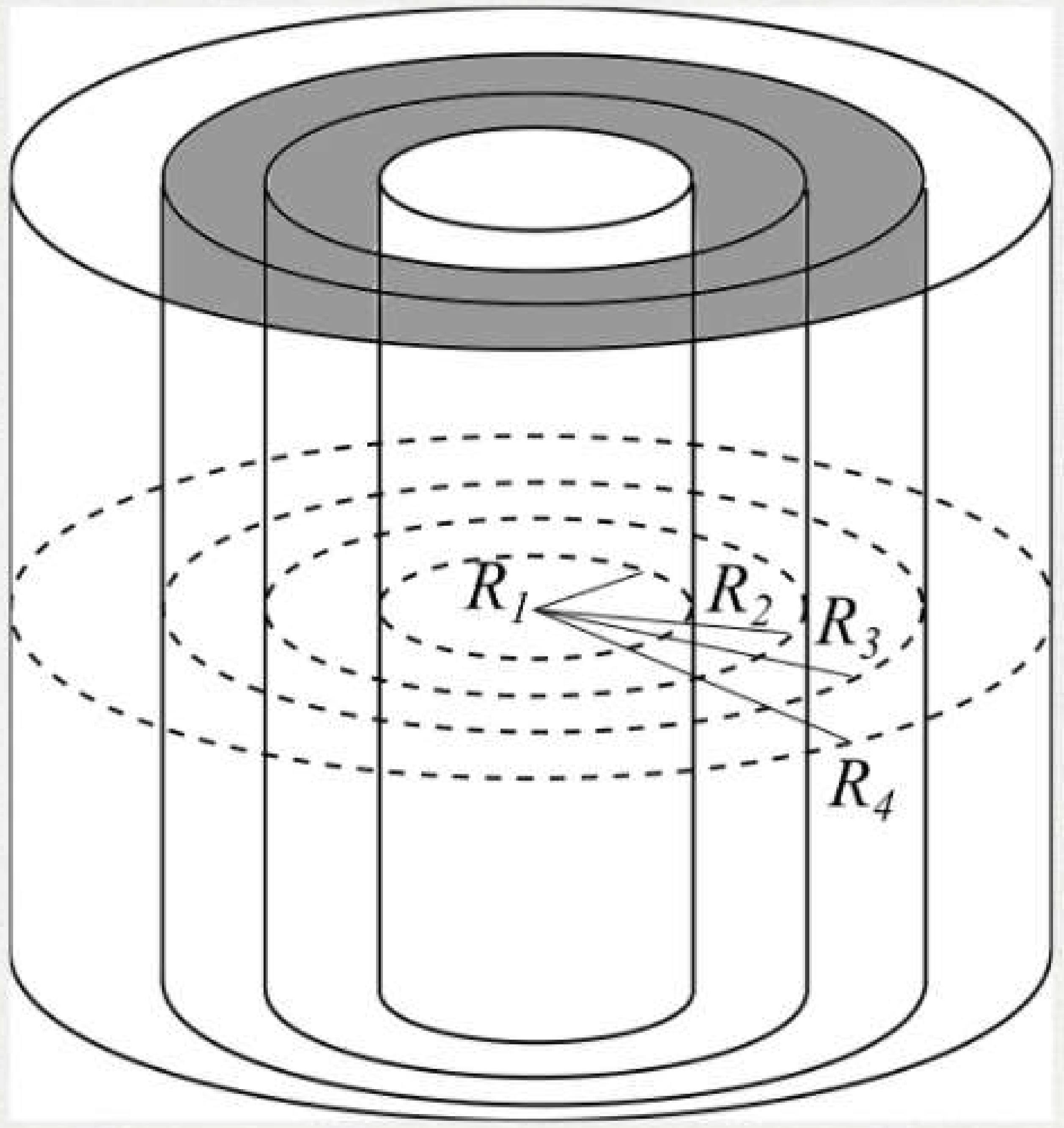


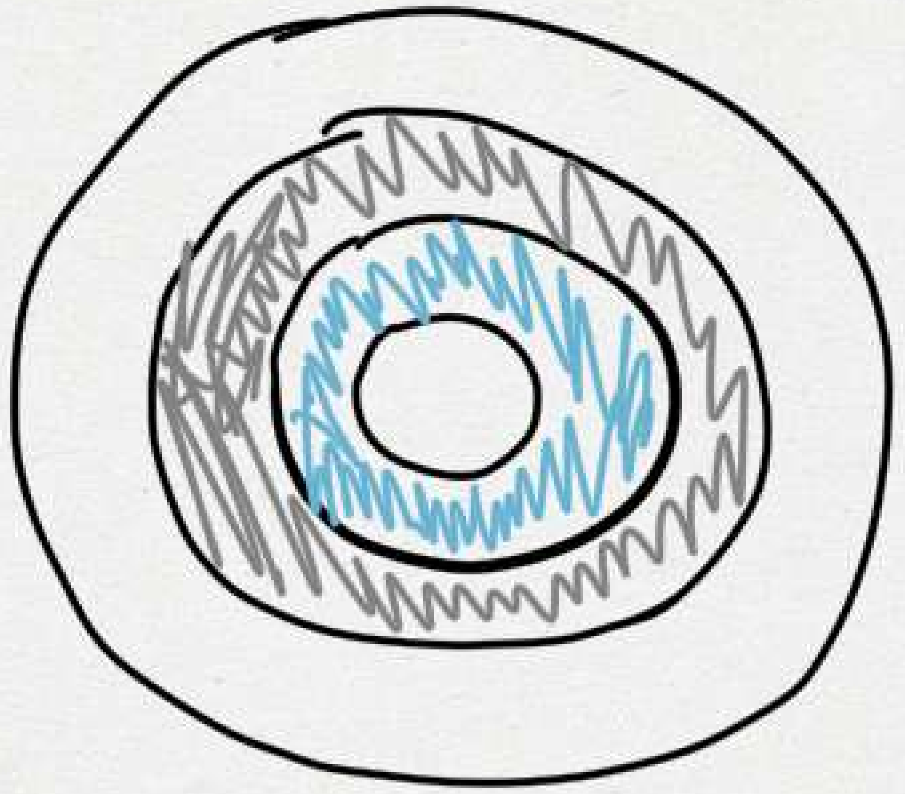
$$\varepsilon = \varepsilon_0 K$$

$$V(A) - V(B) = \int_A^B \vec{E} \cdot d\vec{s} =$$

$$= \int_0^h \frac{\sigma}{\varepsilon} dx + \int_h^x \frac{\sigma}{\varepsilon_0} dx' =$$

$$= \frac{\sigma}{\varepsilon} h + \frac{\sigma}{\varepsilon_0}(x-h) = \frac{\sigma}{K\varepsilon_0} h + \frac{\sigma}{\varepsilon_0}(x-h)$$





σ, K_1, K_2 ① σ_p

R_1, R_2, R_3, R_4

$$\vec{D} \rightarrow \vec{E} \rightarrow \vec{P} \rightarrow \sigma_p$$

$$\vec{E}_0 = \frac{\sigma R_1}{\varepsilon_0 r}\hat{r}$$ ← SE CI RICORDIAMO O APRIAMO IL LIBRO

$$D\,\cancel{2\pi} r \cancel{h} = \cancel{2\pi} R_1 \cancel{h}\,\sigma \Rightarrow D = \frac{R_1\sigma}{r} = E_0\varepsilon_0$$ ← CON GAUSS

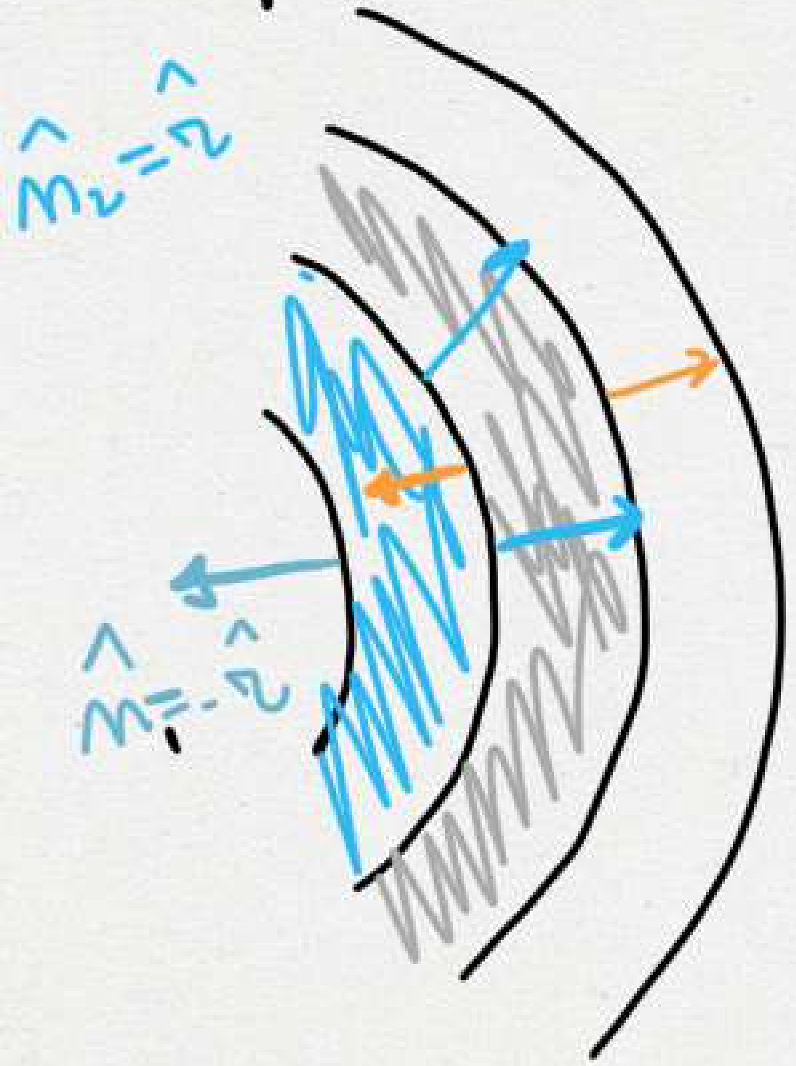
$$\vec{E}_1 = \vec{E}(R_1 < r < R_2) = \frac{\vec{D}}{\varepsilon_1} = \frac{R_1\sigma}{r\varepsilon_1}\hat{r}$$

$$\vec{E}_2 = \frac{\vec{D}}{\varepsilon_2} = \frac{R_1\sigma}{r\varepsilon_2}\hat{r}$$

$$\vec{E}_i = \frac{R_1\sigma}{r\varepsilon_i}\hat{r} \quad i = 1,2$$

$$\vec{P}_i = \varepsilon_0(K_i - 1)\vec{E}_i = \frac{\cancel{\varepsilon_0}(K_i - 1)R_1\sigma}{r\cancel{\varepsilon_0}K_i}\hat{r} = \frac{K_i - 1}{K_i}\frac{R_1\sigma}{r}\hat{r}$$

$$\vec{P}_1 = \frac{K_1 - 1}{K_1}\frac{\sigma R_1}{r}\hat{r}$$



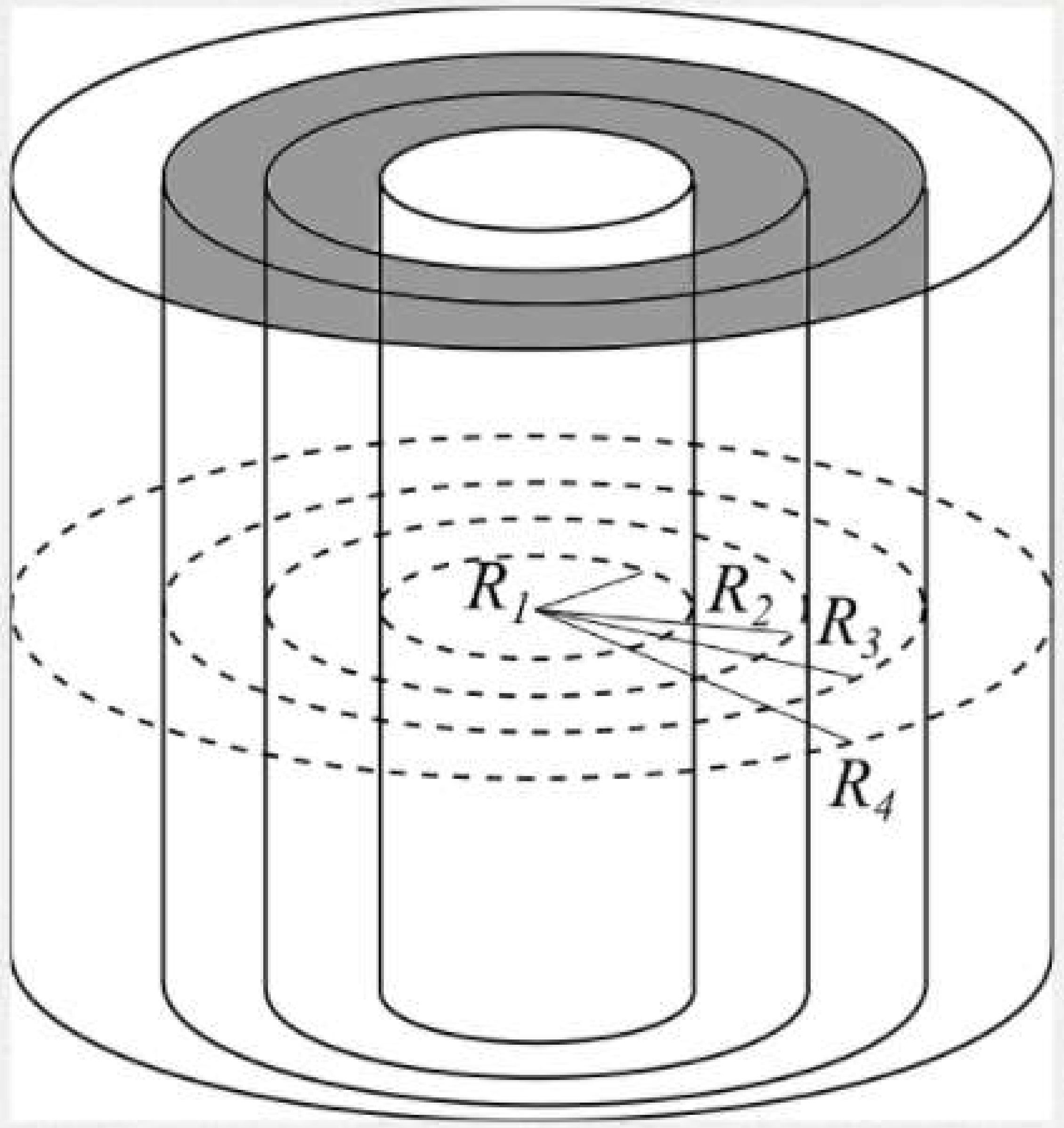
$$\sigma_p^{(1)} = \vec{P}_1 \cdot \hat{m}_1 = \vec{P}_1 \cdot (-\hat{r}) = -\frac{K_1 - 1}{K_1}\frac{\sigma R_1}{R_1} = -\frac{K_1 - 1}{K}\sigma$$

$$\sigma_p^{(2)} = \vec{P}_1 \cdot \hat{m}_2 = \frac{K_1 - 1}{K_1}\frac{\sigma R_1}{R_2}$$

$$\sigma_p^{(3)} = -\frac{K_2 - 1}{K_2}\frac{\sigma R_1}{R_2} = \vec{P}_2 \cdot \hat{m}_3$$

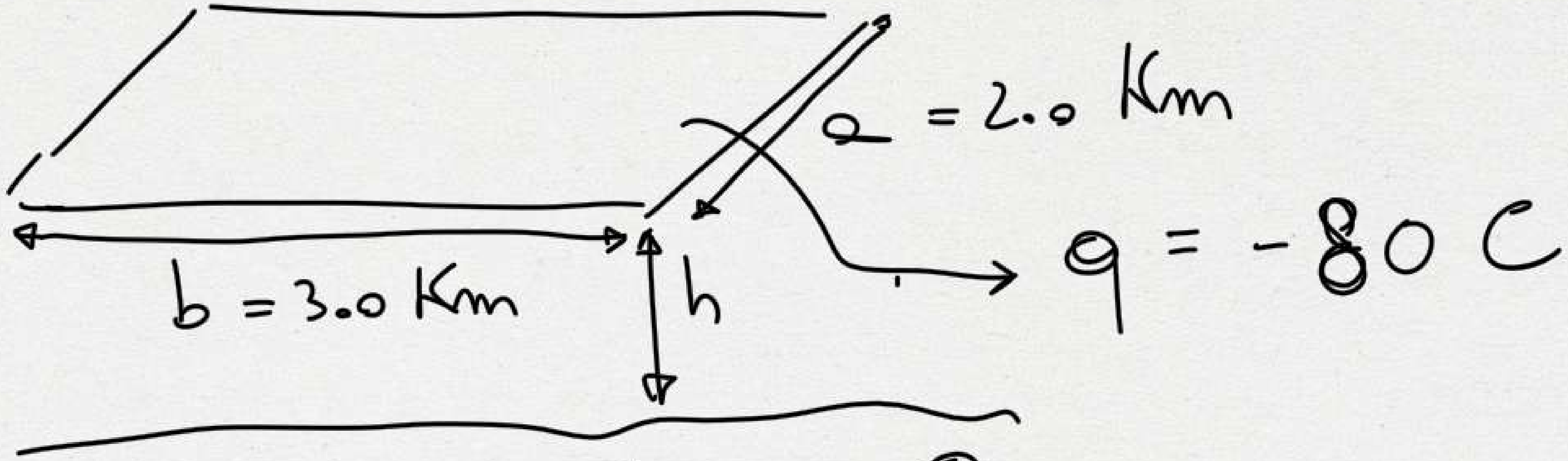
$$\sigma_p^{(4)} = \vec{P}_2 \cdot \hat{m}_4 = \frac{K_2 - 1}{K_2}\frac{\sigma R_1}{R_3}$$

$$\boxed{q_p = \sigma_p \cdot \Sigma}$$



Calcolare la d.d.p. tra il cilindro interno e un punto $r > R_4$

1) quando il cilindro esterno è connesso a terra
2) quando non lo è



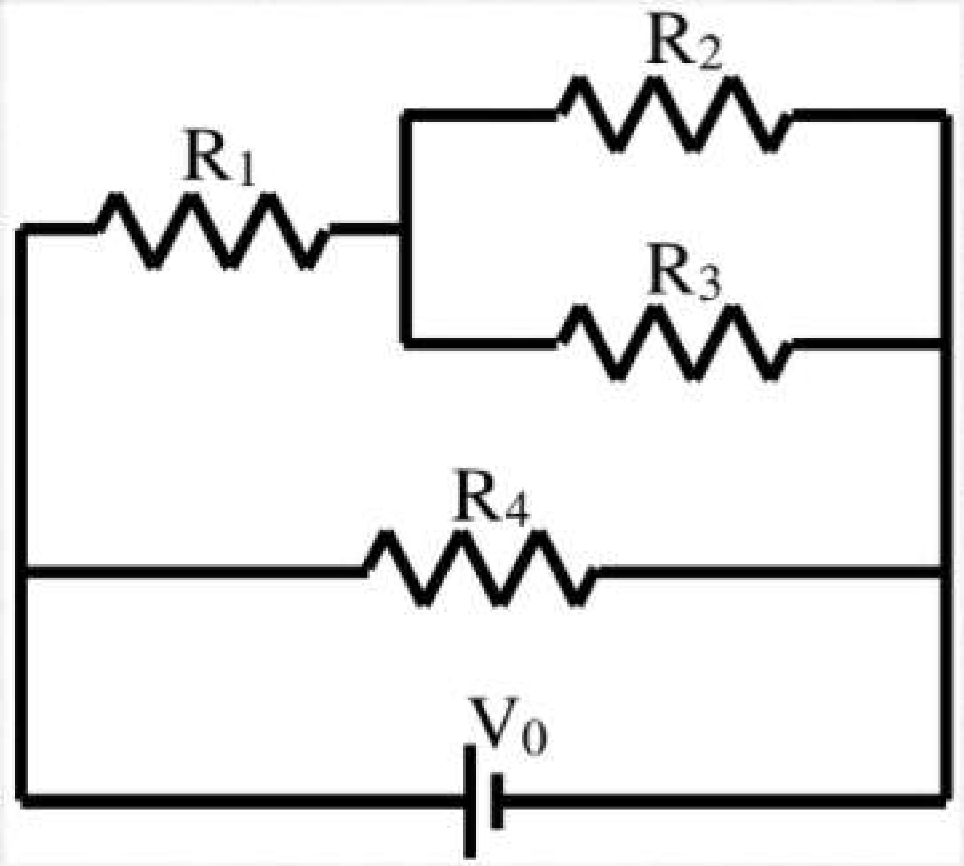
1) rig. dielettrica $3 \cdot 10^6$ V/m, fulmini?

2) qual è U_e?

$$E = \frac{\sigma}{\varepsilon_{ARIA}} \approx \frac{\sigma}{\varepsilon_0} = \frac{q}{ab\varepsilon_0}$$

① $$C = \frac{\varepsilon_0 ab}{h}, \quad \Delta V = \frac{q}{C} = \frac{qh}{\varepsilon_0 ab} = Eh \implies E = \frac{q}{ab\varepsilon_0} \sim 1.5 \cdot 10^6 \, \frac{V}{m}$$

② $$U_e = \frac{1}{2} q \Delta V = \frac{1}{2} C \Delta V^2 = \frac{1}{2} \frac{q^2}{C} \sim \underline{3 \cdot 10^{10} \, J}$$



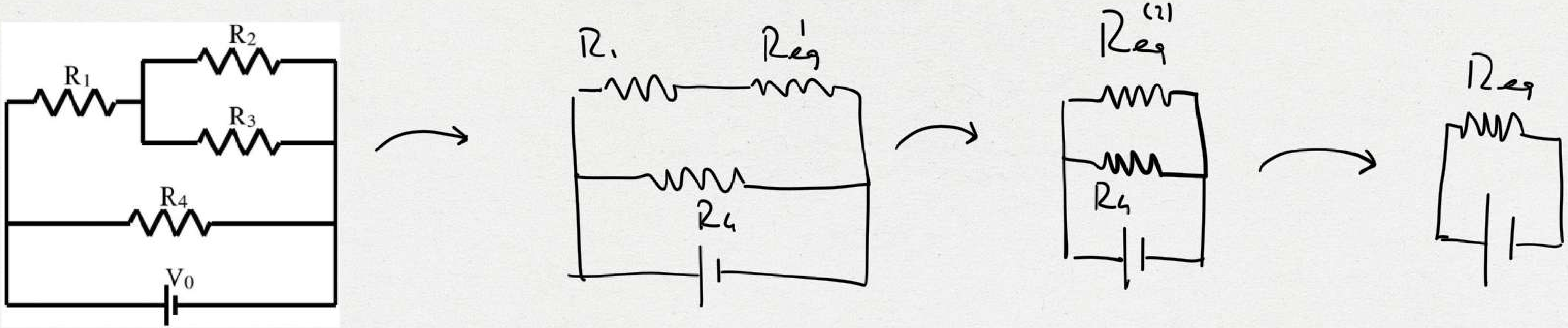
$R_1 = 1\,\Omega$, $R_2 = 3\,\Omega$, $R_3 = 2\,\Omega$, $R_4 = 2\,\Omega$

$V_0 = 6\,V$

1) $R_{eq} = ?$

2) Calcolare P_i: $[P = Ri^2]$

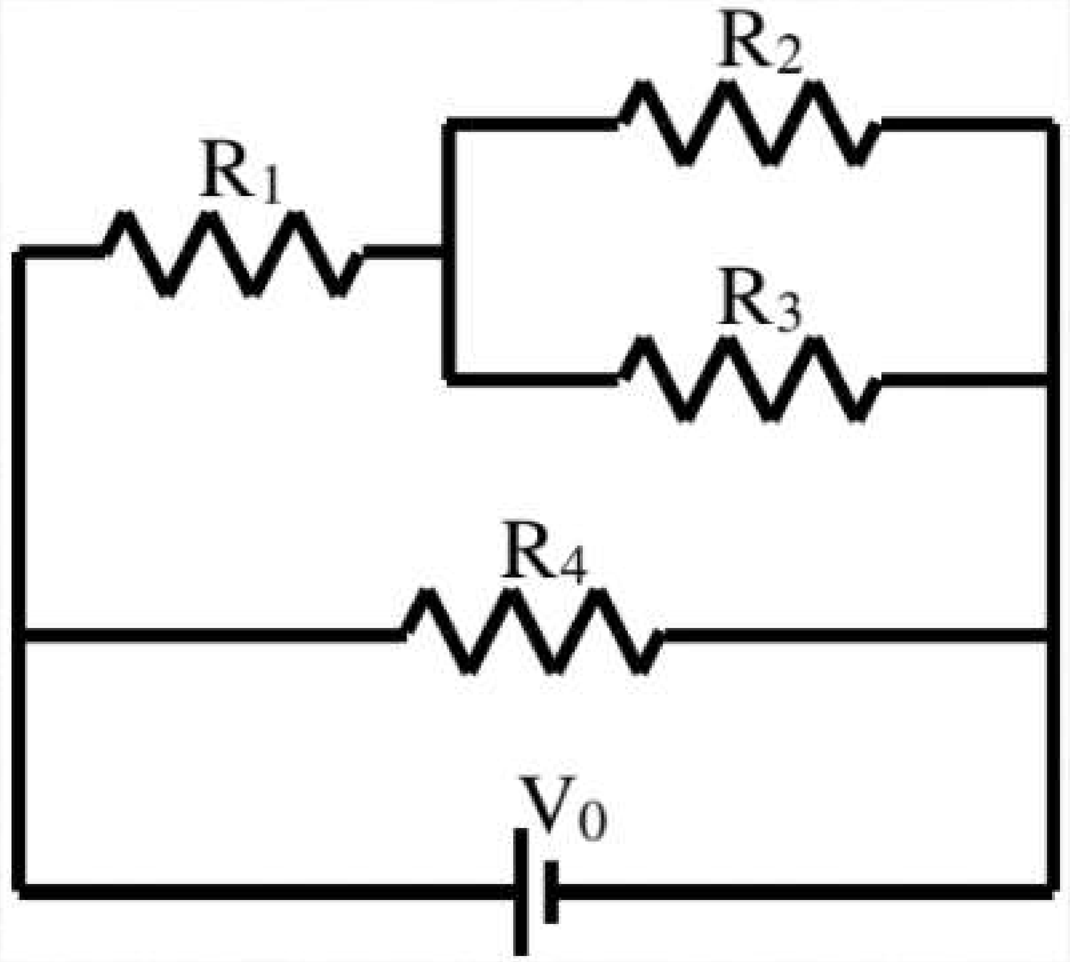
$$\begin{cases} R_{eq}^{ab} = R_a + R_b & \text{SERIE} \\ \dfrac{1}{R_{eq}^{ab}} = \dfrac{1}{R_a} + \dfrac{1}{R_b} & \text{PARALLELO} \end{cases}$$



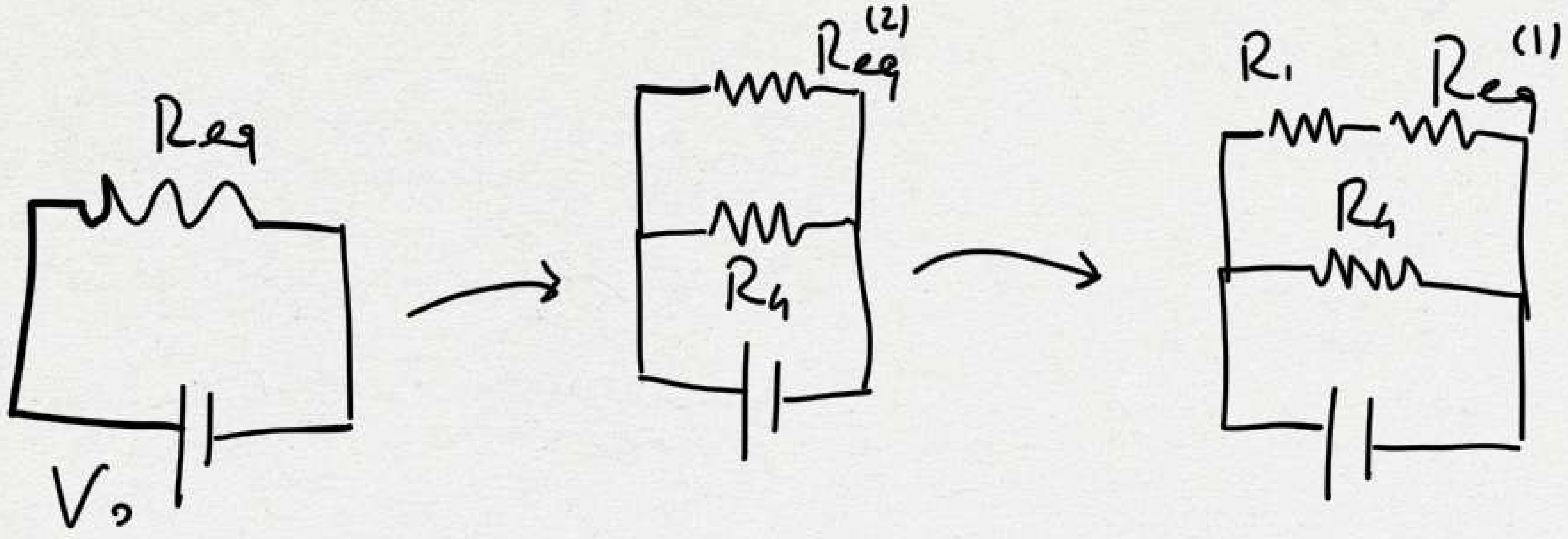
$$R_{eq}^{(1)} = \frac{R_2 R_3}{R_2 + R_3} = 1.2\,\Omega$$

$$R_{eq}^{(2)} = R_{eq}^{(1)} + R_1 = 2.2\,\Omega$$

$$R_{eq} = \frac{R_4 R_{eq}^{(2)}}{R_4 + R_{eq}^{(2)}} = 1.05\,\Omega$$



P_4



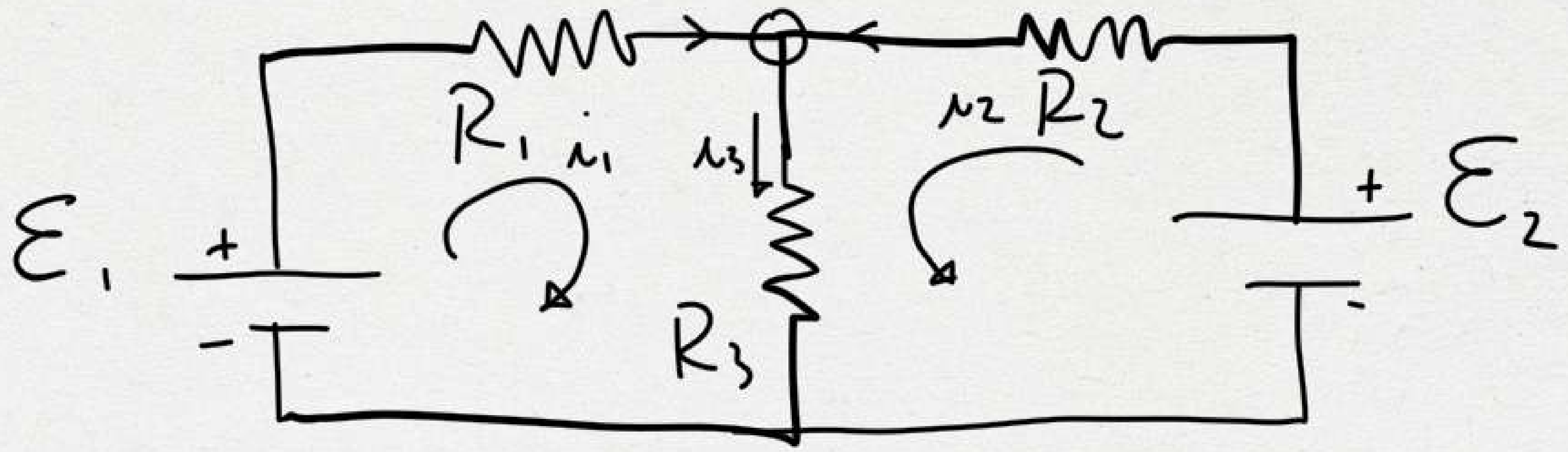
$$P = R i^2 = \Delta V i = \frac{\Delta V^2}{R}$$

$$V_0 = R_4 i_4 \Rightarrow i_4 = \frac{V_0}{R_4} \qquad P_4 = R_4 \frac{V_0^2}{R_4^2}$$

$$i_{eq}^{(2)} = \frac{V_0}{R_{eq}^{(2)}} = i_1 = i_{eq}^{(1)} \Rightarrow \Delta V_{eq}^{(1)} = R_{eq}^{(1)} i_{eq}^{(1)} \Rightarrow$$

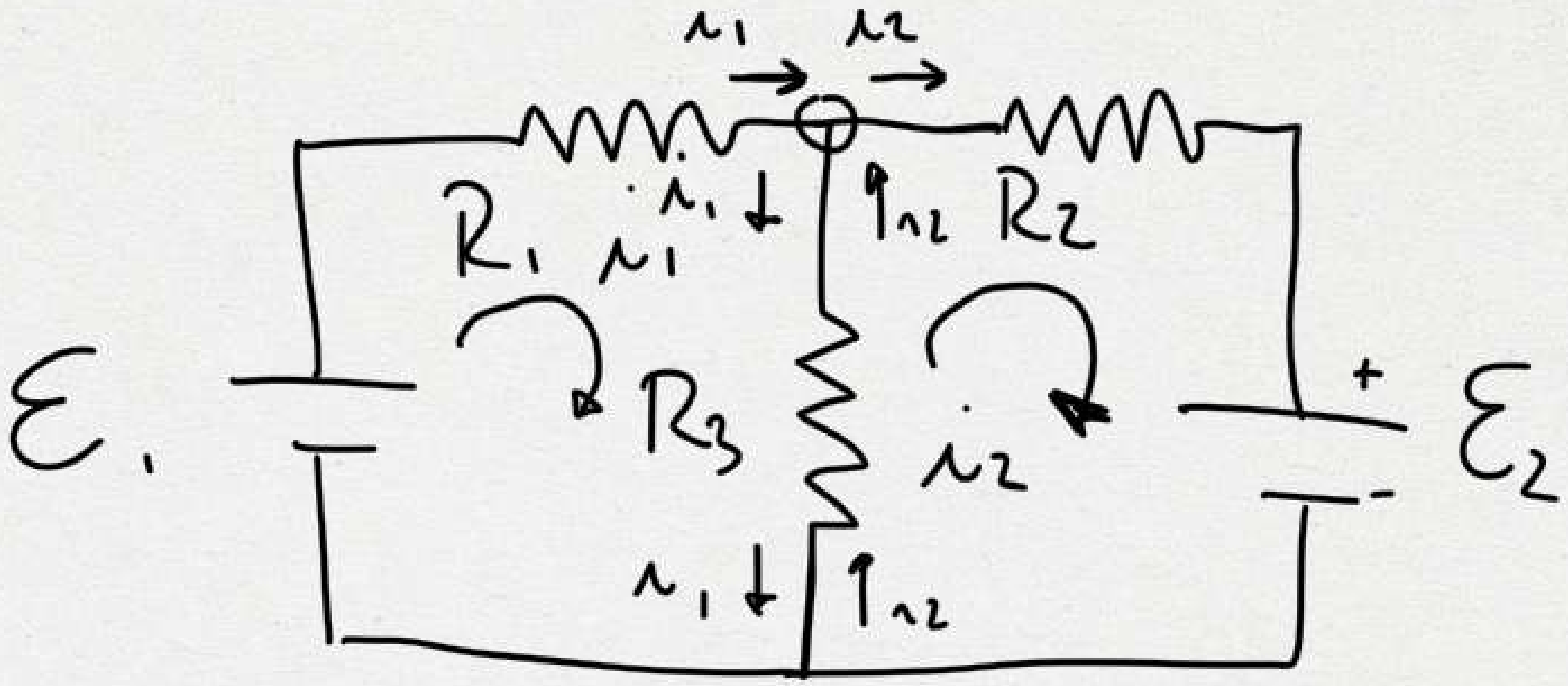
$$i_2 = \frac{\Delta V_{eq}^{(1)}}{R_2}$$

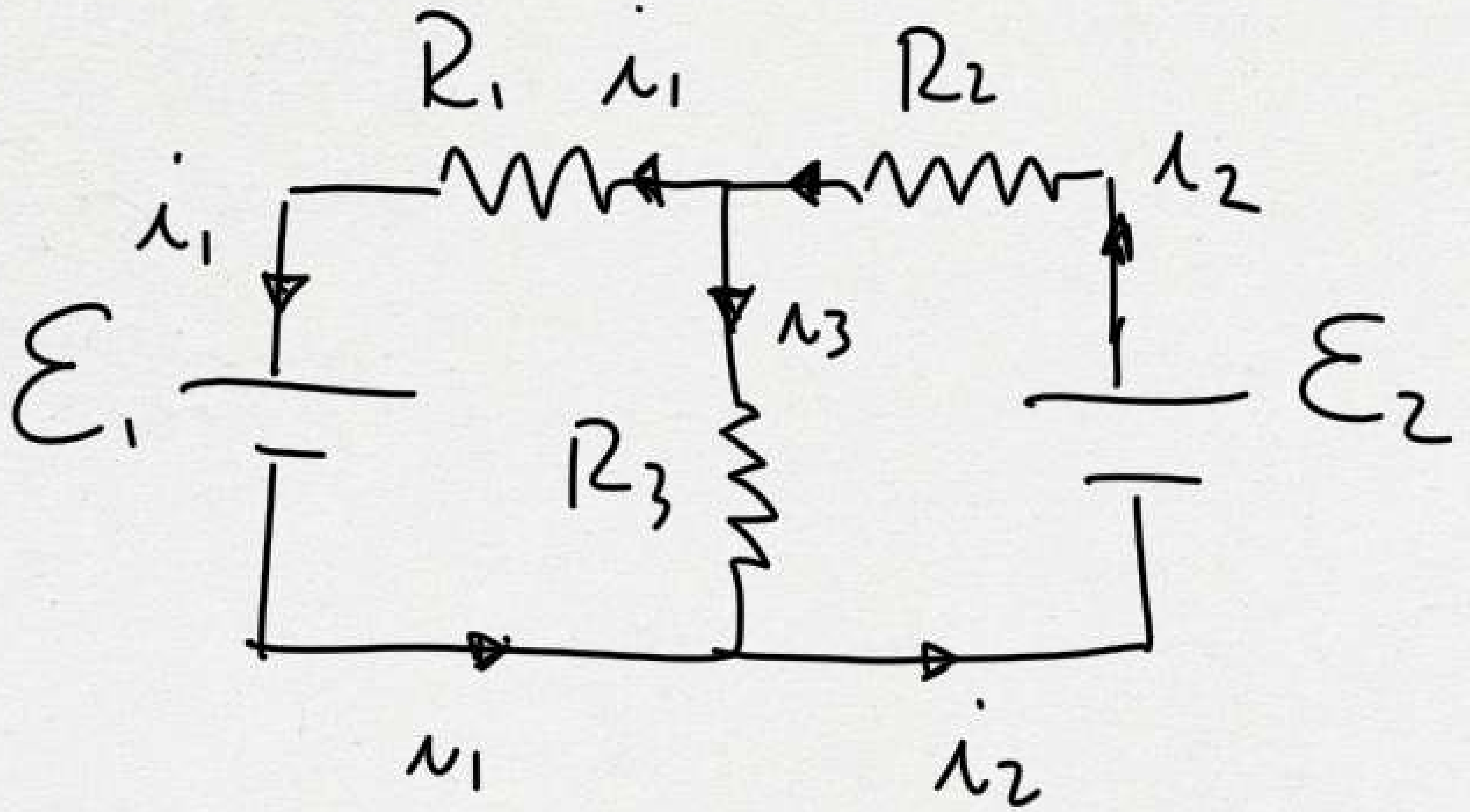
$$i_3 = \frac{\Delta V_{eq}^{(2)}}{R_3}$$



$$i_1 + i_2 = i_3$$

$$\begin{cases} \mathcal{E}_1 = R_1 i_1 + R_3 i_3 = R_1 i_1 + R_3 (i_1 + i_2) \\ \mathcal{E}_2 = R_2 i_2 + R_3 i_3 = R_2 i_2 + R_3 (i_1 + i_2) \end{cases}$$





$i_1 - i_2 = i_3$

$$\begin{cases} \mathcal{E}_1 = R_1 i_1 + R_3 i_3 = R_1 i_1 + R_3 (i_1 - i_2) \\ -\mathcal{E}_2 = R_2 i_2 + R_3 i_3 = R_2 i_2 + R_3 (i_1 - i_2) \end{cases}$$

$$\begin{cases} i_1 = -0.143\,A \\ i_2 = -0.429\,A \\ i_3 = 0.286\,A \end{cases}$$

trovate il valore di $\mathcal{E}_1$ per cui ① $i_1 = i_2$ e i_1 scorre in verso orario e i_2 antiorario

② entrambe in verso orario