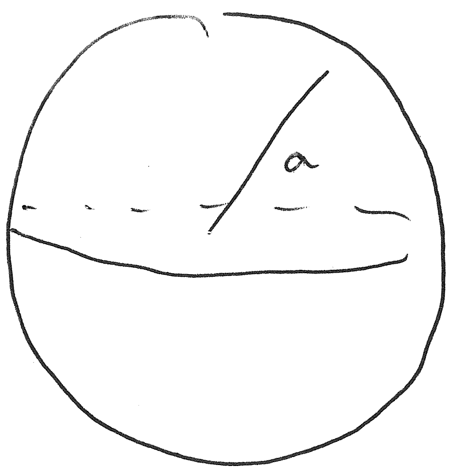
CONDUCTING SPHERE



$r > a \quad E = \frac{1}{4\pi\epsilon_0} \frac{Q}{r^2}$

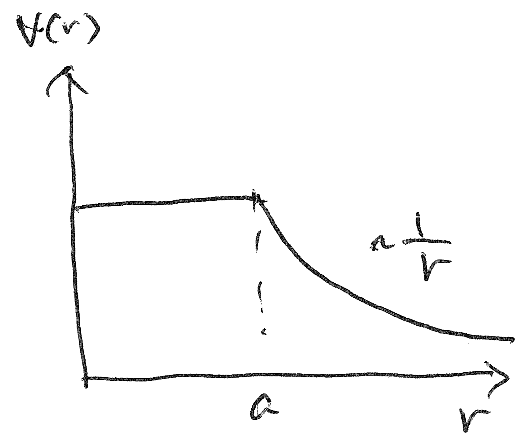
$r < a \quad E = 0$

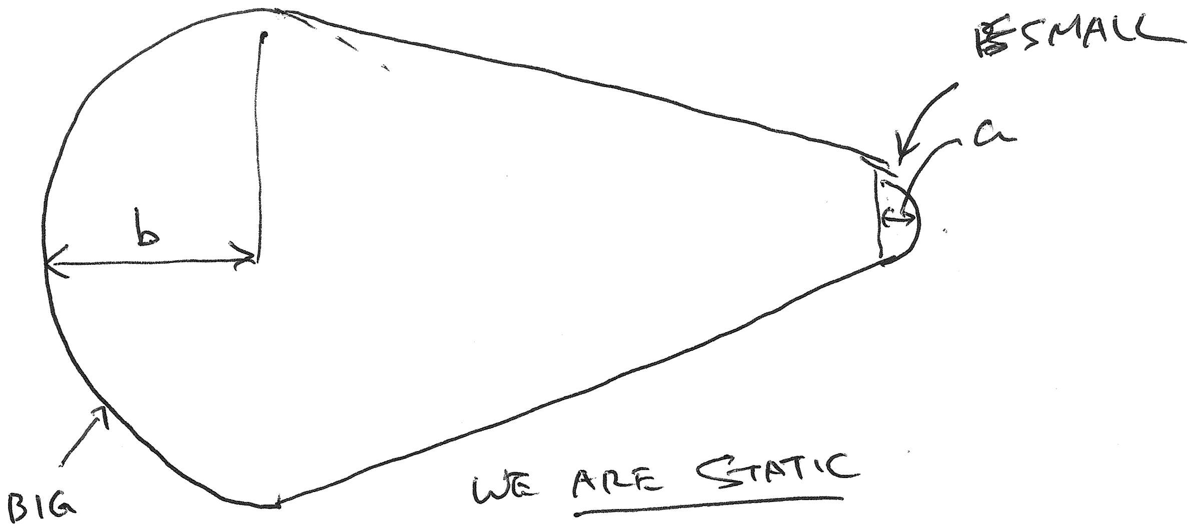
$r > a$

$$V(r) = \frac{1}{4\pi\epsilon_0} \frac{Q}{r}$$

$r < a$

$$V(a) = \frac{1}{4\pi\epsilon_0} \frac{Q}{a}$$



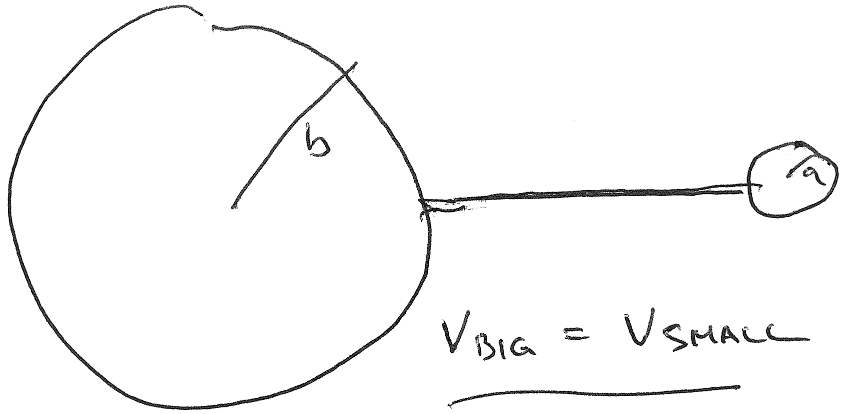


WE ARE STATIC

IF $V_{BIG} \neq V_{SMALL}$ THEN
CHARGES CAN MOVE

SO AT STATIC SITUATION (EQUILIBRIUM)

$$V_{BIG} = V_{SMALL}$$



$$V_{BIG} = V_{SMALL}$$

Q_{BIG} , Q_{SMALL}

$$\frac{1}{4\pi\varepsilon_0}\frac{Q_{BIG}}{b} = \frac{1}{4\pi\varepsilon_0}\frac{Q_{SMALL}}{a}$$

$$\frac{Q_{BIG}}{Q_{SMALL}} = \frac{b}{a}$$

REMEMBER RIGHT OUTSIDE CONDUCTOR $E = \frac{\sigma}{\varepsilon_0}$

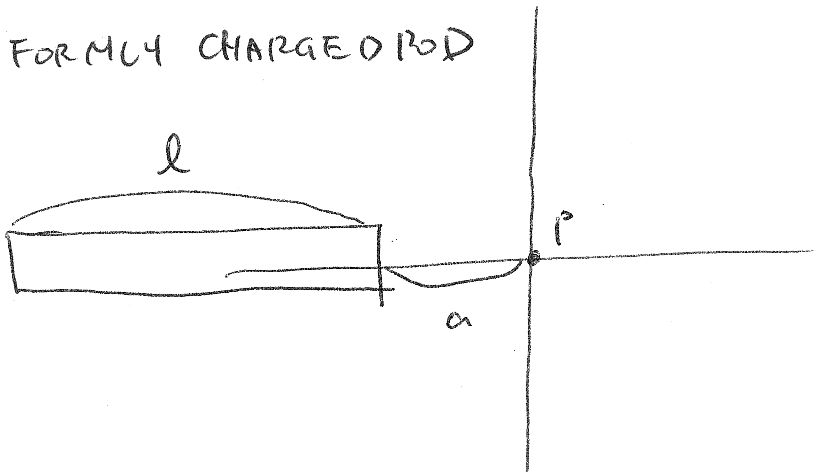
$$\sigma_{BIG} = \frac{Q_{BIG}}{4\pi b^2} \qquad \sigma_{SMALL} = \frac{Q_{SMALL}}{4\pi a^2}$$

$$\frac{E_{BIG}}{E_{SMALL}} = \frac{Q_{BIG}}{4\pi b^2 \varepsilon_0} \cdot \frac{4\pi a^2 \varepsilon_0}{Q_{SMALL}}$$

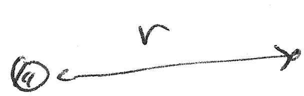
$$= \frac{Q_{BIG}}{Q_{SMALL}} \cdot \frac{a^2}{b^2} = \frac{b}{a} \cdot \frac{a^2}{b^2} = \frac{a}{b}$$

EXAMPLE PROBLEM

UNIFORMLY CHARGED ROD



O.K. POTENTIAL BY A POINT CHARGE IS GIVEN BY



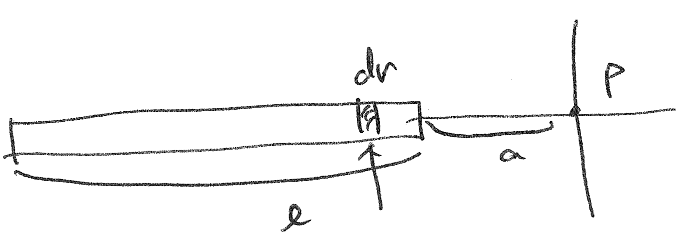
$$V(r) = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}.$$

~~SPHERICAL COORDINATES~~ ~~CYLINDRICAL~~

~~WE~~ r NEVER GOES BELOW ZERO.

SO IT WILL BE GOOD TO SOLVE THIS IN SPHERICAL / CYLINDRICAL COORDINATES

SO PROBLEM LOOKS LIKE



SMALL SEGMENT CONTAINS $dq = \lambda dr$

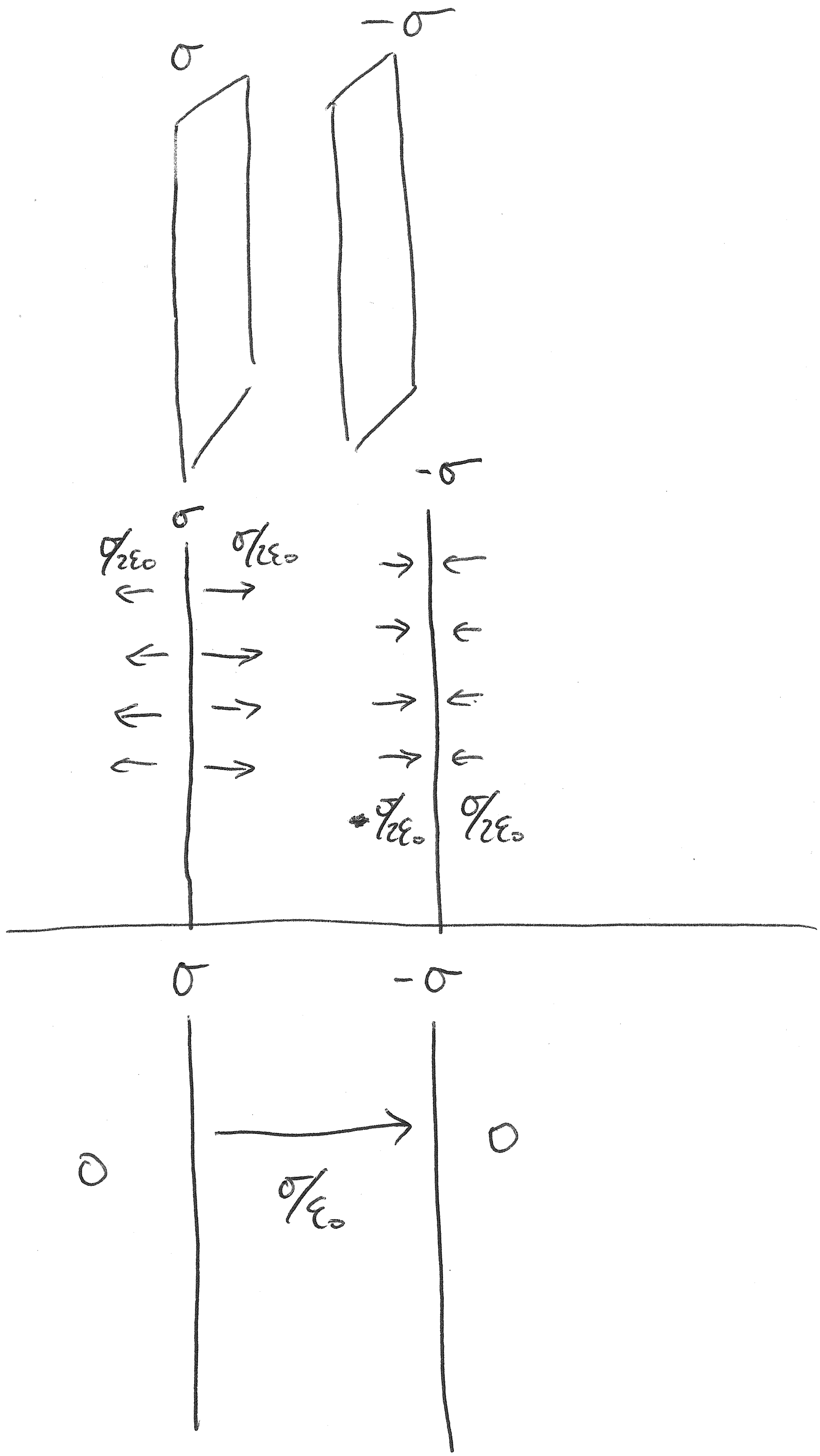
POTENTIAL BY THIS SEGMENT $dV = \frac{\lambda dr}{4\pi\varepsilon_0 r}$

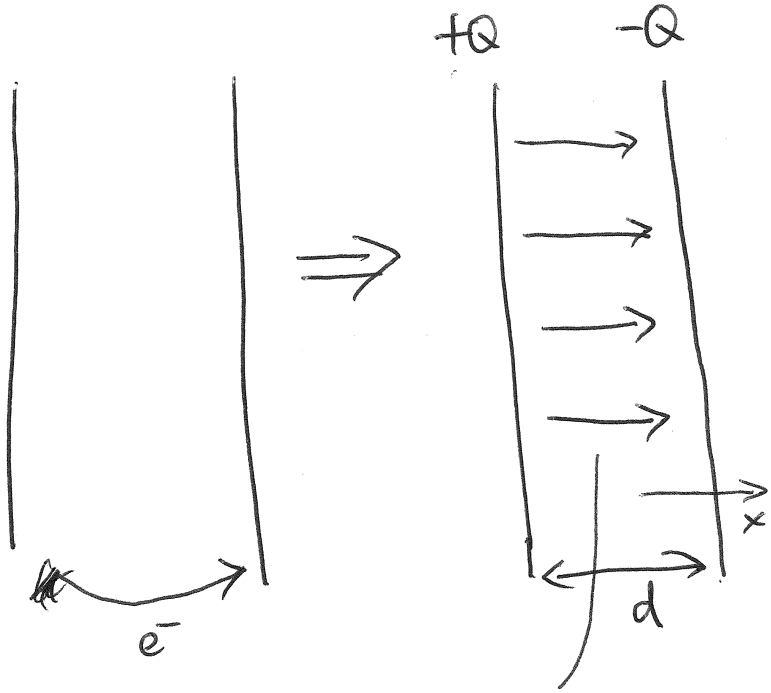
TOTAL POTENTIAL

$$V = \int_{a}^{l+a} \frac{\lambda \, dr}{4\pi\varepsilon_0 r}$$

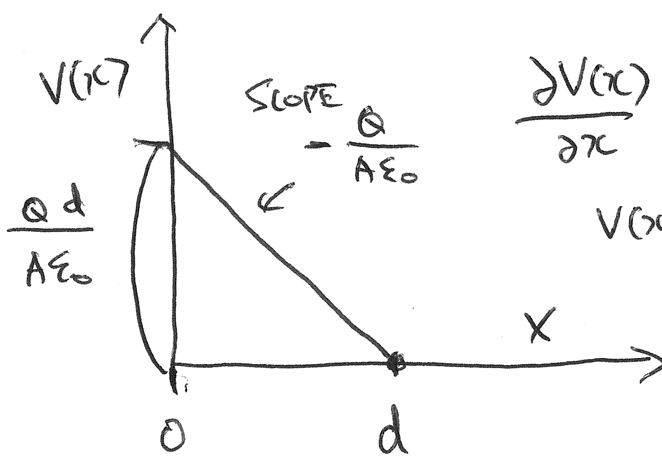
$$= \frac{\lambda}{4\pi\varepsilon_0} \ln r \Big]_{a}^{l+a}$$

$$V_{total} = \frac{\lambda}{4\pi\varepsilon_0} \ln\left(\frac{(l+a)}{a}\right)$$


σ
−σ
−σ
σ
σ/2ε₀
σ/2ε₀
σ/2ε₀
σ/2ε₀
σ
−σ
0
σ/ε₀
0



$$E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{A\varepsilon_0}$$



$$\frac{\partial V(x)}{\partial x} = -E$$

$$V(x) = -\frac{Q}{A\varepsilon_0}x + C$$

$$\Delta V = \frac{Qd}{A\varepsilon_0} = \left(\frac{d}{A\varepsilon_0}\right)Q$$

$$C = \frac{A\varepsilon_0}{d} \qquad Q = C\Delta V$$