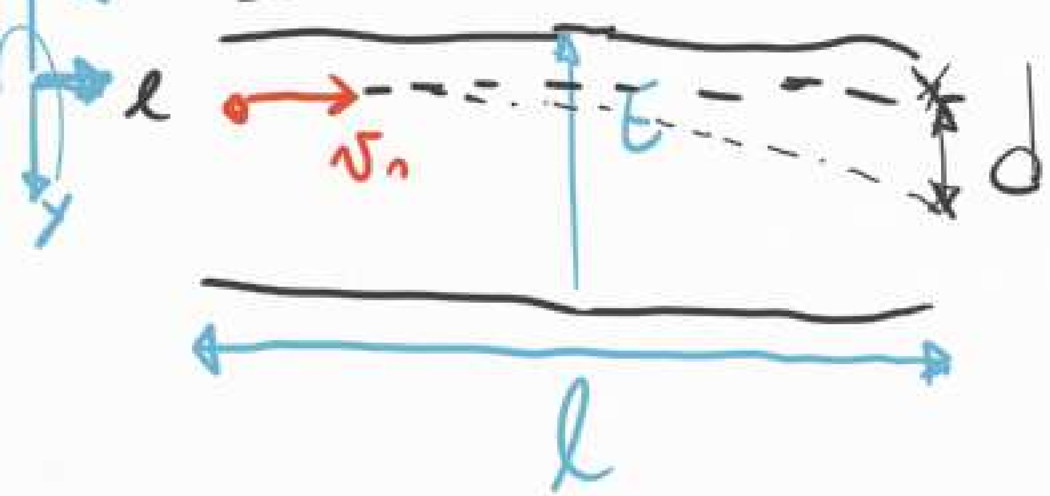
2.12



$$v_0 t^* = l \Rightarrow t^* = \frac{l}{v_0}$$

$$y(t) = \frac{1}{2} a t^2$$

$$\boxed{d = y(t^*)} = \frac{1}{2} a t^{*2} = \frac{1}{2} \frac{eE}{m} \left(\frac{l}{v_0}\right)^2$$

$$\Delta U_K = U_K(d) - U_K(0) = -\Delta U_e = +e\Delta V =$$

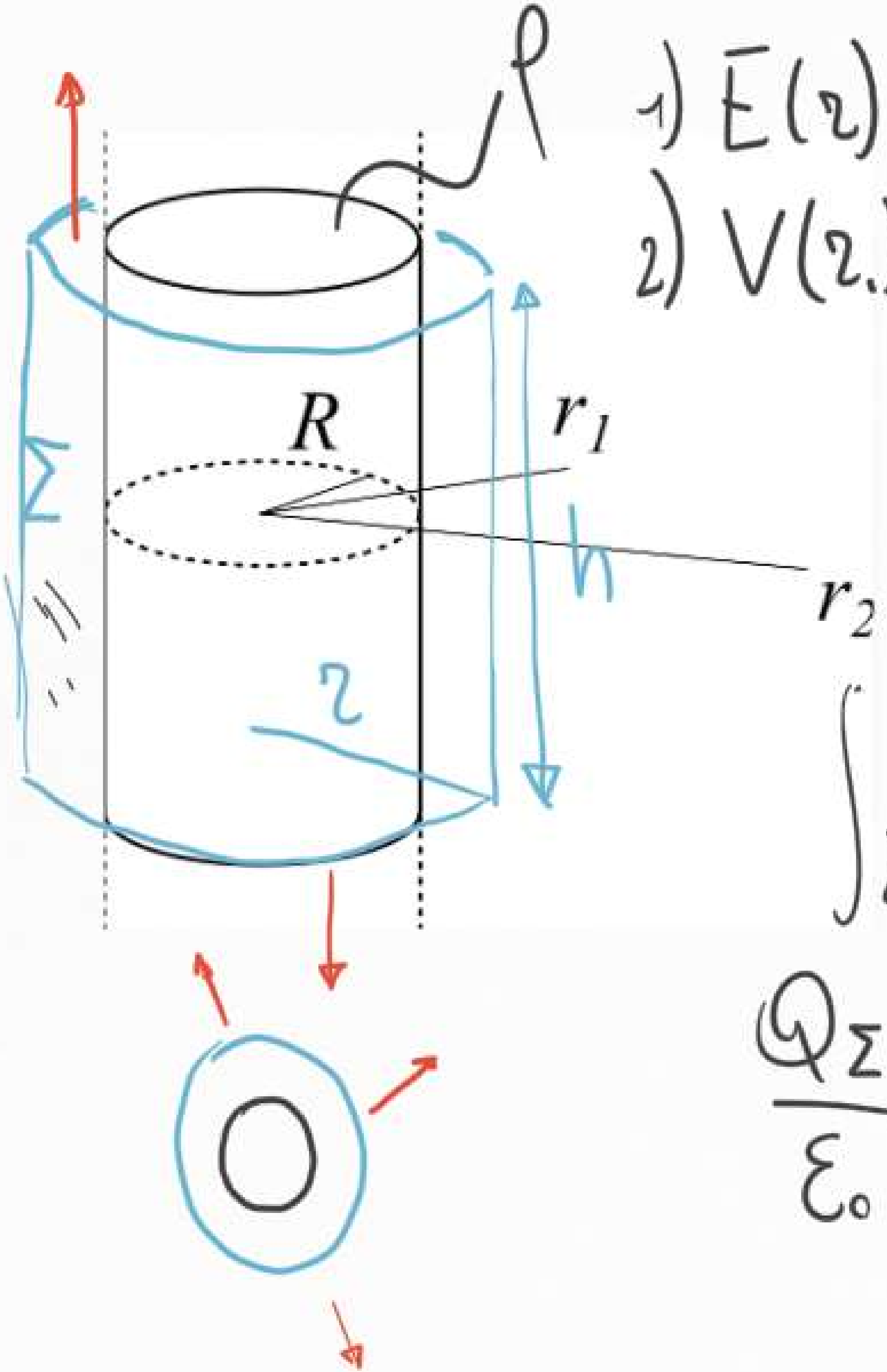
$$= \frac{1}{2} m v^2(t^*) - \frac{1}{2} m v^2(0) = \frac{1}{2} m v^2(t^*) - \frac{1}{2} m v_0^2 =$$

$$= \frac{1}{2} m v_y^2(t^*) = \frac{1}{2} m a t^* = \frac{1}{2} \frac{eE}{\cancel{m}} \frac{l}{v_0} \cancel{m} = \frac{1}{2} e E \frac{l}{v_0}$$

$$\int_\tau \bar{F}\, d\tau = \int_\tau \bar{F}\, dx\, dy\, dz = \int_\tau \bar{F}(r,\theta,\varphi)\, r^2 \underbrace{\sin\theta\, dr\, d\theta\, d\varphi}_{} =$$

$$= \boxed{\int_0^R \bar{F}(r)\, 4\pi r^2\, dr}$$

$$\int_\Sigma G(x,y)\, dx\, dy = \int_\Sigma G(r,\theta)\, r\, dr\, d\theta = \boxed{\int_\Sigma G(r)\, 2\pi r\, dr}$$



1) $\vec{E}(r) = ?$ $\quad r > R$

2) $V(r_1) - V(r_2) = ?$

$$\int_\Sigma \vec{E}\cdot\hat{n}\, d\Sigma = \frac{Q_\Sigma}{\varepsilon_0} \implies$$

$$\int_\Sigma \bar{E}(r)\, d\Sigma = E(r)\int_\Sigma d\Sigma = \bar{E}(r)\, 2\pi r h$$

$$\|$$

$$\frac{Q_\Sigma}{\varepsilon_0} = \frac{1}{\varepsilon_0}\int_{\tau_\Sigma}\rho\, d\tau = \frac{\rho}{\varepsilon_0}\int_{\tau_\Sigma} d\tau = \frac{\rho}{\varepsilon_0}\pi R^2 h \implies$$

$$\overline{E}(r) = \frac{\rho R^2}{2\varepsilon_0 r}, \quad \lambda = \underline{\rho \pi R^2} \Rightarrow$$

$$\boxed{\overline{E}(r) = \frac{\lambda}{2\pi\varepsilon_0 r}}$$

2) $$V(r_1) - V(r_2) = -\int_{r_2}^{r_1} \overline{E}(r)\,dr = -\frac{\rho R^2}{2\varepsilon_0}\int_{r_2}^{r_1}\frac{dr}{r} =$$

$$= -\frac{\rho R^2}{2\varepsilon_0}\left[\log r_1 - \log r_2\right] = \boxed{\frac{\rho R^2}{2\varepsilon_0}\log\frac{r_2}{r_1}} \Rightarrow$$

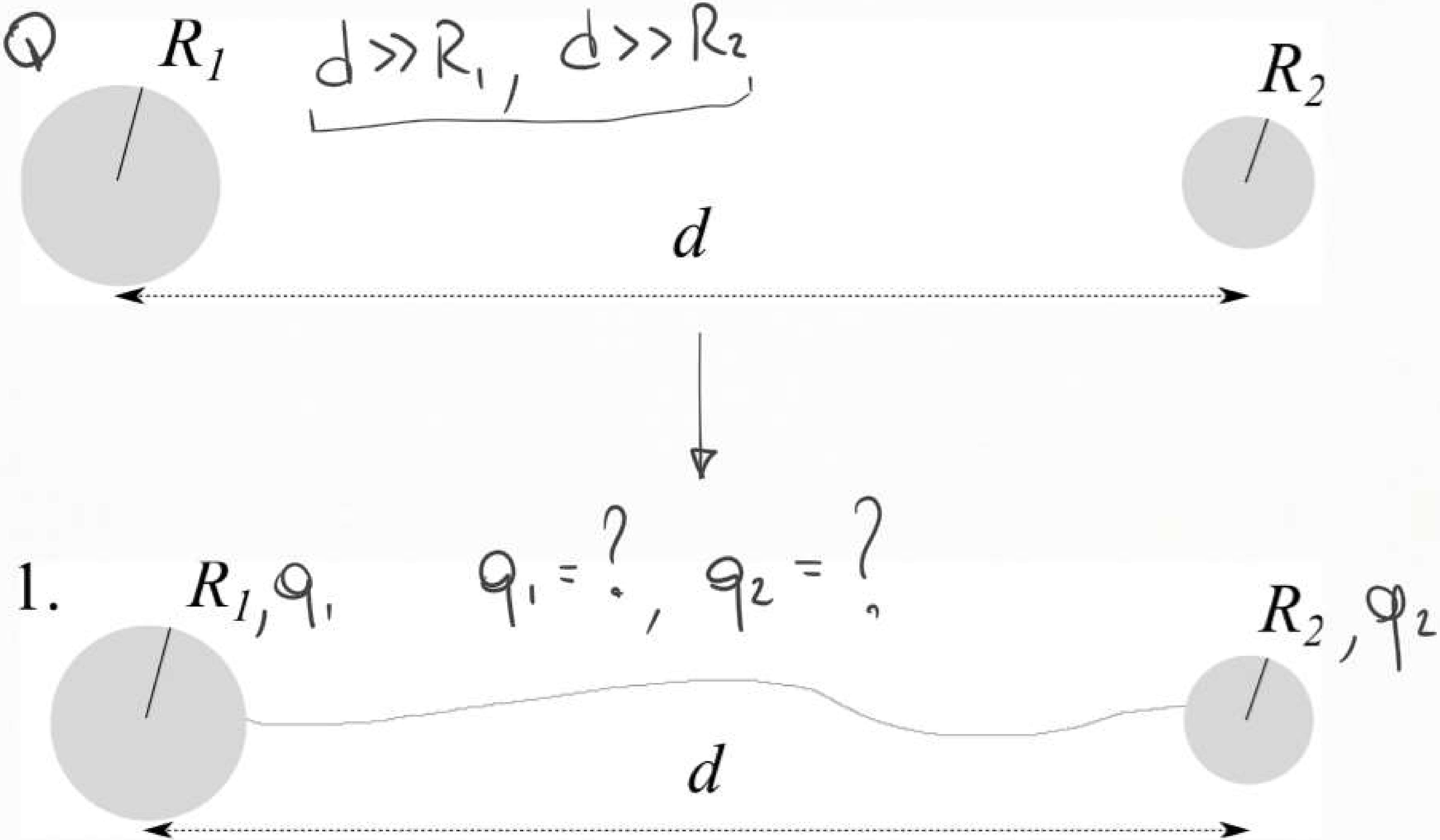
$$q = C\Delta V \Rightarrow C = \frac{q}{\Delta V},$$

$$q = \rho \pi R^2 h = \lambda h \Rightarrow$$

$$\Delta V = \frac{q}{2\pi\varepsilon_0 h} \log \frac{r_2}{r_1} \Rightarrow \boxed{C = \frac{q}{\Delta V} = \frac{2\pi\varepsilon_0 h}{\log\left(\frac{r_2}{r_1}\right)}}$$

ESONERO (DATA PAPABILE)

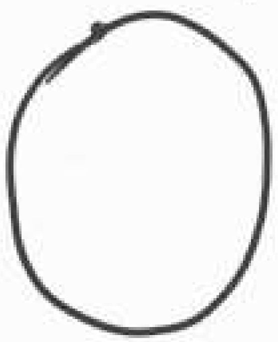
13/11 ORE 13:30 AULA 4



Q
R_1
$d >> R_1, \ d >> R_2$
R_2
d
1.
R_1, q_1
$q_1 = ?, \ q_2 = ?$
R_2, q_2
d

$$V(1) = V(2), \quad V(1) = \frac{q_1}{4\pi\varepsilon_0}\frac{1}{R_1} \Rightarrow$$

q_1, R_1



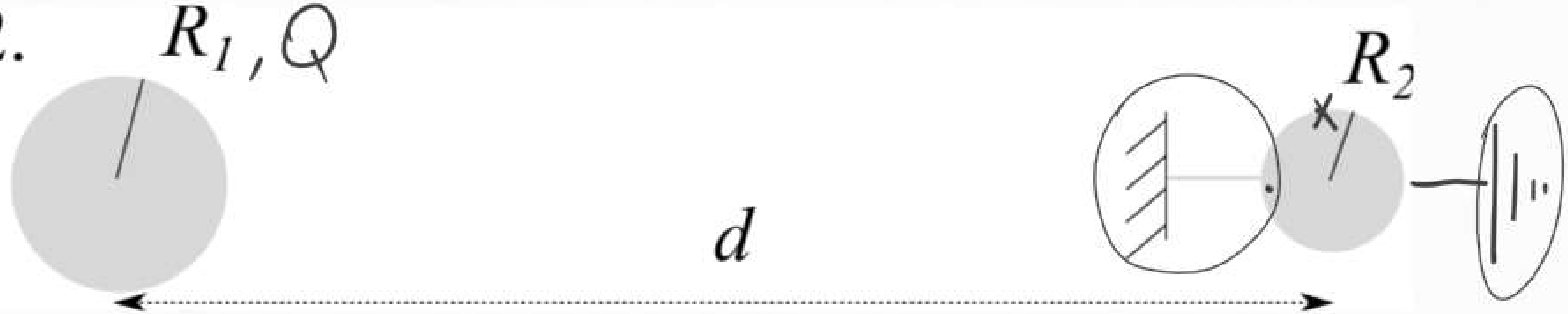
$$V(2) = \frac{q_2}{4\pi\varepsilon_0}\frac{1}{R_2}$$

$$\frac{q_1}{R_1} = \frac{q_2}{R_2}, \quad q_1 + q_2 = Q \Rightarrow$$

$$\frac{Q - q_2}{R_1} = \frac{q_2}{R_2} \Rightarrow q_2\left(\frac{1}{R_2} + \frac{1}{R_1}\right) = \frac{Q}{R_1} \Rightarrow$$

$$\boxed{q_2 = \frac{QR_2}{R_1 + R_2}, \quad q_1 = Q - q_2 = \frac{QR_1}{R_1 + R_2}}$$

2.

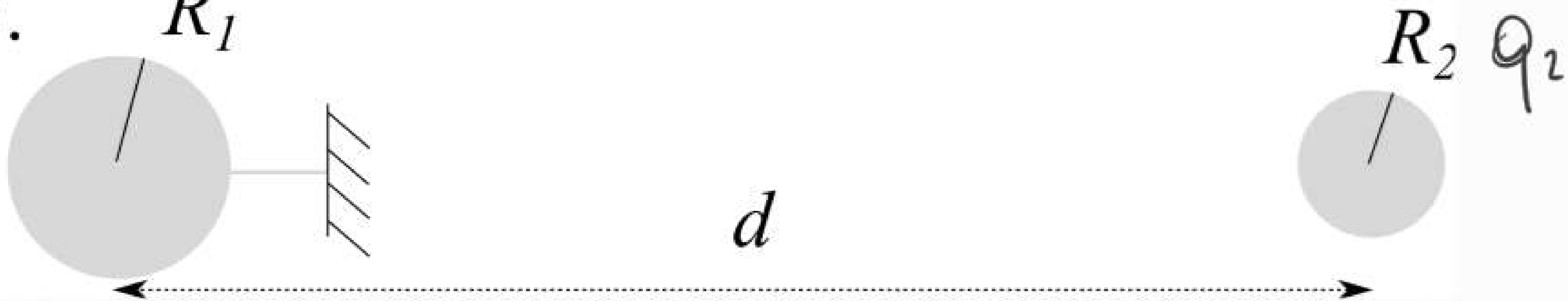


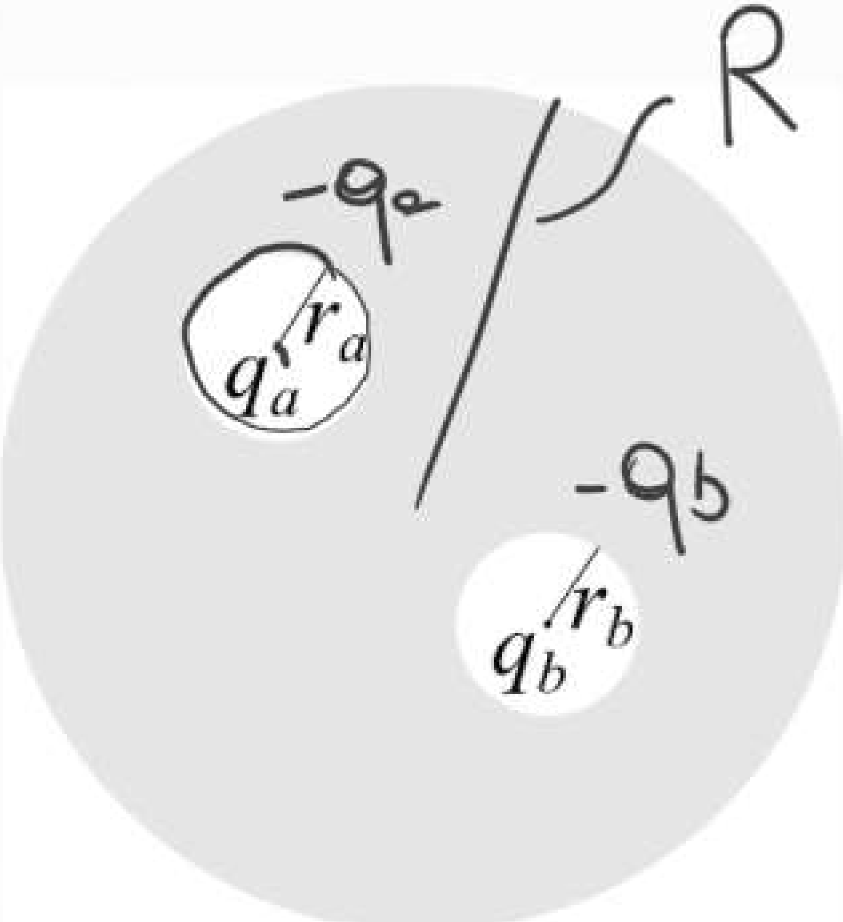
$V(2) = 0 \Rightarrow$

$$V(2) = \frac{q_2}{4\pi\varepsilon_0}\frac{1}{R_2} + \frac{Q}{4\pi\varepsilon_0}\frac{1}{d-R_2} \approx \frac{q_2}{4\pi\varepsilon_0}\frac{1}{R_2} + \frac{Q}{4\pi\varepsilon_0}\frac{1}{d} = 0 \Rightarrow$$

$$\boxed{q_2 = -\frac{QR_2}{d}}$$

3.





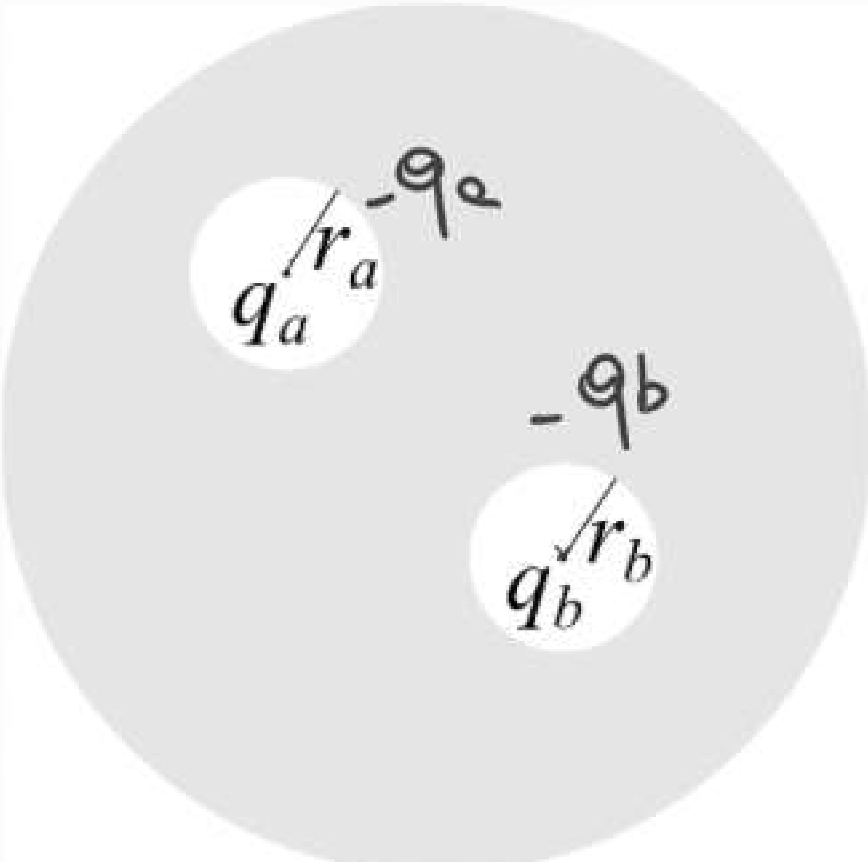
1) $\sigma_R, \sigma_a, \sigma_b$

2) $E(r), r > R$

$q_a + q_b$

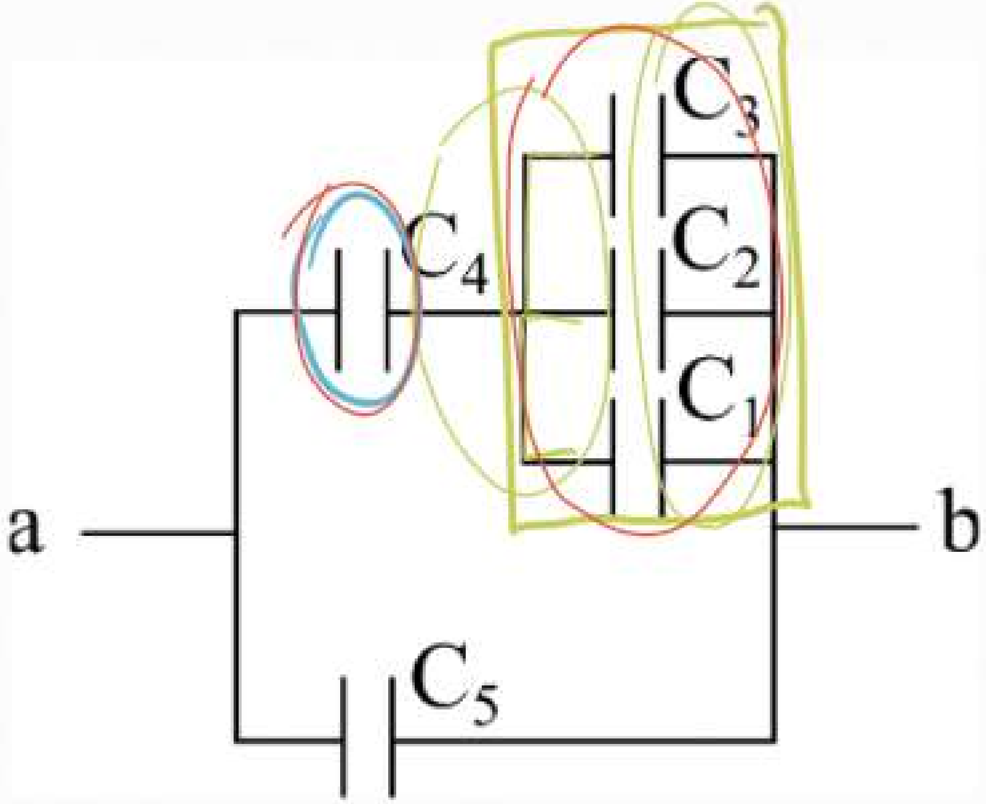
$$\sigma_R = \frac{q_a + q_b}{4\pi R^2}, \quad \sigma_a = -\frac{q_a}{4\pi r_a^2}, \quad \sigma_b = -\frac{q_b}{4\pi r_b^2}$$

$$\boxed{E(r) = \frac{q_a + q_b}{4\pi \varepsilon_0} \frac{1}{r^2}}$$



$$\vec{F}_{ab} = ?$$

$$\boxed{\vec{F} = q_a \vec{E}_a}$$



$\Delta V_{ab} = V(a) - V(b)$

1) $C_{eq} = ?$

2) $q_i, \Delta V_i, \quad i \in 1,2,3,4,5$

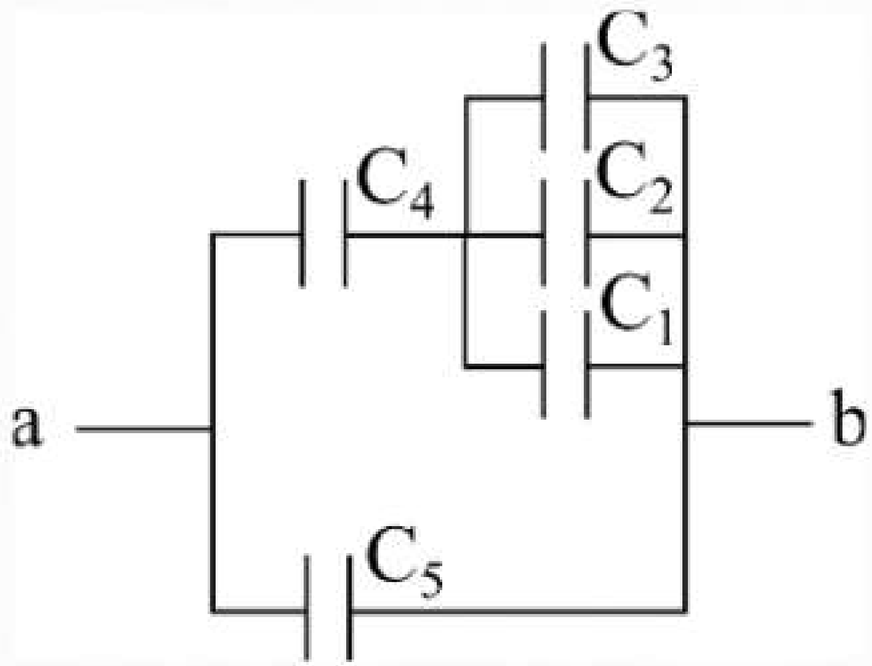
PARALLELO

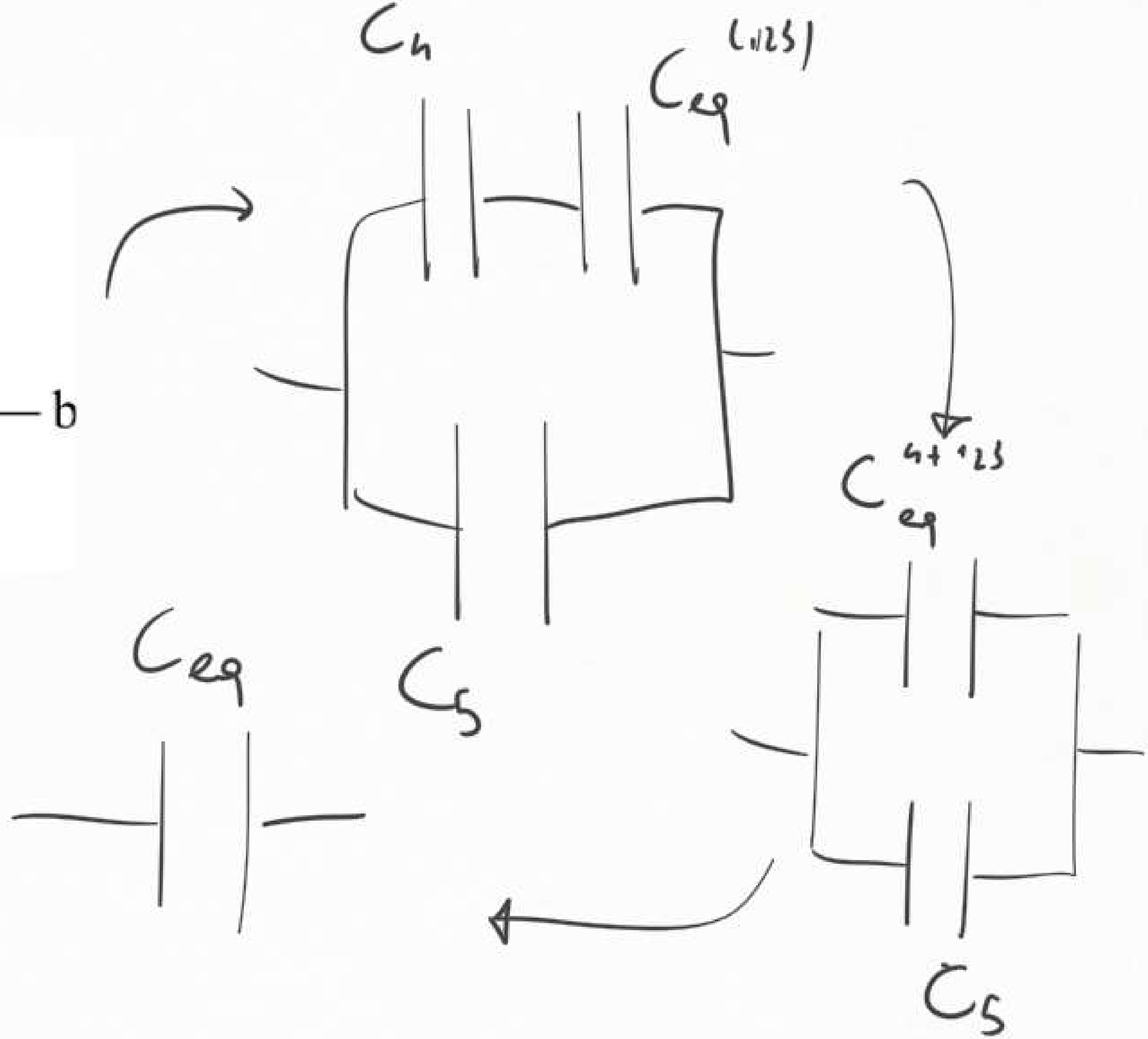
$$\boxed{C_{eq} = \sum_i C_i}$$

SERIE

$$\boxed{\frac{1}{C_{eq}} = \sum_i \frac{1}{C_i}}$$

$$\boxed{C_{eq} = \frac{1}{C_1} + \frac{1}{C_2}}$$


C3
C4
C2
C1
a
b
C5


C4
Ceq
C5
Ceq
C5
Ceq