

$$\vec{E} = \vec{E}_p + \vec{E}_q$$

$$\vec{E}_p = -\frac{\sigma \hat{x}}{2\epsilon_0}$$

$$\vec{E}_q = \frac{q}{4\pi\epsilon_0} \frac{\hat{r}_A}{r_A^2} = (E_x, E_y)$$

$$\vec{r}_A = \left(\frac{l}{3}, \frac{l}{2}\right)$$

$$r_A = \sqrt{\frac{l^2}{9} + \frac{l^2}{4}} = l \sqrt{\frac{13}{36}} = \frac{\sqrt{13}}{6} l$$

$$\hat{r}_A = \frac{\vec{r}_A}{r_A} = \frac{6}{\sqrt{13}} \left(\frac{1}{3}, \frac{1}{2}\right) = \frac{1}{\sqrt{13}} (2, 3)$$

$$\vec{E}_q = \frac{q}{4\pi\epsilon_0} \frac{1}{\sqrt{13}} \frac{36}{13l^2} (2, 3) \Rightarrow$$

$$\vec{E} = \left(-\frac{\sigma}{2\epsilon_0} + \frac{q}{\pi\epsilon_0} \frac{18}{13\sqrt{13}l^2}, \frac{q}{4\pi\epsilon_0} \frac{27}{13\sqrt{13}l^2} \right)$$

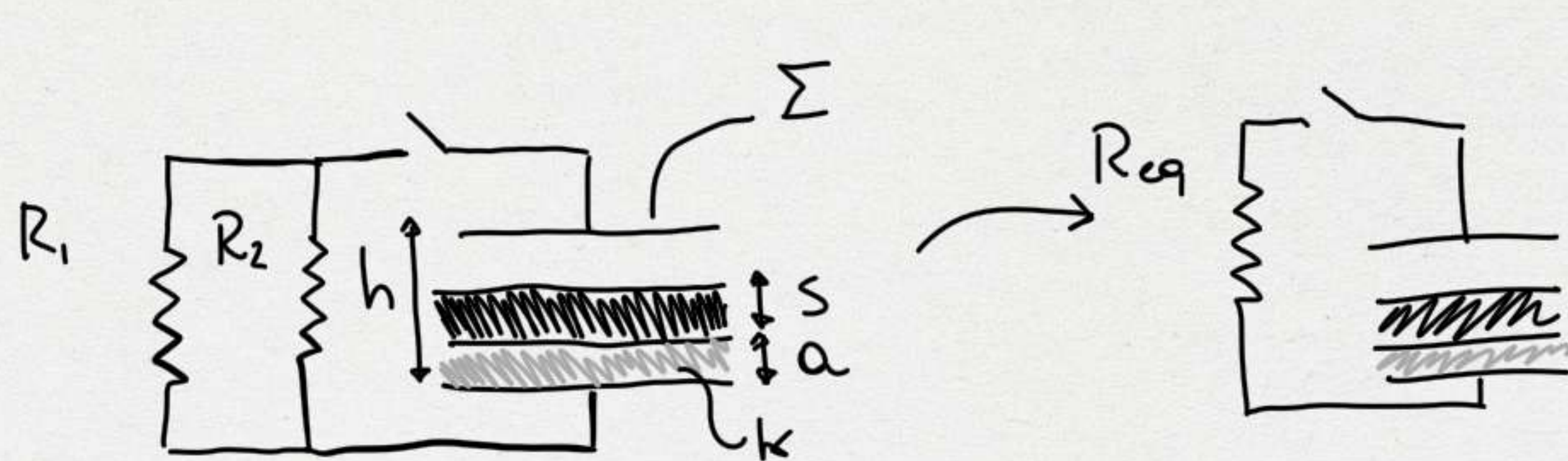
$< 0 \qquad \qquad \qquad < 0$

$$\Delta V = -\int \vec{E} \cdot d\vec{s} = \int (E_x, E_y) \cdot d\vec{s}$$

$$\Delta V = V(A) - V(B) = V_q(A) - V_q(B) =$$

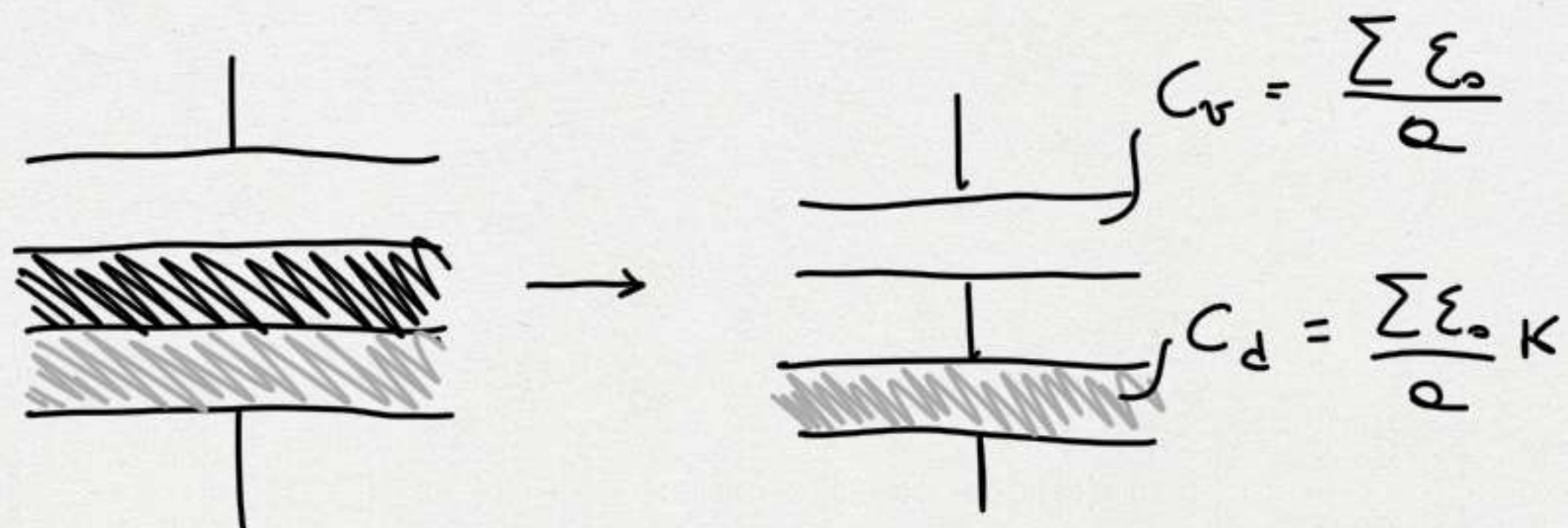
$$= \frac{q}{4\pi\epsilon_0} \left(\frac{1}{r_A} - \frac{1}{r_B} \right) = \frac{q}{4\pi\epsilon_0 l} \left(\frac{6}{\sqrt{13}} - \frac{3}{\sqrt{2}} \right) = -41V$$

$$r_B = l \sqrt{\frac{1}{9} + \frac{1}{9}} = l \frac{\sqrt{2}}{3}$$



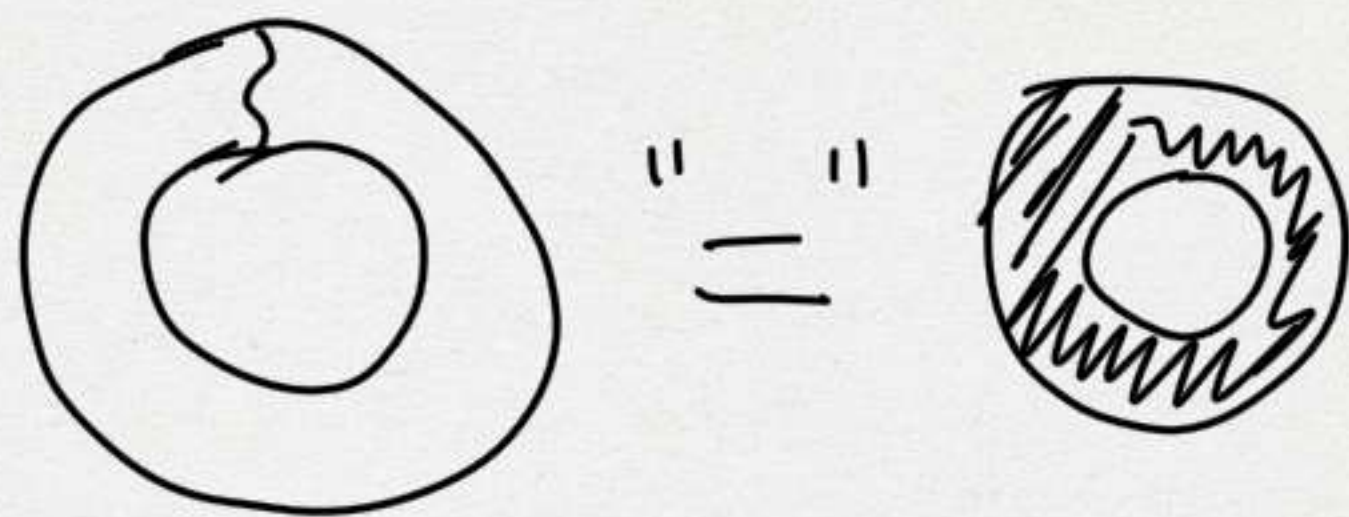
$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

Diagram of a parallel plate capacitor with two dielectric layers. The top layer has thickness h and permittivity Σ . The bottom layer has thickness a and permittivity κ . The total thickness is $h+a$. The area is A . The equivalent circuit shows two resistors in parallel, R_1 and R_2 , with an arrow pointing to the equivalent resistance R_{eq} .



$$C_{eq} = \frac{C_v C_d}{C_v + C_d}$$

$$C_{eq} = \frac{Q}{\Delta V}, \quad \Delta V = E_d a + E_v a = \frac{Q}{\Sigma} \frac{a}{\kappa} + \frac{Q}{\Sigma} \frac{a}{\Sigma}$$



$$\Delta V, q = ?$$

$$q = C_{eq} \Delta V$$

$$3) U_{dis} = U_o - U_{\infty} = U_c - 0 = \frac{1}{2} C_{eq} \Delta V^2 = \frac{1}{2} q \Delta V$$