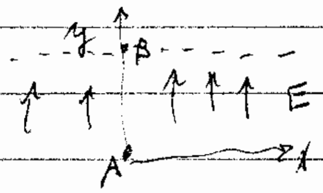
week 12   22-23, 48, 58

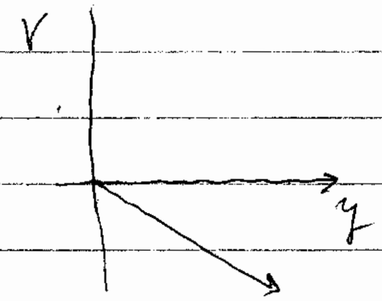
22-23: $\vec{E} = E_0 \hat{j}$ $V = ?$



$V_A = 0$ by def.

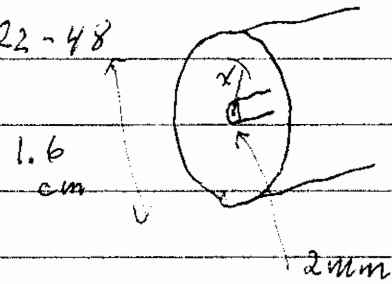
$V_B - V_A = \int_B^A E_0 \, dy = E_0 \int_B^A dy =$

$V_B = E_0 (y_A - y_B) = \boxed{-E_0 y_B = V_B}$



The potential decreases as y increases.

22-48



line charge densities $\lambda = \pm 0.56 \, nC/m$ (10^{-9})

Potential difference?

outer radius $R_O = (1.6/2) \times 10^{-2} m$

inner " $R_I = (2/2) \times 10^{-3} m$

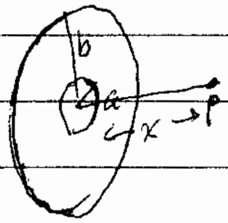
The outer cylinder produces no electric field inside the cylinder. (in the region)

The inner cylinder produces a field of magnitude $\frac{k\lambda}{x} \cdot 2$ where x is the distance of a point to the center of the inner cylinder. The potential difference is given by the integral

$$\Delta V = -\int_{R_I}^{R_O} 2\frac{k\lambda}{x} \, dx = \boxed{-2k\lambda \ln(R_O/R_I)}$$

$$= -2 \times 9 \times 10^9 \times 0.56 \times 10^{-9} = \boxed{10.1 \, V}$$

23-58



disk charged uniformly, with a hole in the middle. Potential at point P?

according to problem 22-7, the potential for a full disk of radius R is

$$V_B = k\sigma \cdot 2\pi \left[\sqrt{x^2+R^2} - x \right]$$

use for R the value b, and subtract the potential due to a disk of the size of the hole

$$V_A = k\sigma \cdot 2\pi \left[\sqrt{x^2+a^2} - x \right]$$

Total, due to disk with hole is

$$V_B - V_A = k\sigma \cdot 2\pi \left\{ \left(\sqrt{x^2+b^2} - x \right) - \left(\sqrt{x^2+a^2} - x \right) \right\}$$

$$\boxed{= k\sigma \cdot 2\pi \left\{ \sqrt{x^2+b^2} - \sqrt{x^2+a^2} \right\}}$$