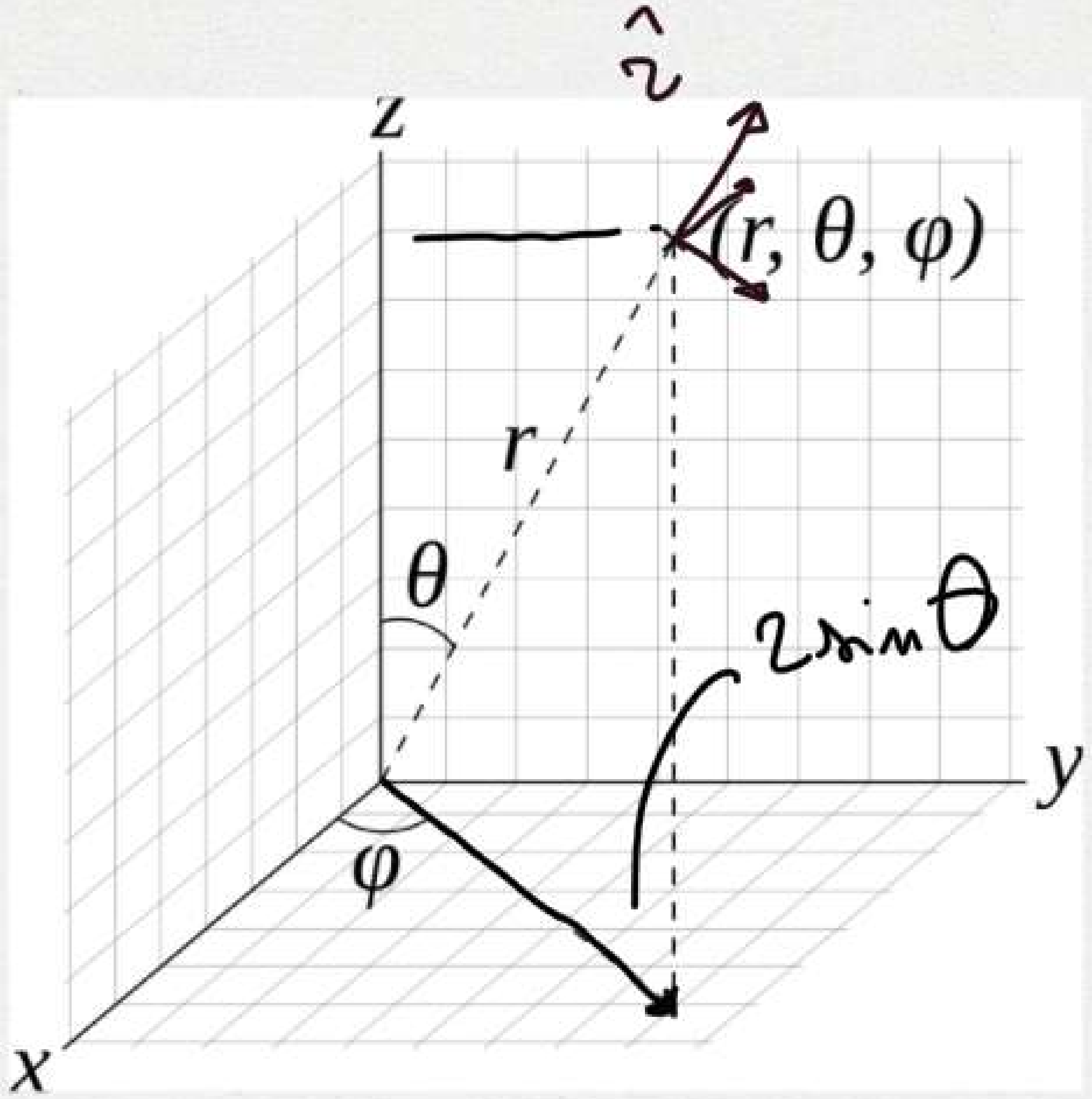
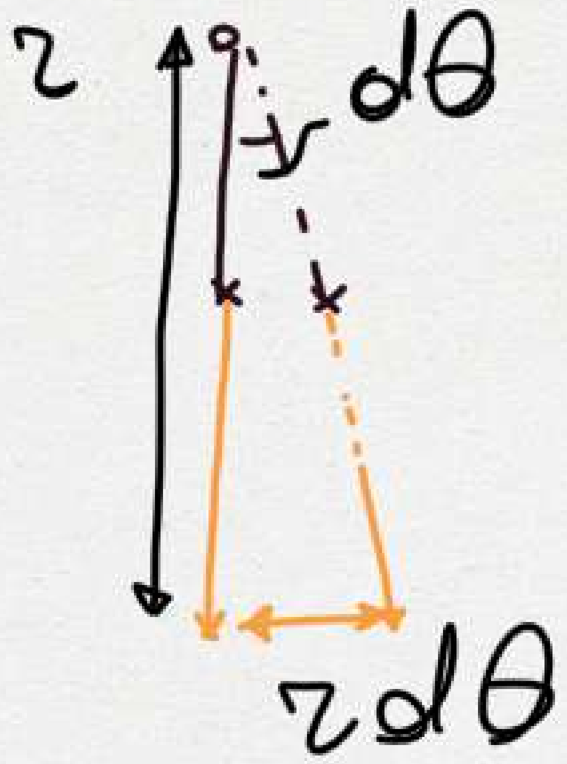


$$\begin{cases} x = r\sin\theta\cos\varphi \\ y = r\sin\theta\sin\varphi \\ z = r\cos\theta \end{cases}$$

$\hat{r}, \hat{\theta}, \hat{\varphi}$



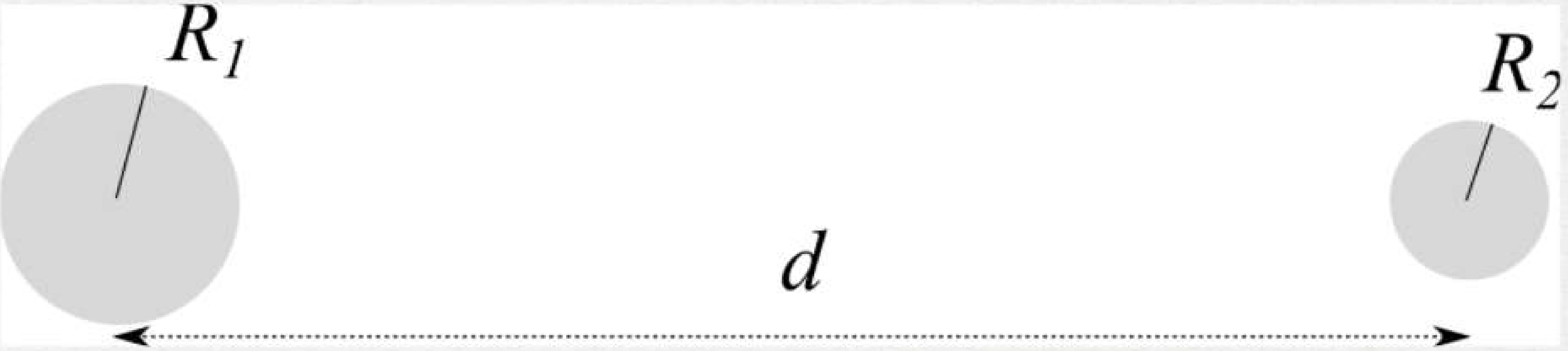
(x, y, z)

$$d\tau = ds_1\, ds_2\, ds_3 \doteq dx\, dy\, dz$$

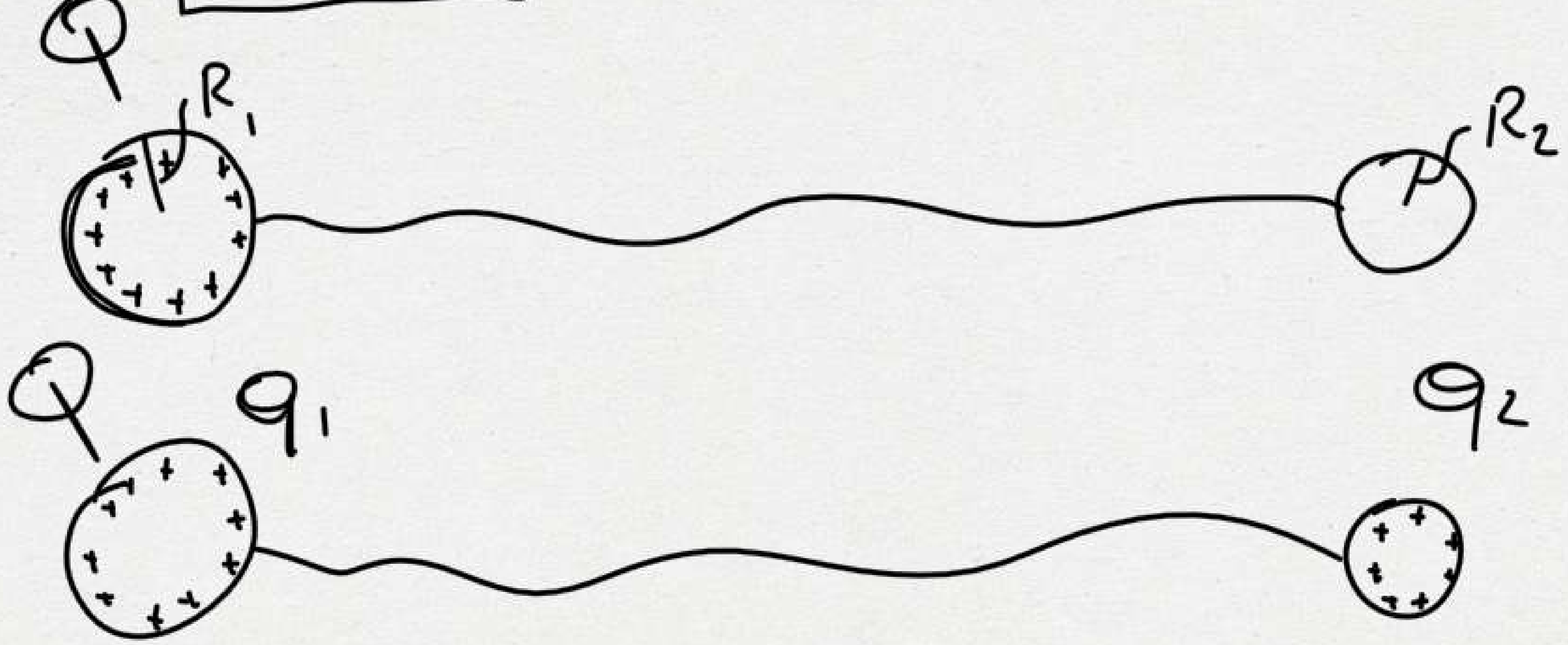
$$ds_r = dr$$
$$ds_\theta = r\,d\theta$$
$$ds_\varphi = r\sin\theta\, d\varphi$$

$$\Rightarrow \quad d\tau = r^2 \overbrace{\overbrace{\sin\theta\, d\theta}^{2}\; \overbrace{d\varphi}^{2\pi}}\, dr = \boxed{4\pi r^2\, dr}$$

$$\int f(r)\, d\tau \Rightarrow \int f(r)\, 4\pi r^2\, dr$$



$$\boxed{\begin{array}{l} d \gg R_1 \\ d \gg R_2 \end{array}}$$

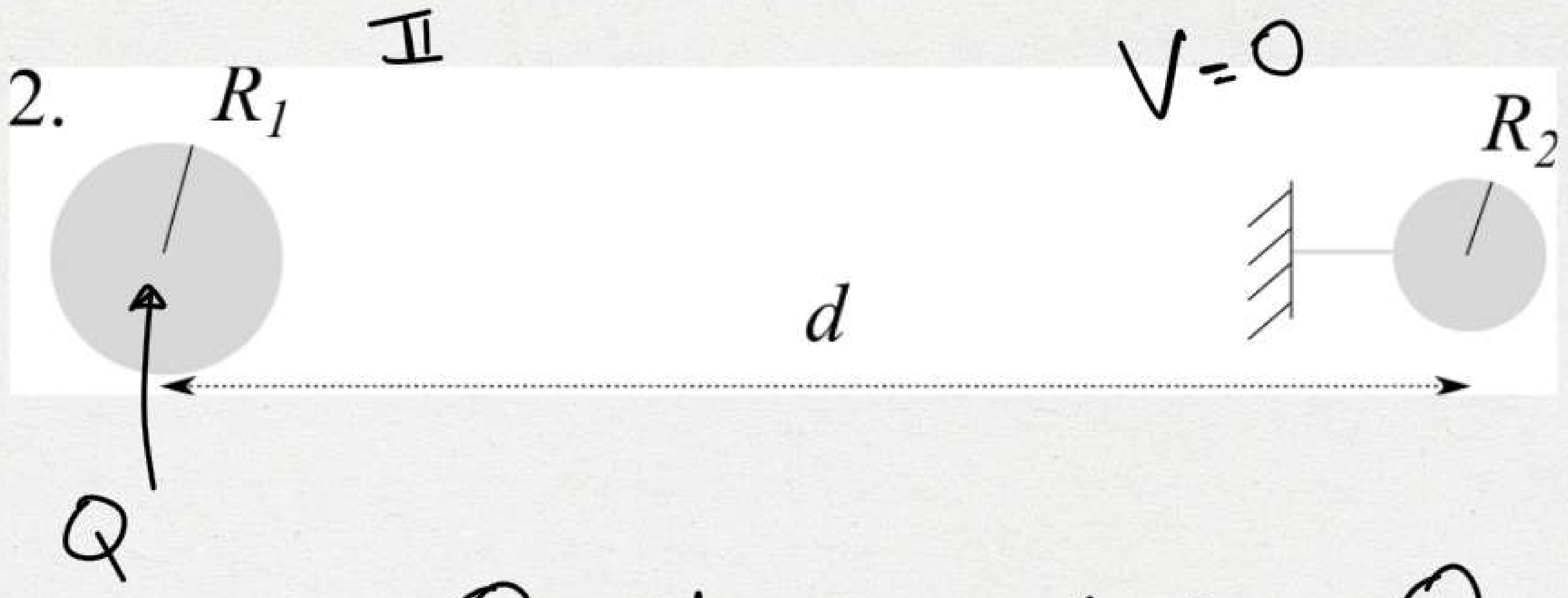


① DEPOSITIAMO Q SU R_1 ←

② COLLEGHIAMO I CONDUTTORI

quanto valgono q_1 e q_2 ?

$$\left.\begin{array}{l} V(1) = \dfrac{q_1}{4\pi\varepsilon_0 R_1} \\ \\ V(2) = \dfrac{q_2}{4\pi\varepsilon_0 R_2} = V(1) \end{array}\right\} \rightarrow \begin{array}{l} \dfrac{q_1}{R_1} = \dfrac{q_2}{R_2} \\ \\ Q = q_1 + q_2 \end{array} \Longrightarrow \left\{\begin{array}{l} q_1 = Q\dfrac{R_1}{R_1+R_2} \\ \\ q_2 = Q\dfrac{R_2}{R_1+R_2} \end{array}\right.$$



1) CARICHIAMO R_1
2) COLLEGHIAMO R_2 A TERRA
3) CONSIDERIAMO L'INTERAZIONE TRA I CONDUTTORI

$$E(2) \simeq \frac{Q}{4\pi\varepsilon_0}\frac{1}{d^2} \Rightarrow V_1(2) = \frac{Q}{4\pi\varepsilon_0}\frac{1}{d}$$

$$V_2(2) = \frac{q}{4\pi\varepsilon_0}\frac{1}{R_2}$$

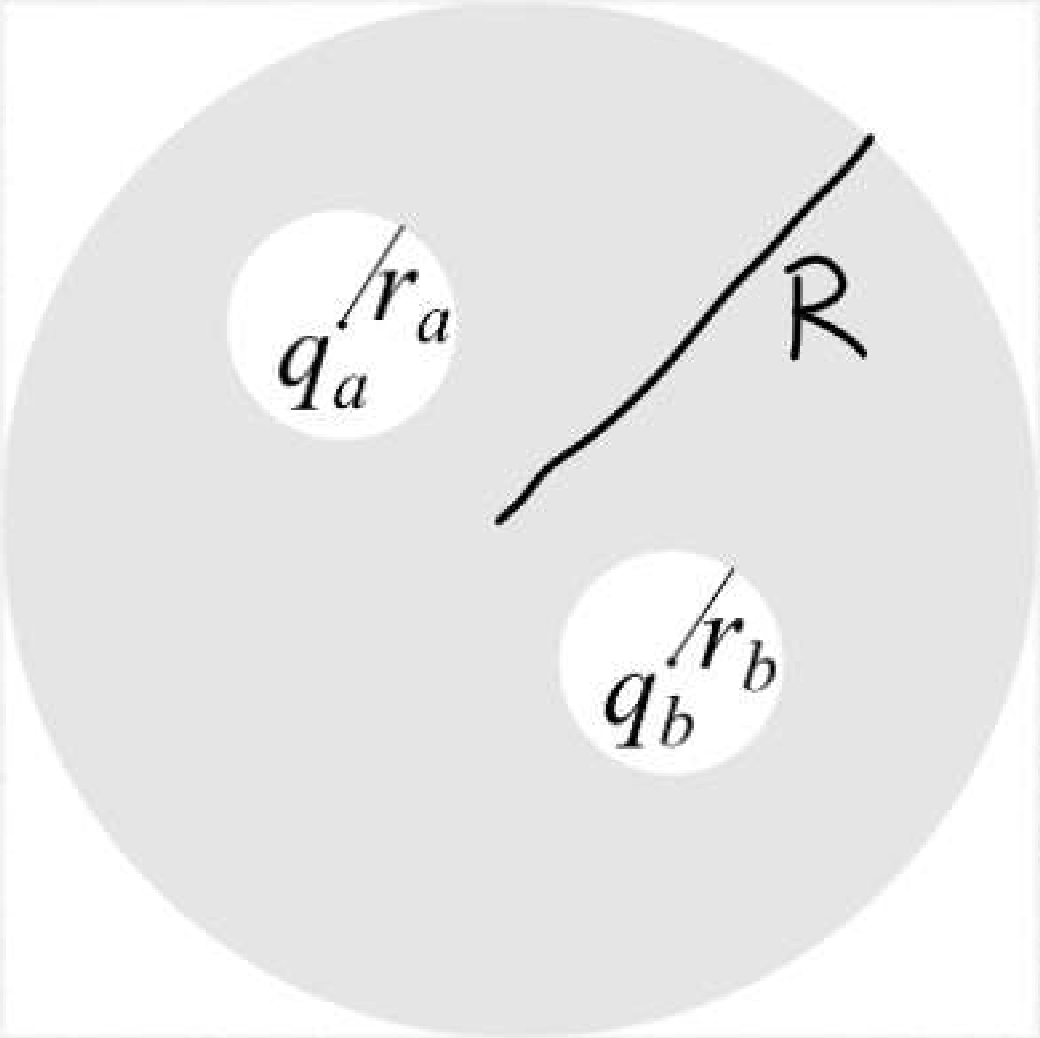
$$\Rightarrow V_{TOT} = V_1(2) + V_2(2) = \frac{Q}{4\pi\varepsilon_0}\frac{1}{d} + \frac{q}{4\pi\varepsilon_0}\frac{1}{R_2} = 0 \Rightarrow$$

$$q = -\frac{Q R_2}{d}$$

III

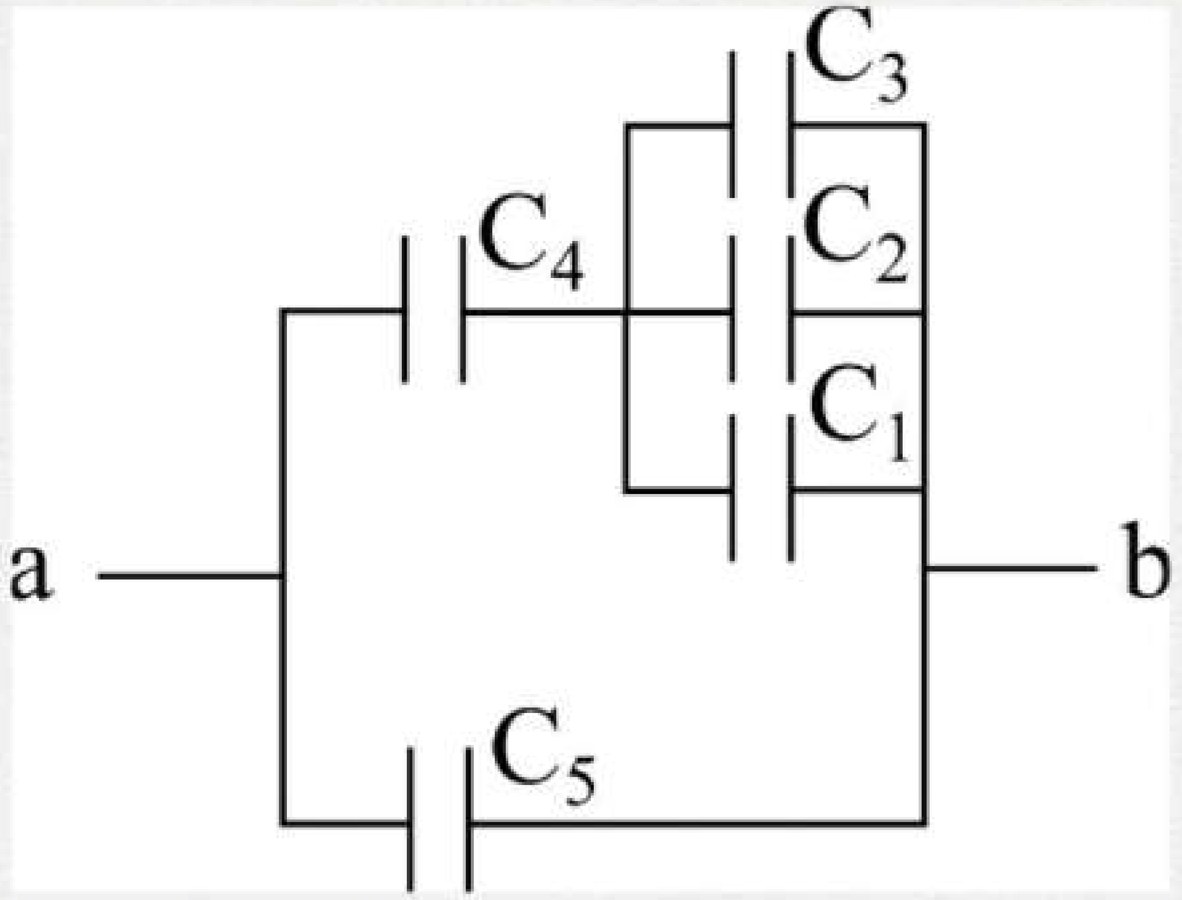
1. PARTIAMO DAL PUNTO II
2. SCOLLEGATE R_2
3. METTETE A TERRA R_1
4. QUANTA CARICA HA R_1?

ESERCIZIO 17



• q_c

1) $\sigma_a, \sigma_b, \sigma$
2) $E\ (r > R)$
3) E_a, E_b all'interno delle due cavità
4) Le forze che sentono q_a e q_b
5) Cosa cambia <u>qualitativamente</u> se ponete una carica q_c fuori dal conduttore



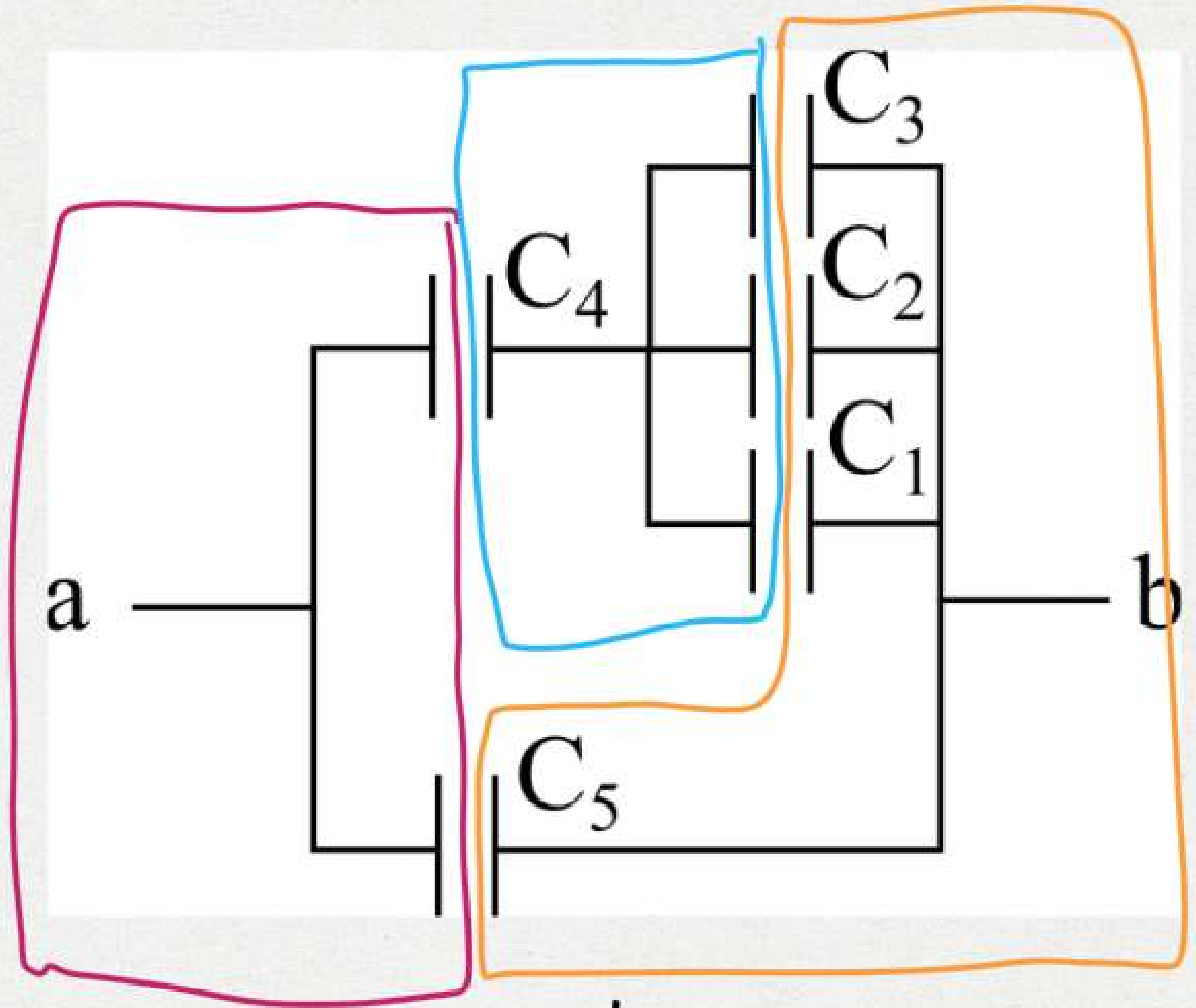
ΔV_{ab} è noto

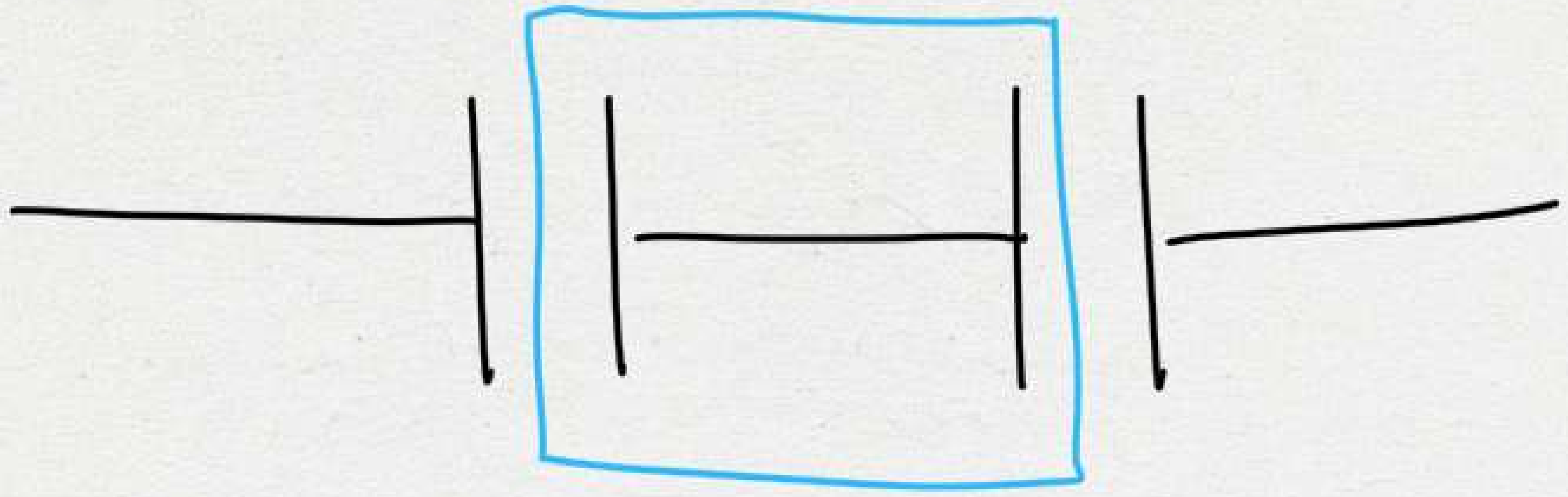
C_1, C_2, C_3, C_4, C_5

1) DETERMINARE C_{eq}

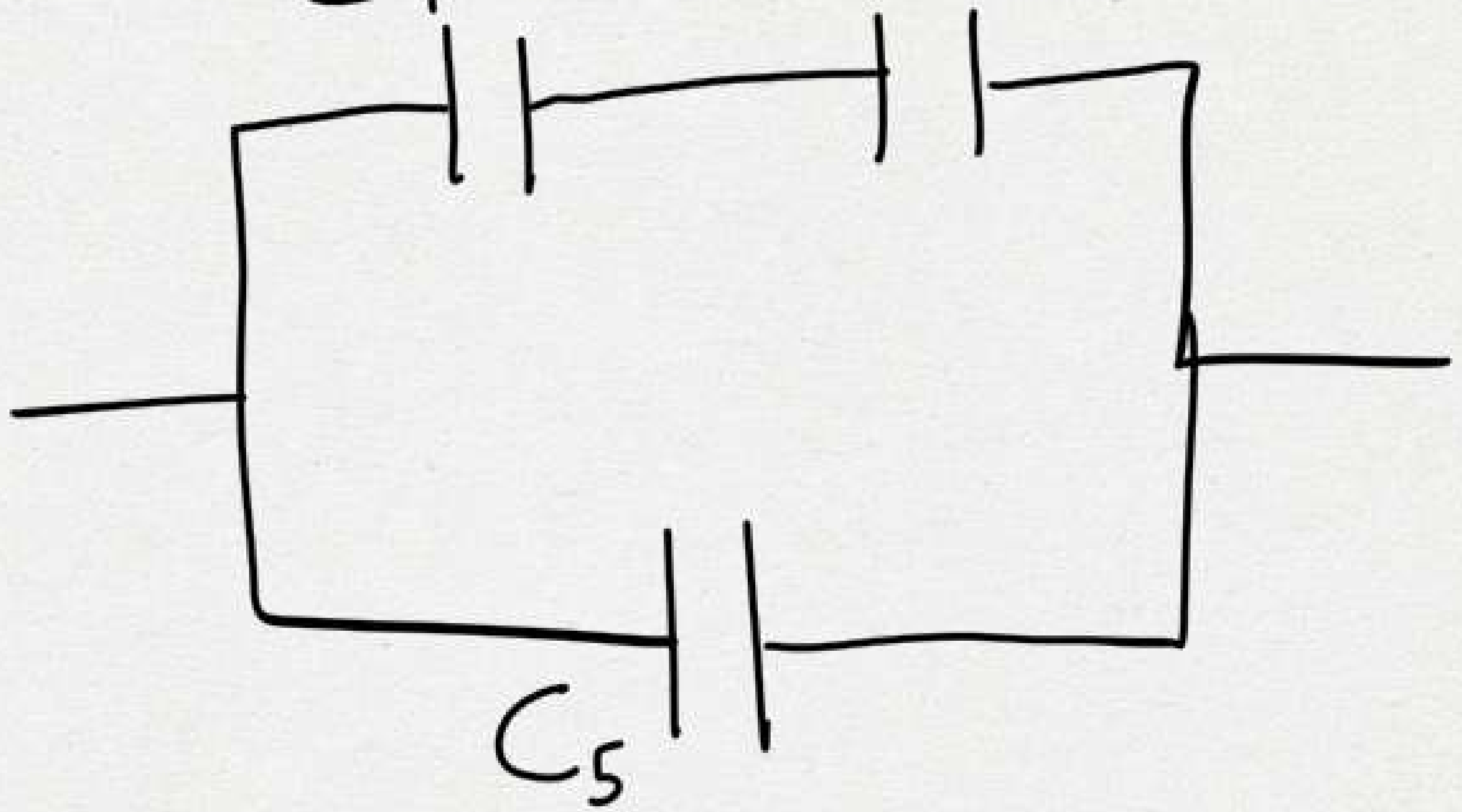
2) CALCOLARE q_i e ΔV_i $\forall C_i$

$$\begin{cases} C_{eq}^{(ab)} = C_a + C_b & \text{PARALLELO} \\ \dfrac{1}{C_{eq}^{(ab)}} = \dfrac{1}{C_a} + \dfrac{1}{C_b} & \text{SERIE} \end{cases}$$

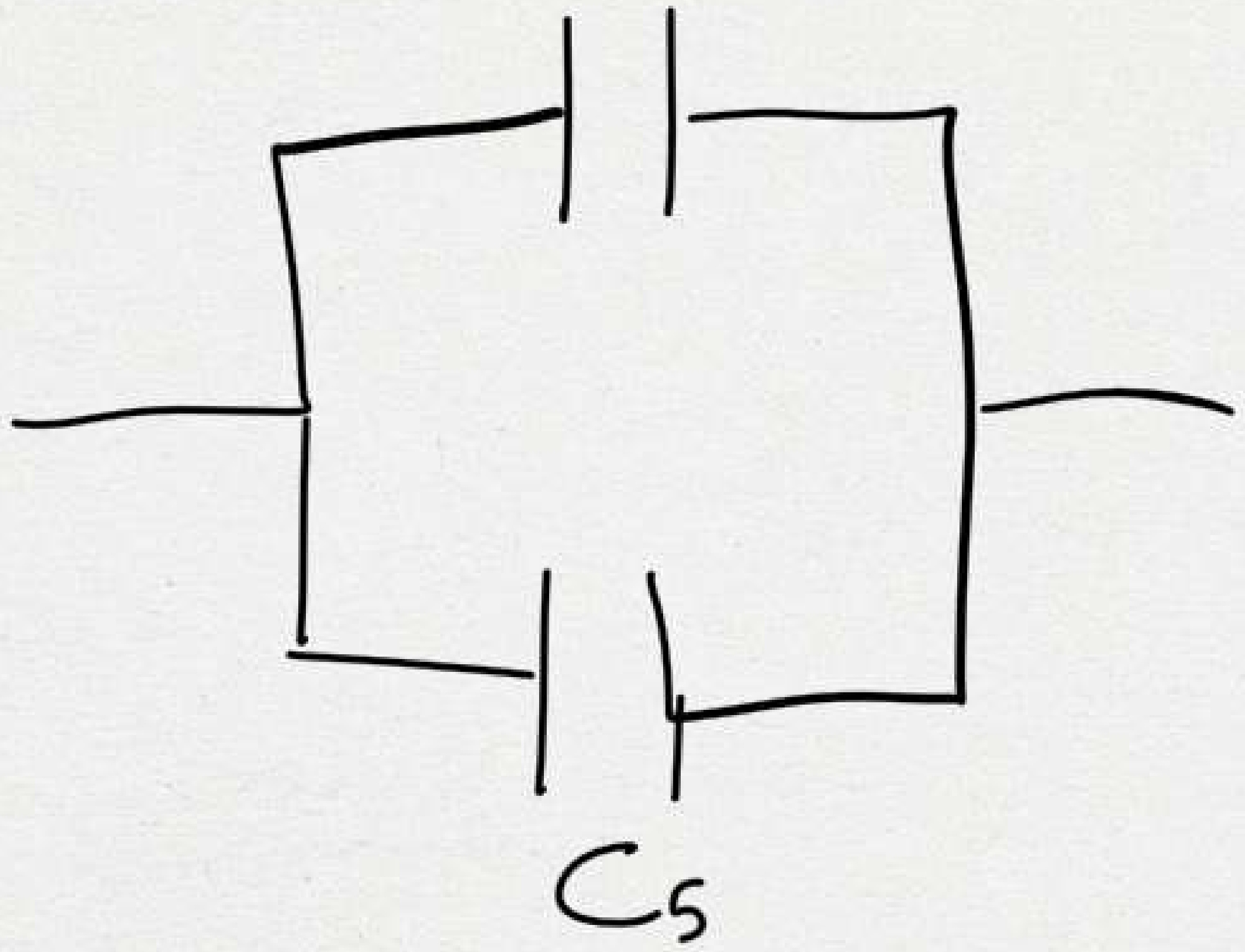




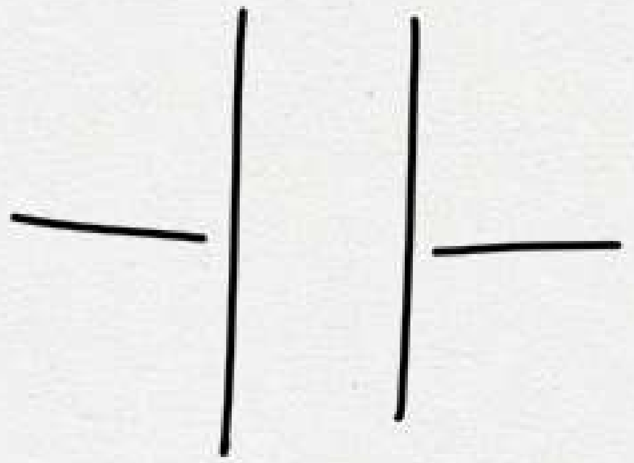
$$C_{eq}^{(1)} = C_1 + C_2 + C_3$$

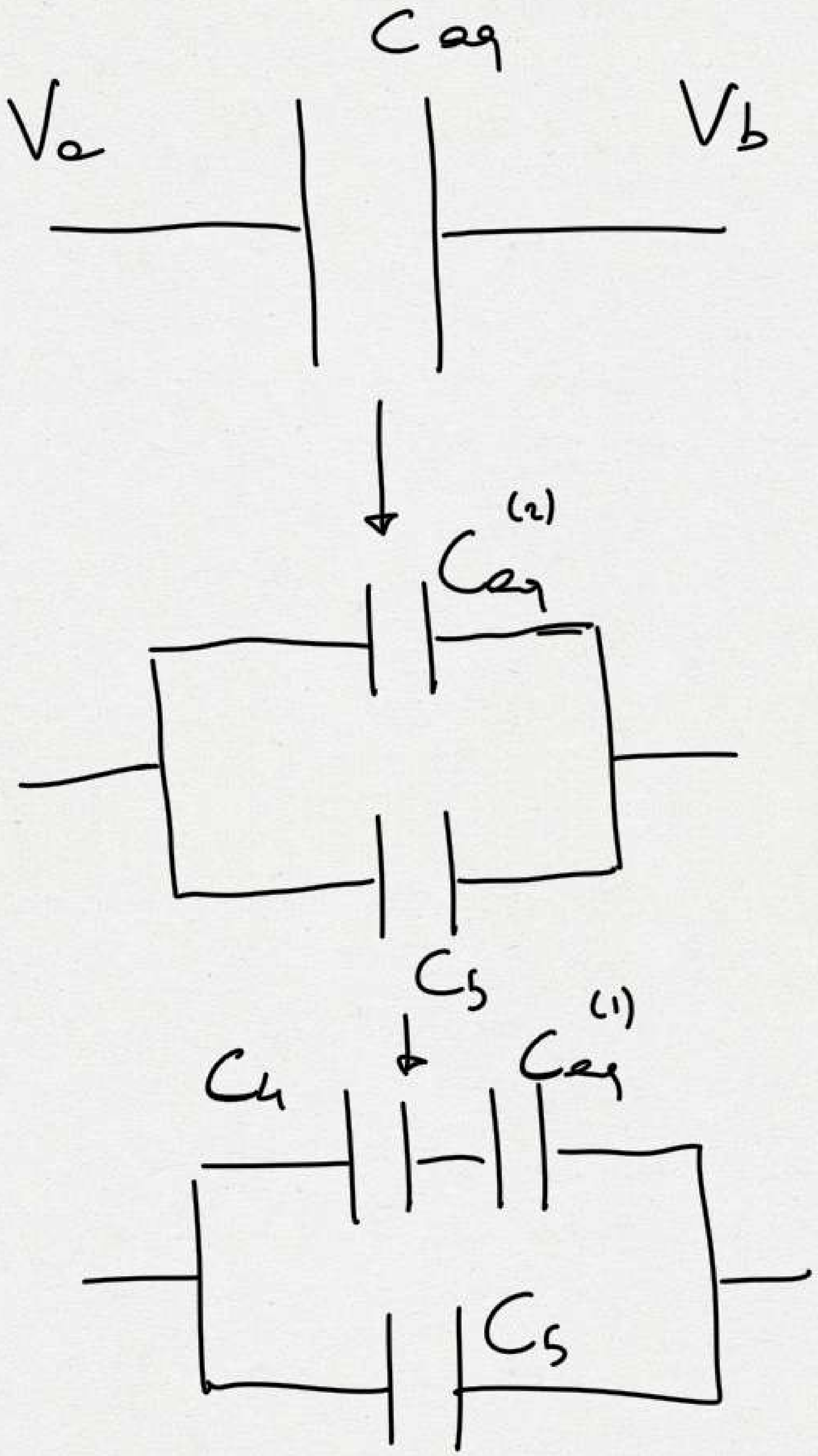


$$\frac{1}{C_{eq}^{(2)}} = \frac{1}{C_{eq}^{(1)}} + \frac{1}{C_4}$$

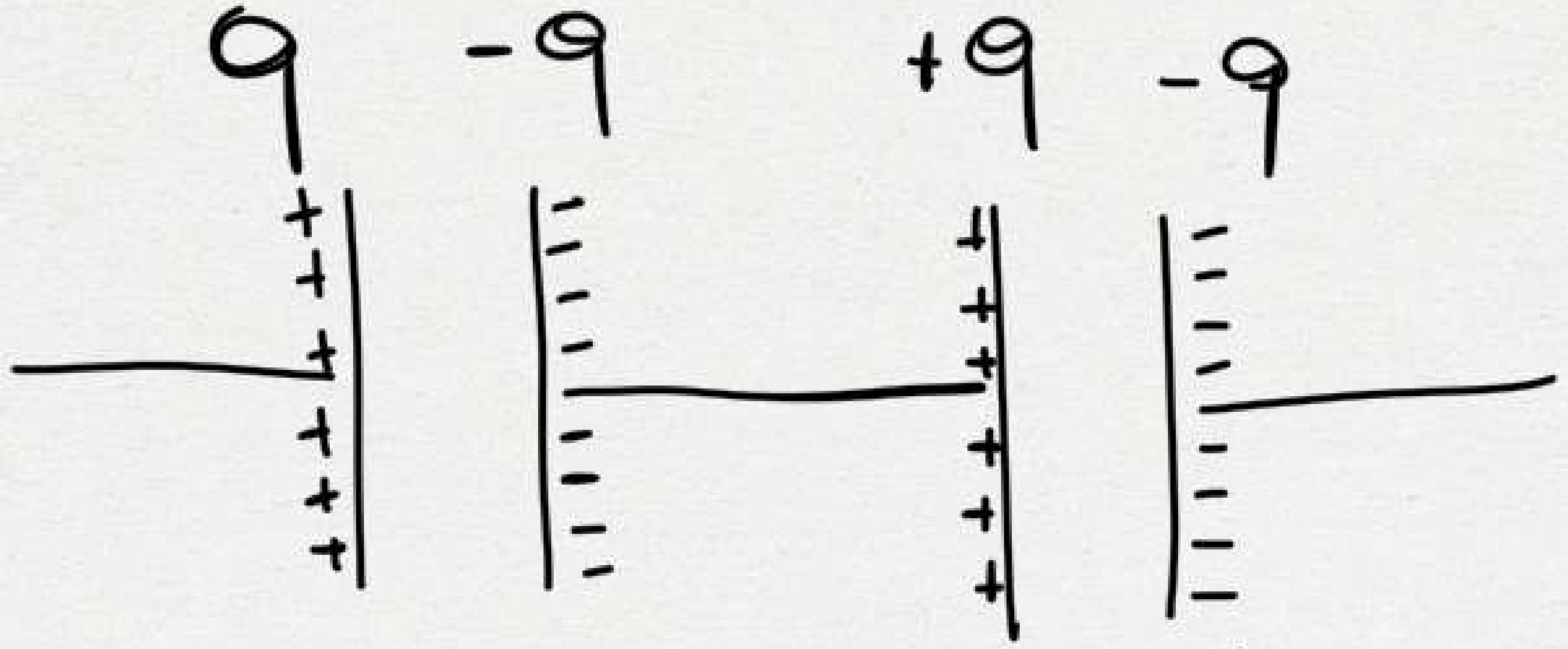


$$C_{eq} = C_5 + C_{eq}^{(2)}$$





$$q_{eq} = C_{eq} \Delta V_{ab}$$



$$q_1 = C_1 \Delta V_{eq}^{(1)}$$

$$q_2 = C_2 \Delta V_{eq}^{(1)}$$

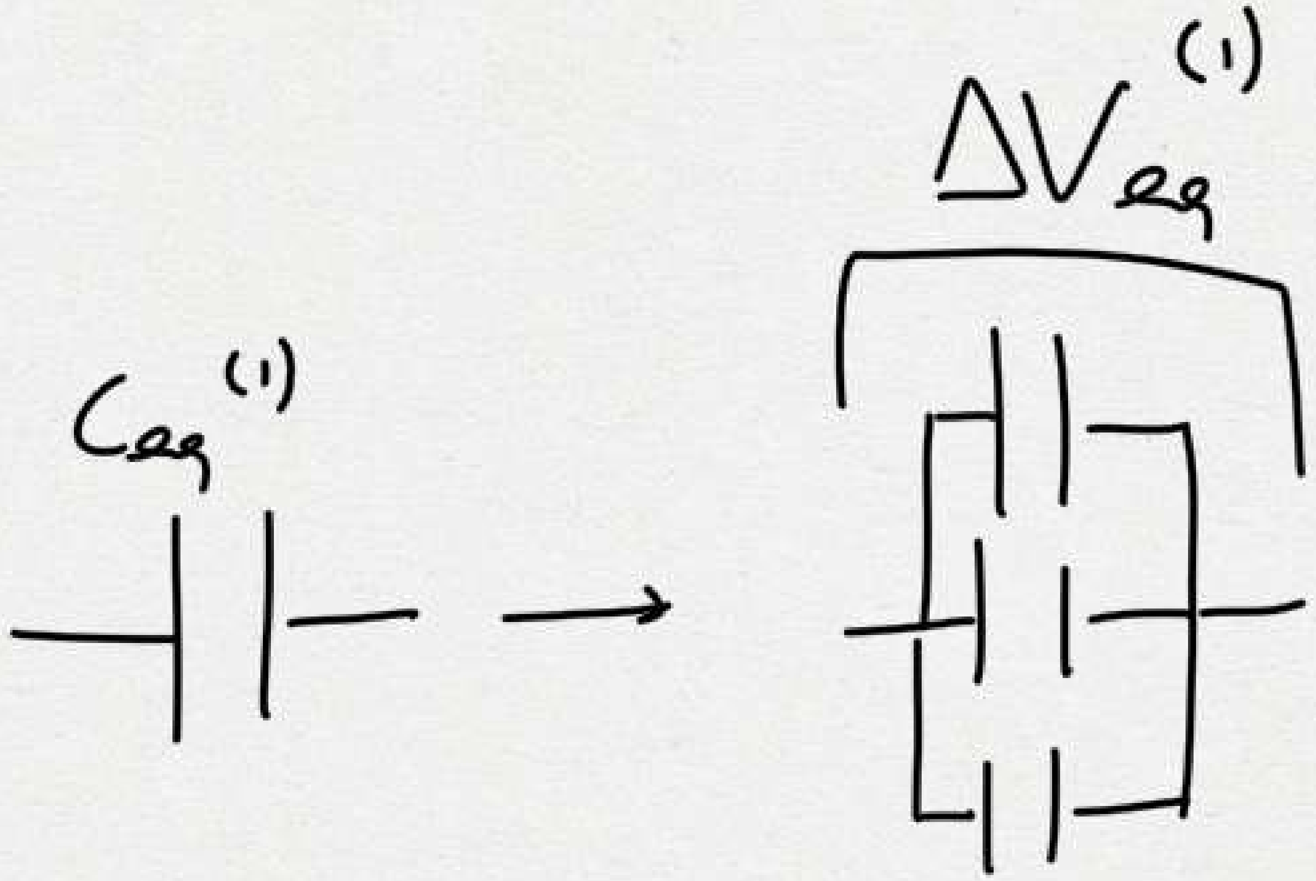
$$q_3 = C_3 \Delta V_{eq}^{(1)}$$

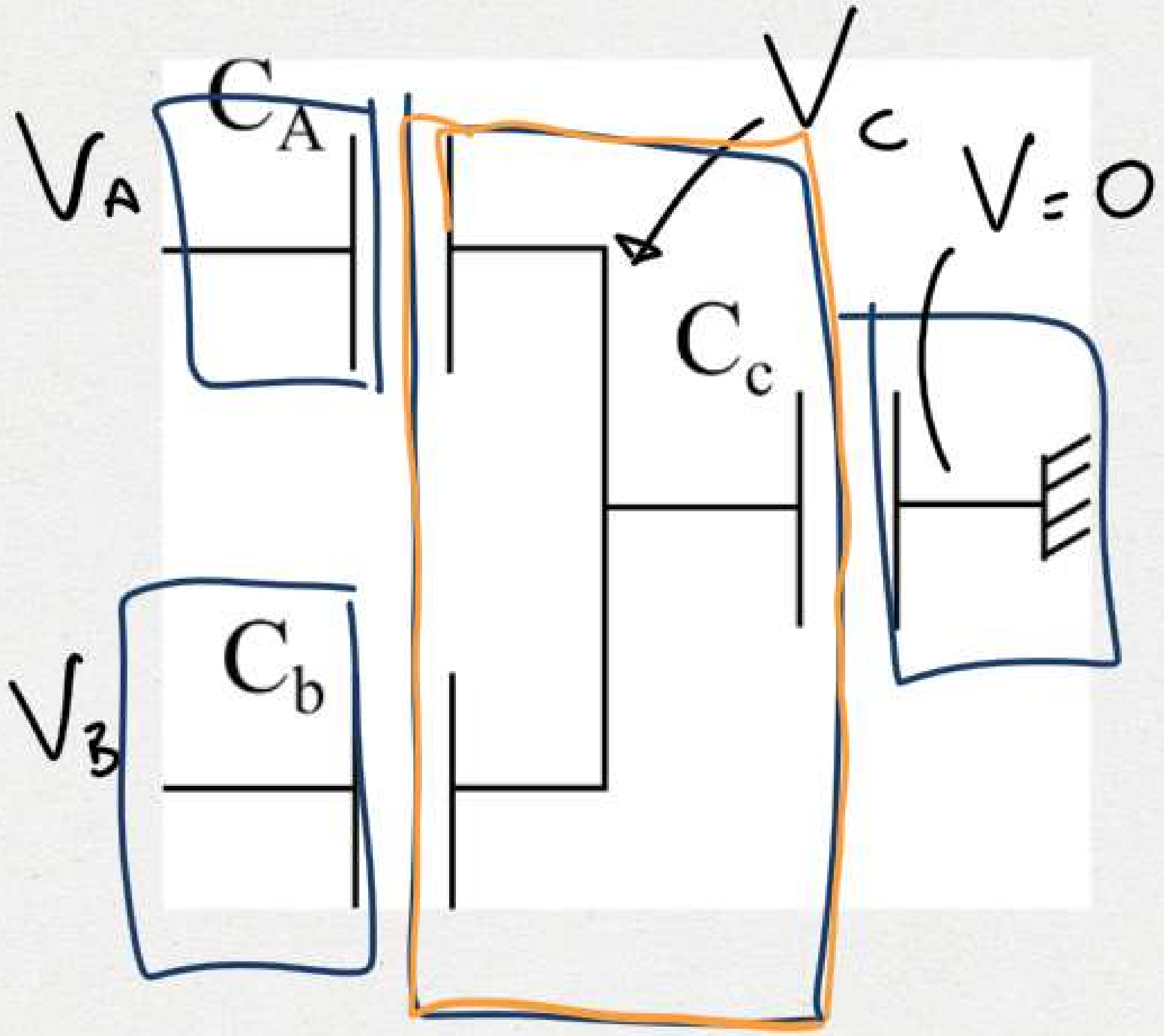
$$q_5 = C_5 \Delta V_{ab}$$

$$q_{eq}^{(2)} = C_{eq}^{(2)} \Delta V_{ab}$$

$$q_4 = q_{eq}^{(2)} \Rightarrow \Delta V_4 = \frac{q_4}{C_4}$$

$$q_{eq}^{(1)} = q_{eq}^{(2)} \Rightarrow \Delta V_{eq}^{(1)} = \frac{q_{eq}^{(1)}}{C_{eq}^{(1)}}$$





$$C_A = C$$

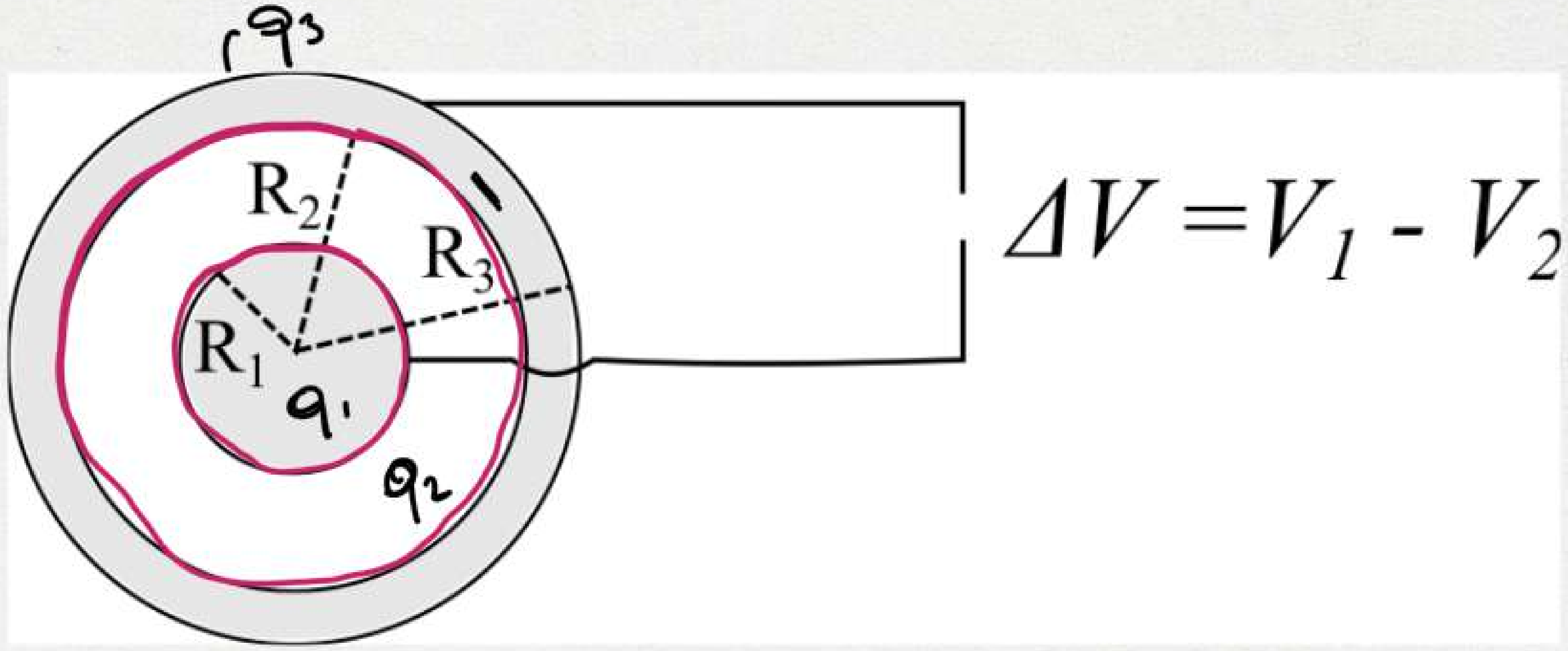
$$C_B = 2C$$

$$C_C = 3C$$

$$V_A = 10\,V, \quad V_B = 40\,V$$

$$V_C = \, ? = 15\,V$$

$$\begin{cases} V_A - V_C = \dfrac{q_A}{C_A} \\[2em] V_B - V_C = \dfrac{q_B}{C_B} \\[2em] V_C - 0 = V_C = \dfrac{q_C}{C_C} = \dfrac{q_A + q_B}{C_C} \end{cases}$$

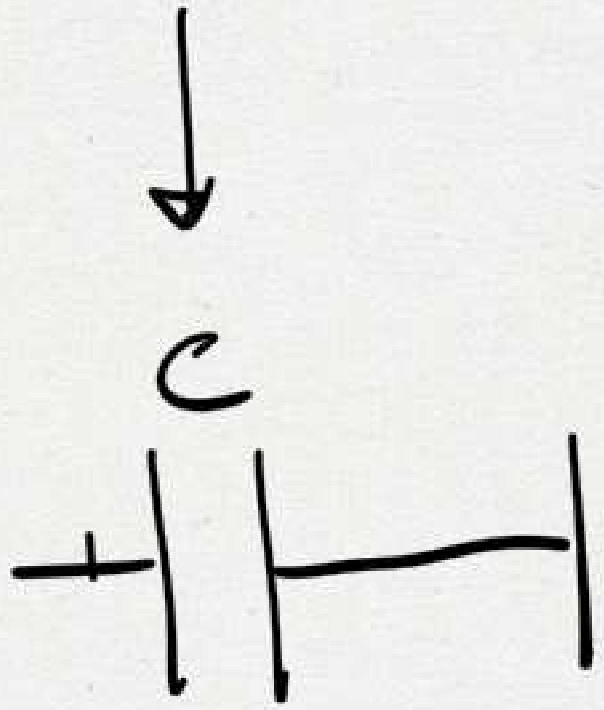


$$\Delta V_1 = V_1 - V(\infty) = V_1$$

$$\Delta V_2 = V_2 - V(\infty) = V_2$$

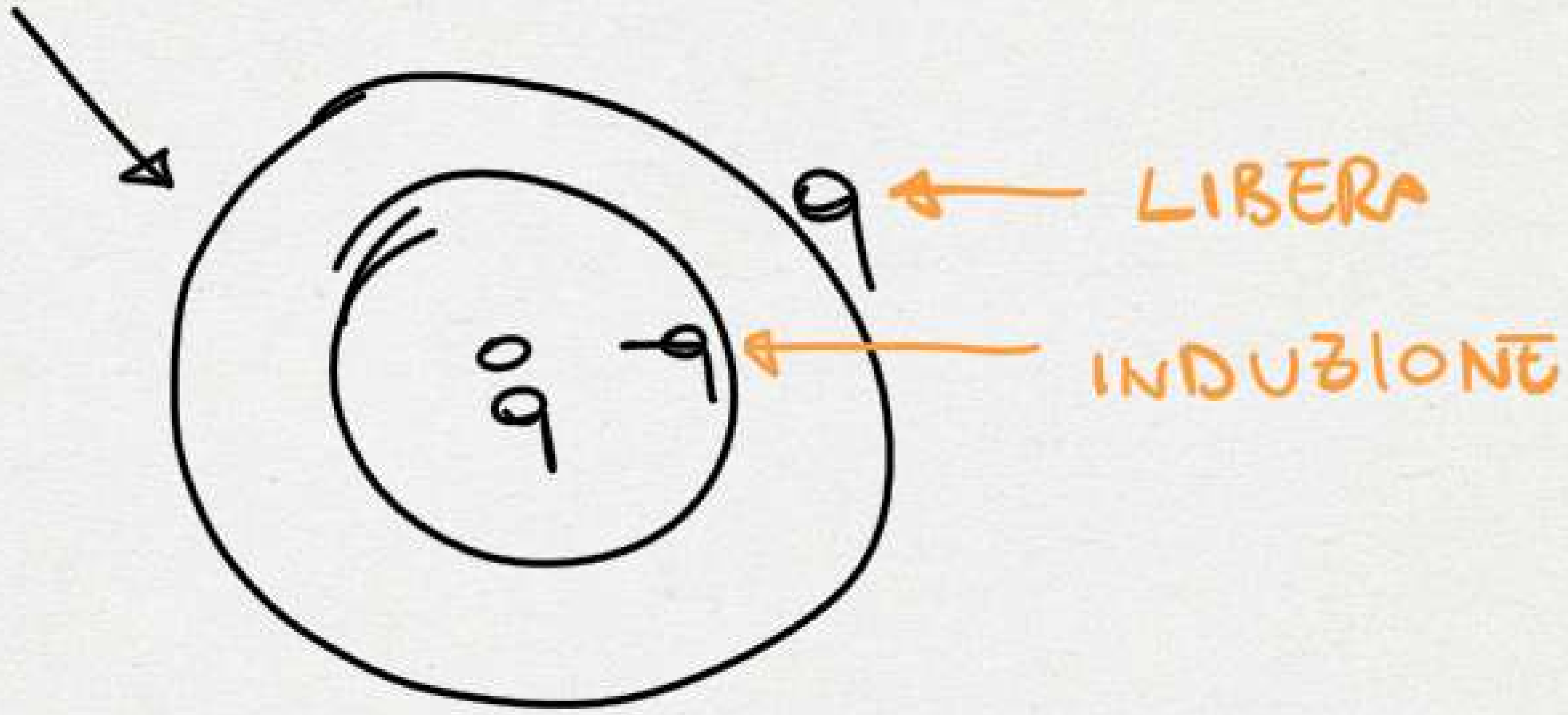
1) CALCOLARE q_1, q_2, q_3

$q_2 = -q_1$



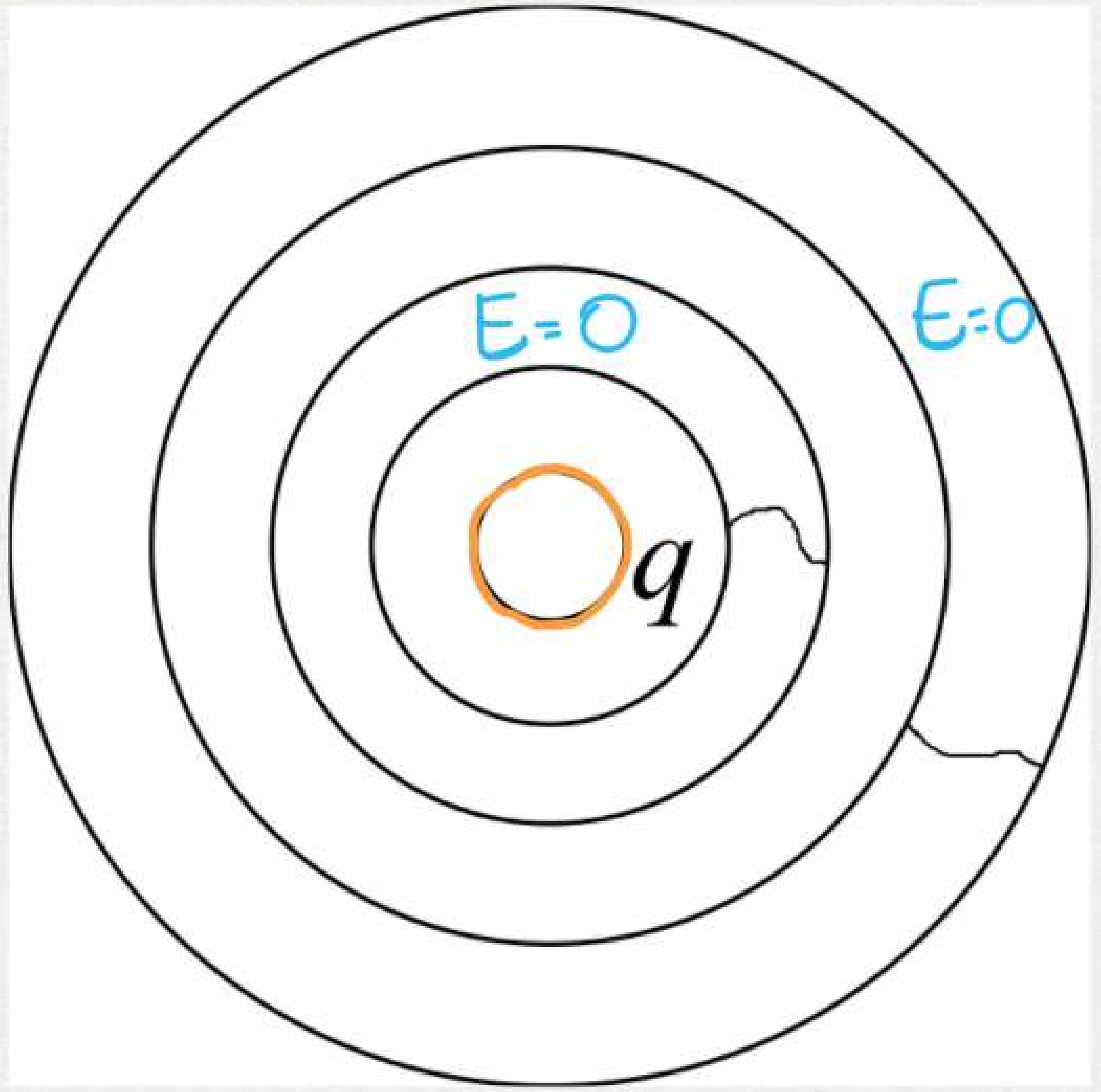
$$q = c\,\Delta V$$

$$q_1 = c\,\Delta V \,,\quad q_2 = -q_1 \,,\quad c = 4\pi\varepsilon_0 \frac{R_1 R_2}{R_2 - R_1}$$

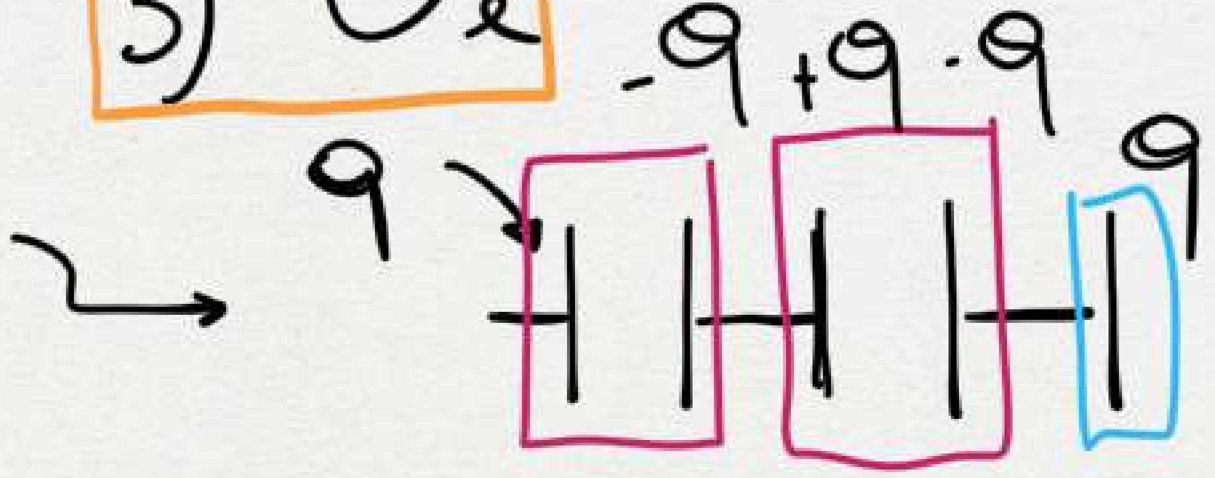


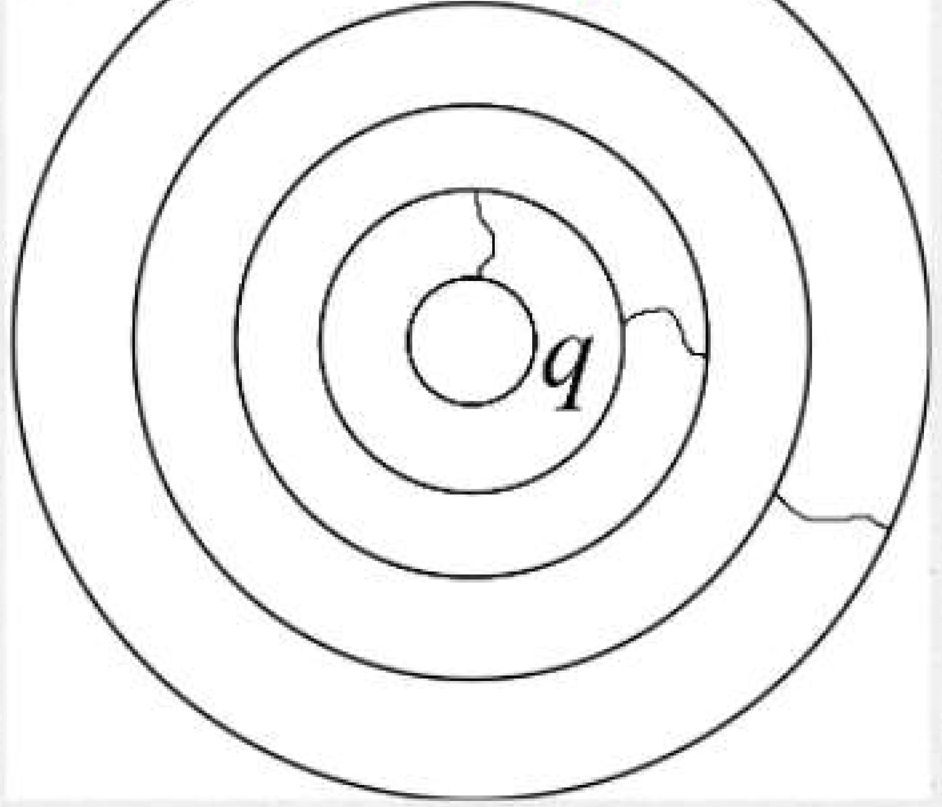
$$V_2 = \frac{q_3}{4\pi\varepsilon_0 R_3} \Rightarrow \boxed{q_3 = V_2 4\pi\varepsilon_0 R_3}$$

4.10 MNV



1) le cariche presenti sulle superfici
2) $E(r)$
3) $\boxed{U_e}$



4.


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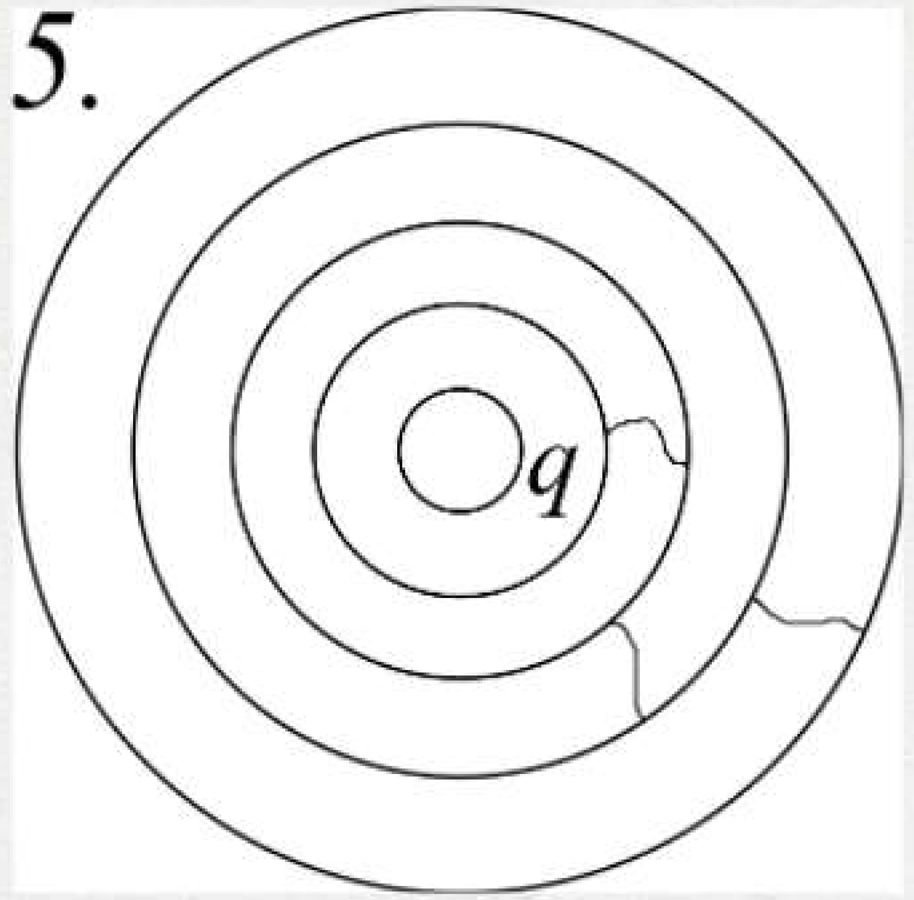

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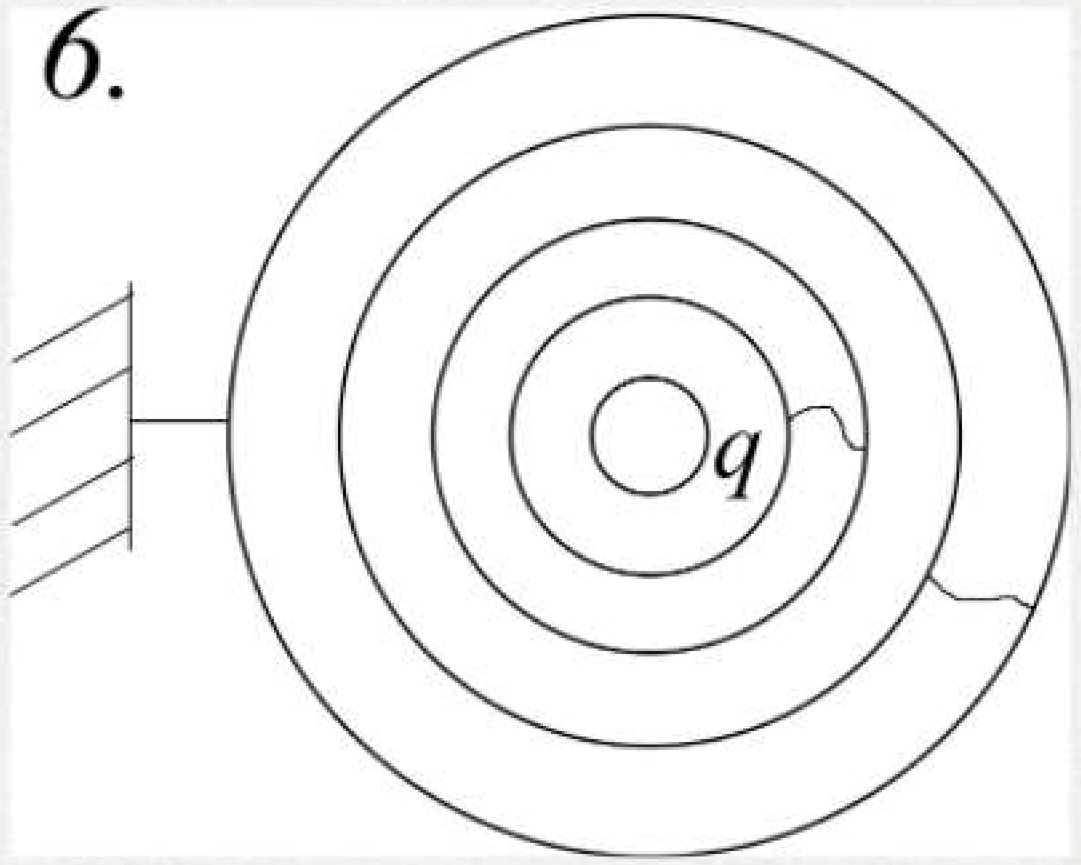

$$U_e = \frac{1}{2}\frac{q^2}{C}$$

$$U_e = \frac{1}{2}\frac{q^2}{C_1} + \frac{1}{2}\frac{q^2}{C_2} = \frac{1}{2}\frac{q^2}{C_{eq}}$$

$$C = 4\pi\varepsilon_0 \frac{R_1 R_2}{R_2 - R_1} \xrightarrow[R_2 \to \infty]{} \boxed{4\pi\varepsilon_0 R_1}$$

$$U_e^{\text{SPAIATO}} = \frac{1}{2}\frac{q^2}{C_\infty}$$