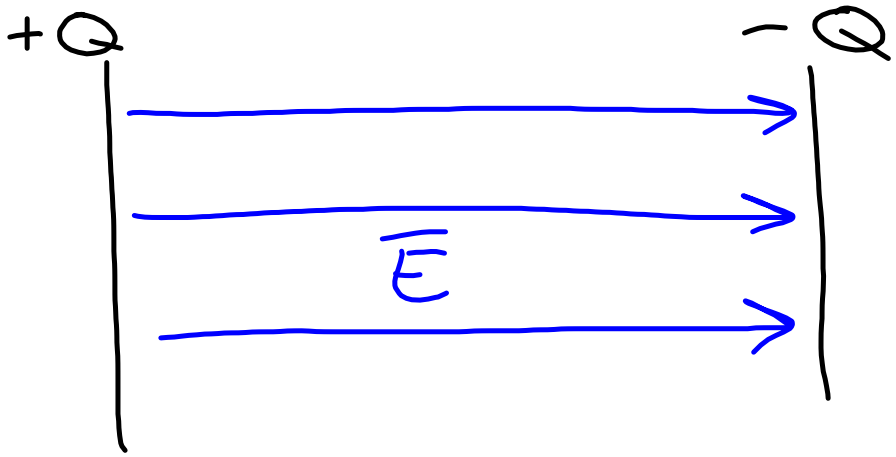
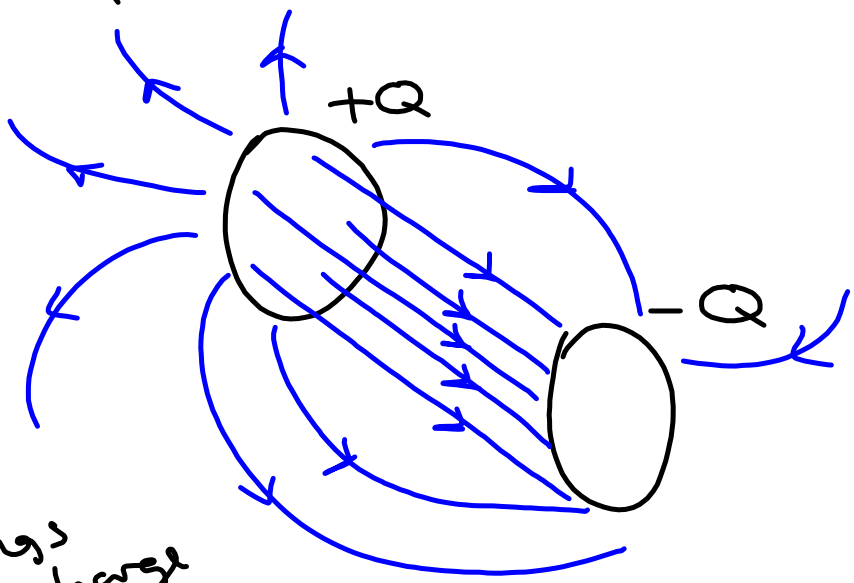
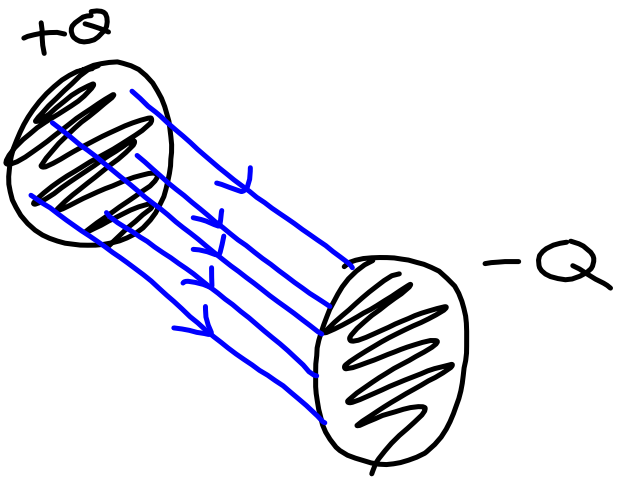
ELETRIC FIELDS





Rings of charge



Disks of charge

Uniformly Charged Disk

Origin: center of ring

Location of piece: Given by radius r

Integration variable: r

$$\bar{r} = \langle 0, 0, z \rangle$$

$$|\bar{r}| = z$$

$$\hat{r} = \frac{\bar{r}}{|\bar{r}|}$$

$$= \frac{\langle 0, 0, z \rangle}{z} = \left\langle \frac{0}{z}, \frac{0}{z}, \frac{z}{z} \right\rangle$$

$$= \langle 0, 0, 1 \rangle$$

$$\Delta q = Q \frac{(\text{area of ring})}{(\text{area of disk})}$$

$$= \frac{Q\, 2\pi r\, \Delta r}{\pi R^2}$$

$$\Delta \bar{E} = \frac{1}{4\pi\varepsilon_0} \frac{\left(\frac{Q\, 2\pi r \Delta r}{\pi R^2} \right) z}{(r^2 + z^2)^{3/2}} \langle 0, 0, 1 \rangle$$

$$\Delta E_z = \frac{1}{2\varepsilon_0}\left(\frac{Q}{\pi R^2}\right)\frac{z}{(r^2+z^2)^{3/2}}\; r\,\Delta r$$

$$dE_z = \frac{1}{2\varepsilon_0}\left(\frac{Q}{\pi R^2}\right)\frac{z}{(r^2+z^2)^{3/2}}\; r\,dr$$

$$E_z = \frac{1}{2\varepsilon_0}\left(\frac{Q}{\pi R^2}\right) z \int_0^R \frac{r\,dr}{(r^2+z^2)^{3/2}}$$

$$E_z = \frac{1}{2\varepsilon_0}\left(\frac{Q}{\pi R^2}\right)\left[1 - \frac{z}{(R^2+z^2)^{1/2}}\right]$$

Area of Disk: $A = \pi R^2$

$$E_z = \frac{(Q/A)}{2\varepsilon_0}\left[1 - \frac{z}{(R^2+z^2)^{1/2}}\right]$$

CAPACITOR: Two parallel plates (disks) close to each other.

FIELD BETWEEN PLATES:

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

Tonight

Read 15.6 – 15.8

Problems: P37, P41, P45

$$\Delta \vec{E} = \frac{1}{4\pi\varepsilon_0} \frac{(\Delta q)z}{(r^2+z^2)^{3/2}} \langle 0, 0, 1 \rangle$$

$$\frac{z}{(r^2+z^2)^{3/2}}$$