

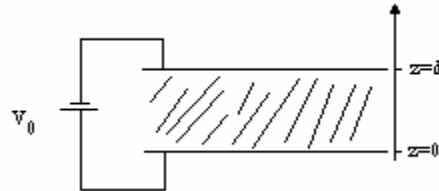
1) In space there is a solid charge of  $\rho_v = \begin{cases} \rho_0 \frac{z}{d} \text{ for } |z| \leq d \\ 0 \text{ for } |z| \geq d \end{cases}$ , calculate electrical field and potential for any point of space .

2) There are three sphere shell conductor with same centered in space of radiuses  $a, 2a, 3a$  .  $r \leq a$  space contains a solid charge of  $\rho_v = \rho_0 \frac{r}{a}$  and  $2a \leq r \leq 3a$  region has solid charge  $\rho_v = \frac{3\rho_0}{7b}$  and other places are  $\rho_v = 0$  , calculate:

- a)  $\vec{D}$  in all points.
- b) amount of charge on the every sphere shell.
- c) the potential between two surface  $r = 2a, r = 3a$  .
- d) potential of centre of spheres.

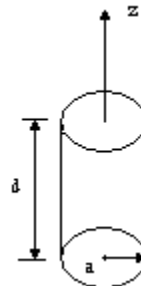
3) Distance of two parallel conductive sheet of distance  $d$  from themselves is filled with linear non homogenous dielectric with  $\epsilon = \epsilon_0 (1 + \epsilon_r \frac{z}{d})$  , calculate:

- a)  $\vec{E}, \vec{D}, \vec{P}$  and  $V(z)$  in between two sheet.
- b) Density of solid and surface free and banded charge.



4) A cylindrical dielectric is polarized as  $P = P_0 \hat{a}_z$  and placed in space. Show that electrical potential produced by this cylinder at a point on z-axis is equal:

$$V(z) = \frac{P_0}{2\epsilon_0} \left( \sqrt{a^2 + (z - \frac{d}{2})^2} - (z - \frac{d}{2}) - \sqrt{a^2 + (z + \frac{d}{2})^2} + (z + \frac{d}{2}) \right)$$



5) Two conductive surface of area  $A$  and distance  $d$  provide a capacitor. Dielectric of the capacitor has a variable dielectric factor that varies from one plat to other plat linearly from  $\epsilon_1$  to  $\epsilon_2$ .

a) show that  $c = A(\epsilon_2 - \epsilon_1)d \ln\left(\frac{\epsilon_2}{\epsilon_1}\right)$ .

b) Find the density of banded solid charge in dielectric.

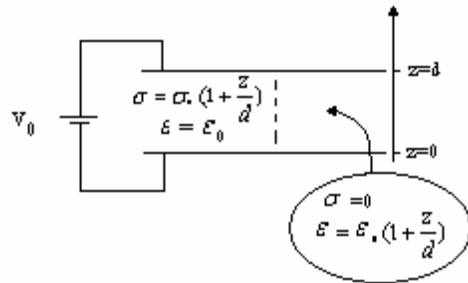
6) Distance of two conductive surface of area  $A$  is filled with two environments as equal ( as shown in fig.). And a battery of  $V_0$  voltage is connected between them.

Calculate:

a)  $\vec{J}, \vec{E}$  in two environments.

b) Solid density of free and banded charge in two environments.

c) Resistance between two surface.



7) A direct current is flowed in a non homogenous ( $\sigma, \epsilon$  are variable). Show that there is a solid charge in the environment as:

$$\rho = -\frac{1}{\sigma} [\sigma \vec{\nabla} \epsilon - \epsilon \vec{\nabla} \sigma] \cdot \vec{\nabla} V$$

$$\vec{E} = -\vec{\nabla} V$$