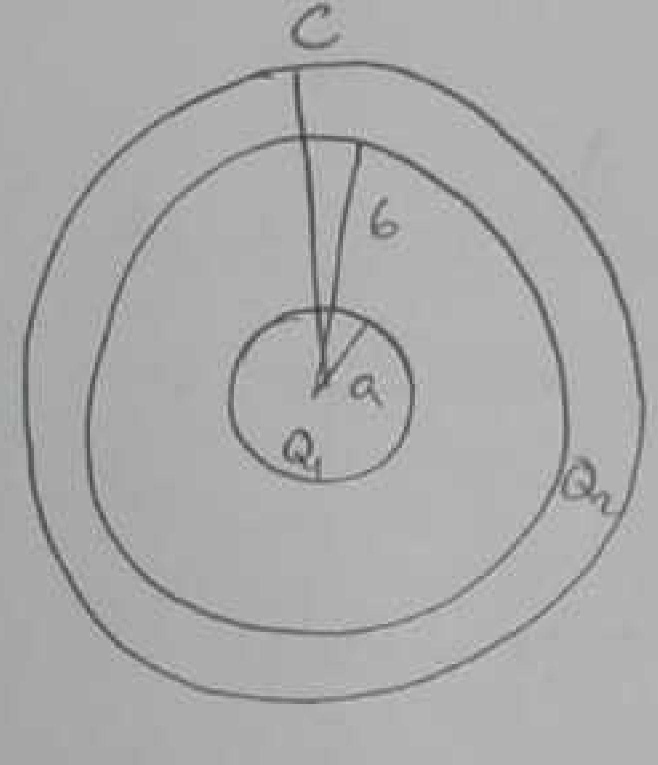


$Q_1 = +2\mu C$

$Q_2 = +1\mu C$

(a) Q_1 quedará uniformemente distribuida en $r = a$

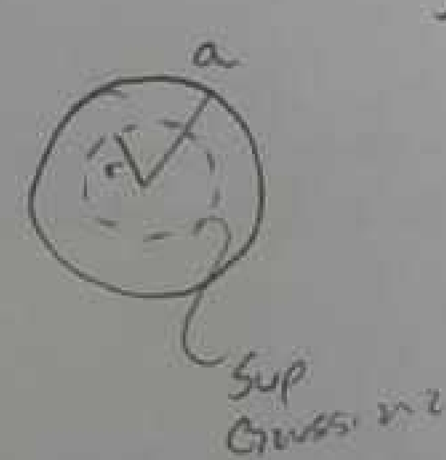
$$\sigma_a = \frac{Q_1}{4\pi a^2}$$

Sobre el conductor, en la superficie interna $r = b$ se inducirá $q_b = -Q_1$ uniformemente distribuida $\sigma_b = \frac{-Q_1}{4\pi b^2}$

Sobre la superficie externa $r = c$ quedará la suma del exceso de carga, en este caso $q_c = Q_1 + Q_2$ $\therefore$ $\sigma_c = \frac{Q_1 + Q_2}{4\pi c^2}$

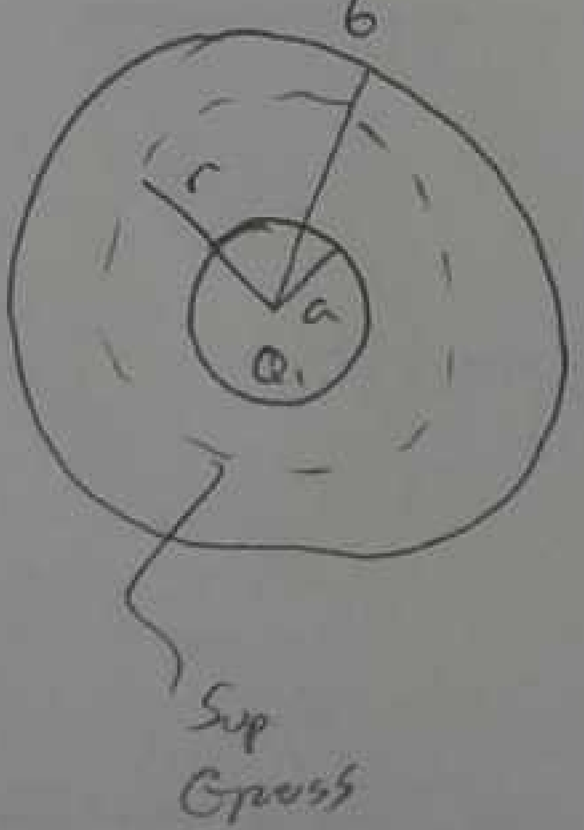
(b) $r < a$

$$\int \bar{E}\, d\bar{s} = \frac{Q_{enc}}{\varepsilon_0}$$



$Q_{enc} = 0$ $\therefore$ $\boxed{\bar{E}(r) = 0}$

$a < r < b$



$$\int \bar{E} . d\bar{s} = \frac{Q_{enc}}{\varepsilon_0}$$

$$\boxed{\bar{E}(r) = \frac{Q_1}{4\pi r^2 \varepsilon_0} \hat{e}_r}$$

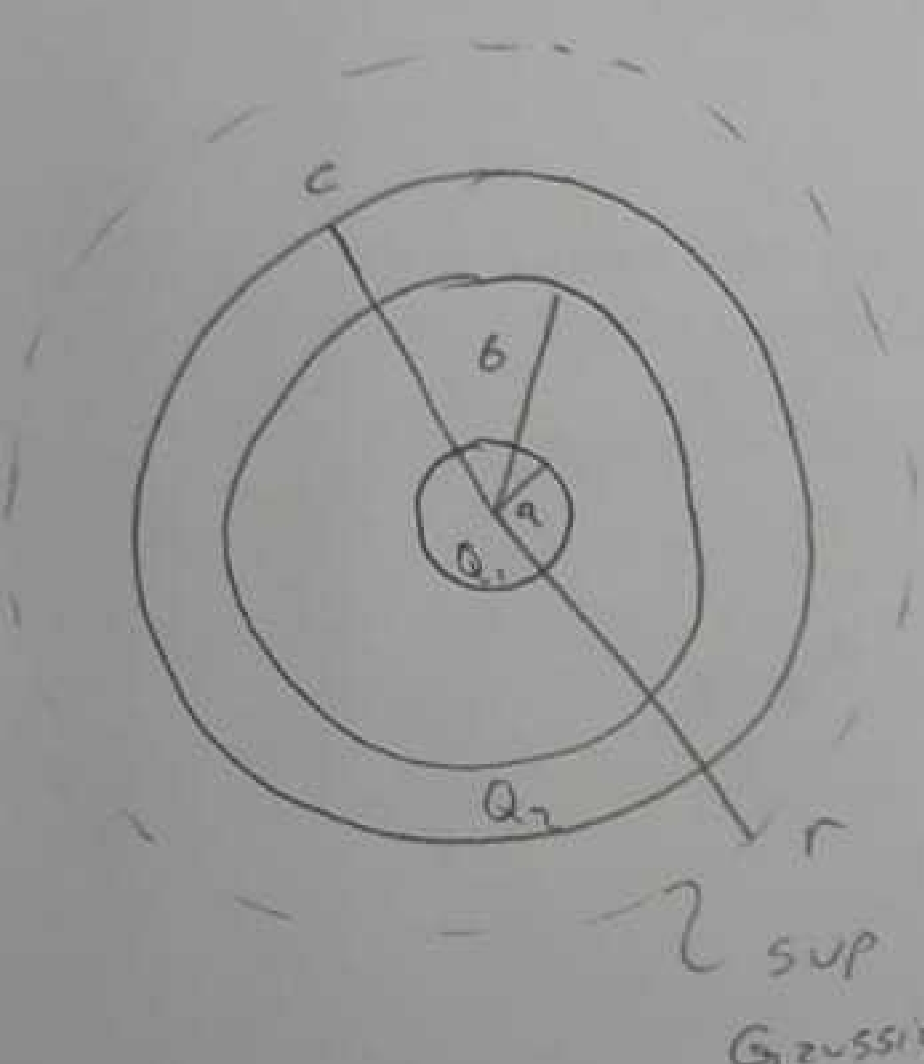
$b < r < c$

$$\int \bar{E} \cdot d\bar{s} = \frac{Q_{enc}}{\varepsilon_0}$$

$$\left.\begin{aligned} Q_{enc} &= Q_1 + q_b \\ &= Q_1 - Q_1 \\ &= 0 \end{aligned}\right\} \Rightarrow \boxed{\bar{E}(r) = 0}$$

Por conductor

$r > c$



$$\int \bar{E} \cdot d\bar{s} = \frac{Q_{enc}}{\varepsilon_0}$$

$$Q_{enc} = Q_1 + Q_2$$

$$\therefore \boxed{\bar{E}(r) = \frac{Q_1 + Q_2}{4\pi r^2 \varepsilon_0} \hat{e}_r}$$

(c) $r > c$

$$\int_{V_{ref}(\infty)=0}^{V(r)} dV = -\int_{\infty}^{r} \bar{E} \cdot d\bar{r}$$

$$V(r) = -\int_{\infty}^{r} \frac{Q_1 + Q_2}{4\pi \varepsilon_0 r^2} \hat{e}_r \cdot dr \, \hat{e}_r$$

$$\boxed{V(r) = \frac{Q_1 + Q_2}{4\pi \varepsilon_0 r}} \longrightarrow V(c) = \frac{Q_1 + Q_2}{4\pi \varepsilon_0 c}$$

$\underline{b < r < c}$

$$\int_{V_{ref}=V(c)}^{V(r)} dV = -\int_{c}^{r} \underbrace{-\bar{E} \cdot d\bar{r}}_{=0}$$

$$V(r) = V(c)$$

$$\boxed{V(r) = \frac{Q_1 + Q_2}{4\pi \varepsilon_0 c}} \longrightarrow V(b) = \frac{Q_1 + Q_2}{4\pi \varepsilon_0 c}$$

$\underline{a < r < b}$

$$\int_{V_{ref}=V(b)}^{V(r)} dV = -\int_{b}^{r} \bar{E} \cdot d\bar{r}$$

$$V(r) - V(b) = -\int_{b}^{r} \frac{Q_1}{4\pi r^2 \varepsilon_0} \hat{e}_r \cdot dr\, \hat{e}_r$$

$$V(r) - \frac{Q_1 + Q_2}{4\pi \varepsilon_0 c} = \left. \frac{Q_1}{4\pi \varepsilon_0 r} \right|_{b}^{r}$$

$$\boxed{V(r) = \frac{Q_1}{4\pi \varepsilon_0 r} - \frac{Q_1}{4\pi \varepsilon_0 b} + \frac{Q_1 + Q_2}{4\pi \varepsilon_0 c}}$$

$$\hookrightarrow V(a) = \frac{Q_1}{4\pi \varepsilon_0 a} - \frac{Q_1}{4\pi \varepsilon_0 b} + \frac{Q_1 + Q_2}{4\pi \varepsilon_0 c}$$

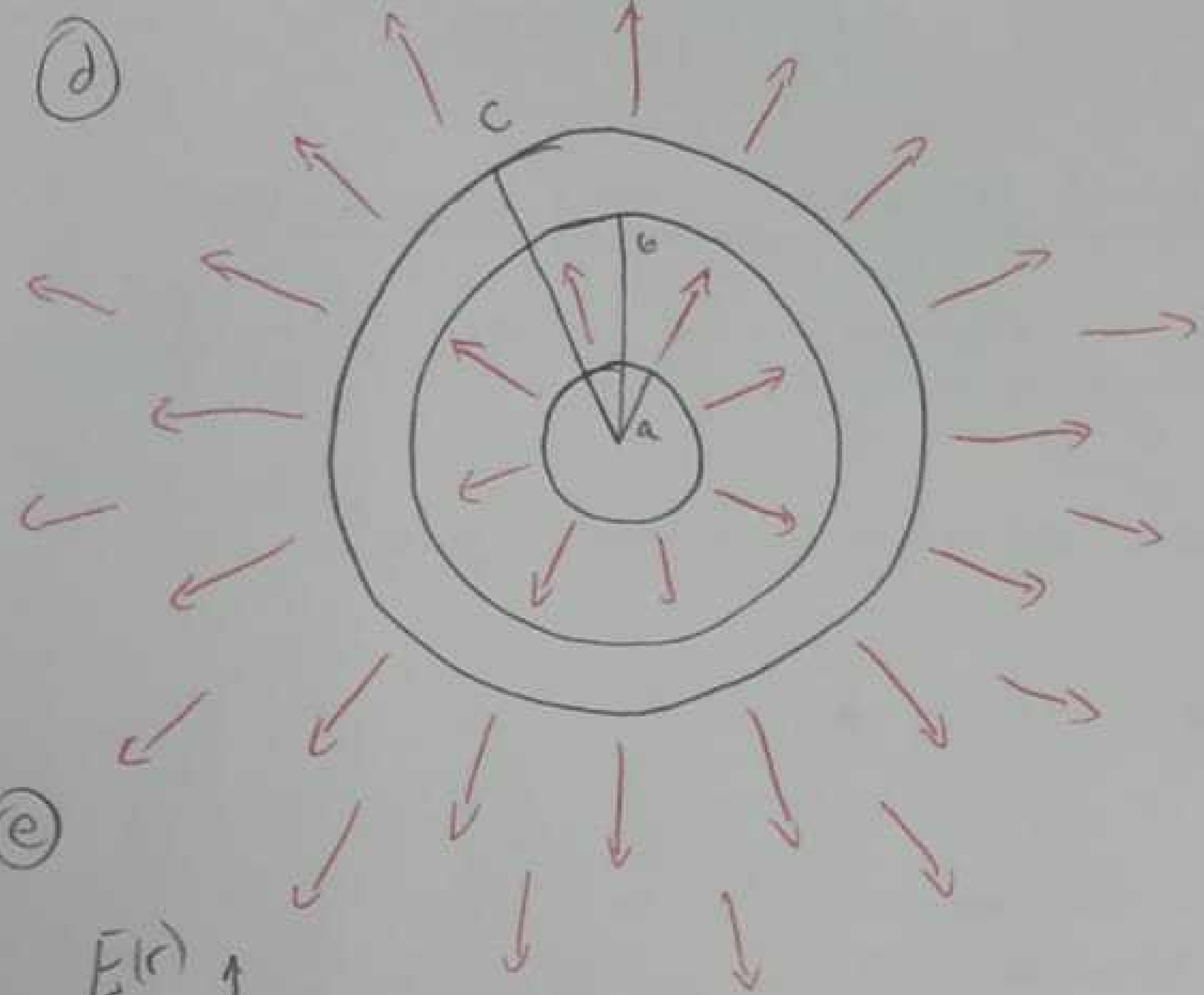
$\underline{r < a}$

$$\int_{V_{ref}=V(a)}^{V(r)} dV = -\int_{a}^{r} \bar{E} \cdot d\bar{r} \qquad \bar{E} = 0$$

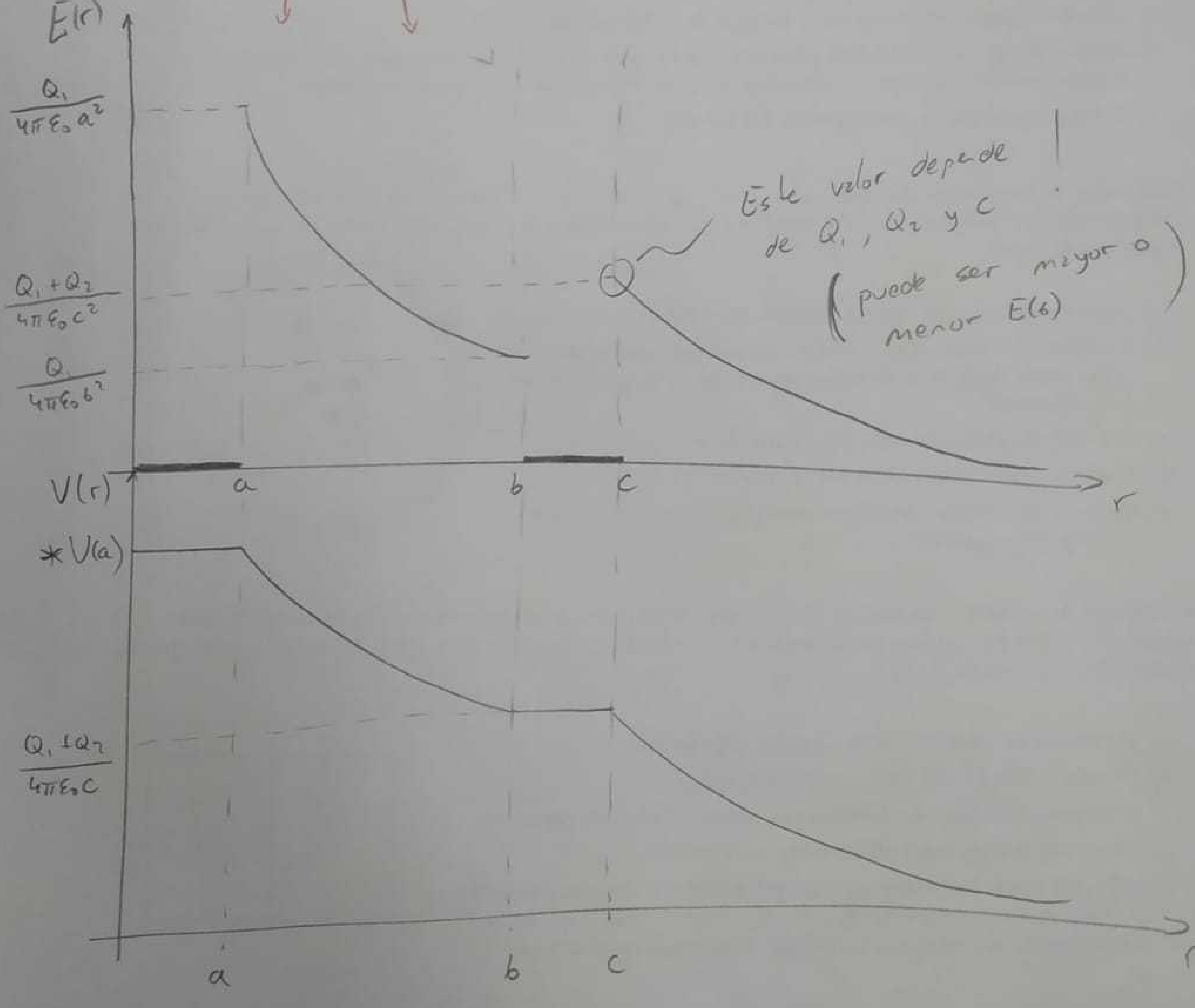
$$V(r) = V(a)$$

$$\boxed{V(r) = \frac{1}{4\pi \varepsilon_0} \left(\frac{Q_1}{a} - \frac{Q_1}{b} + \frac{Q_1 + Q_2}{c} \right)}$$

(d)



(e)



$$* \; V(a) = \frac{Q_1}{4\pi\varepsilon_0 a} - \frac{Q_1}{4\pi\varepsilon_0 b} + \frac{Q_1+Q_2}{4\pi\varepsilon_0 c}$$