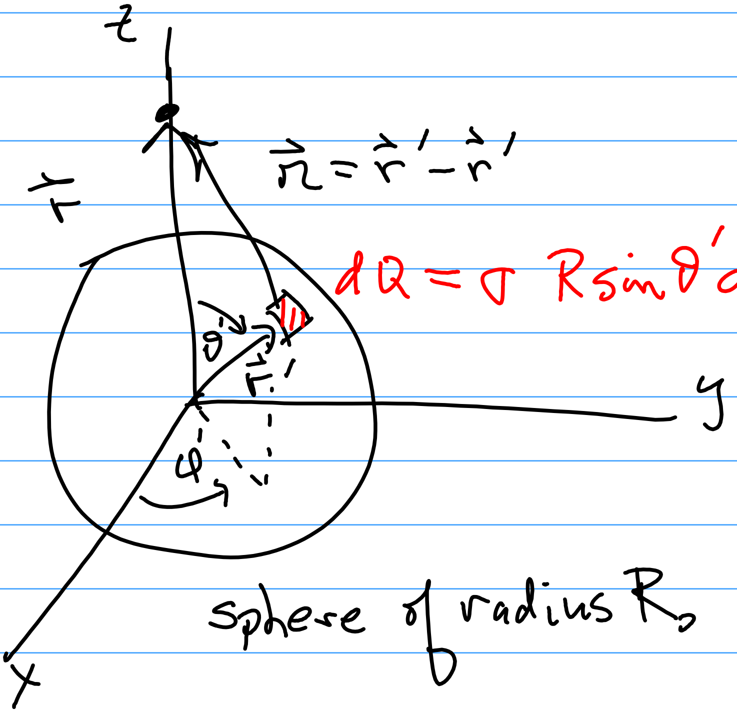
Shadowitz

Monday Jan 13: Sec 1-2, part of 1-5, 2-3

Ink Survey Feedback



$\vec{\mathscr{r}} = \vec r' - \vec r'$

$dQ = \sigma R\sin\theta' d\varphi' R d\theta'$

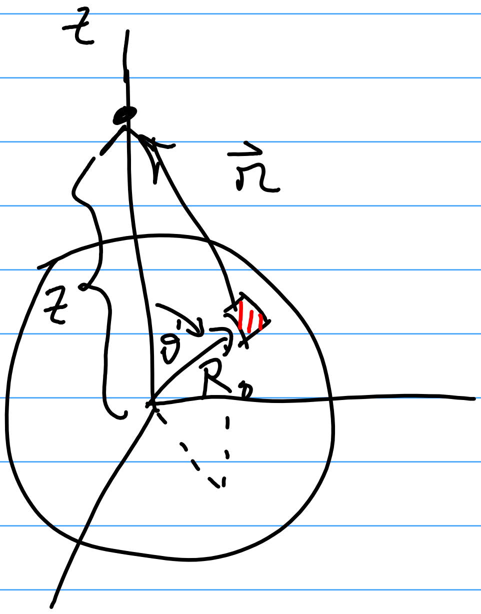
$$\vec r' = z\hat z \qquad \vec r' = R_0\hat r = R_0(\sin\theta'\cos\varphi'\hat x + \sin\theta'\sin\varphi'\hat y + \cos\theta'\hat z)$$

$$\vec{\mathscr{r}} = \vec r - \vec r' = -R_0\sin\theta'\cos\varphi'\hat x - R_0\sin\theta'\sin\varphi'\hat y - (R_0\cos\theta' - z)\hat z$$

$$|\vec{\mathscr{r}}| = \sqrt{R_0^2\sin^2\theta'\underbrace{(\cos^2\varphi' + \sin^2\varphi')}_{1} + z^2 - 2zR_0\cos\theta' + R_0^2\cos^2\theta'}$$

$$|\vec{\mathscr{r}}| = \sqrt{R_0^2 + z^2 - 2zR_0\cos\theta'}$$

Law of cosines



InkSurvey response comments

$$\vec{E} = \int d\vec{E} = \int \frac{k\,dQ}{r^2}\hat{r} = \int_0^{2\pi}\int_0^{\pi} \frac{k\sigma R\sin\theta'\,d\varphi'\,R\,d\theta'}{r^2}\hat{r}$$

→ $\sigma(\theta', \varphi')$?

→ 1/2 spherical shell

→ volume charge density

→ $\vec{E}$ from dQ on bottom go thru charge on top hemisphere?

→ simpler way to get $\hat{r} = \_\_\,\hat{x} + \_\_\,\hat{y} + \_\_\,\hat{z}$ without all the trig?

http://en.wikipedia.org/wiki/Del_in_cylindrical_and_spherical_coordinates

$$\hat{x} = \sin\theta\cos\varphi\,\hat{r} + \cos\theta\cos\varphi\,\hat{\theta} - \sin\varphi\,\hat{\varphi}$$

$$\hat{y} = \sin\theta\sin\varphi\,\hat{r} + \cos\theta\sin\varphi\,\hat{\theta} + \cos\varphi\,\hat{\varphi}$$

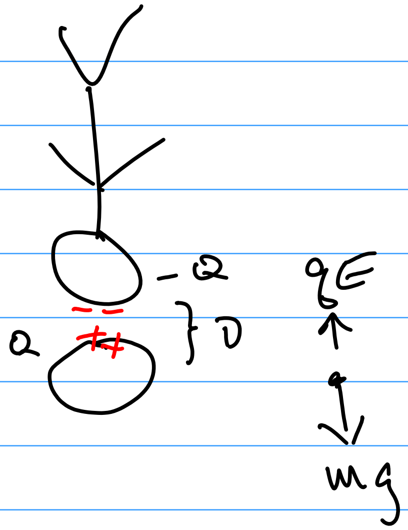
$$\hat{z} = \cos\theta\,\hat{r} - \sin\theta\,\hat{\theta}$$

$$\hat{r} = \hat{r}\cdot\hat{x}\,\hat{x} + \hat{r}\cdot\hat{y}\,\hat{y} + \hat{r}\cdot\hat{z}\,\hat{z}$$

If you don't understand these InkSurvey answers ask me.

Ballon charge

$$mg = \frac{kQ^2}{D^2}$$



$$10^{-2}\,10 = \frac{10^{10}\,Q^2}{10^{-4}}$$

$$10^{-5}\,10^{-10} = Q^2 \qquad Q \simeq 10^{-7} \to 10^{-8}$$

$q \sim 1.6 \times 10^{-19}$ $\qquad$ # electrons $= \frac{Q}{q} \simeq 10^{12}$ elect

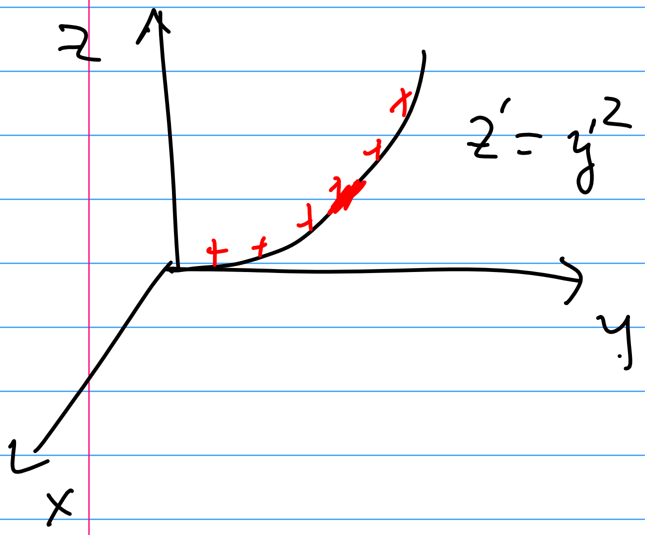
How are electrons removed?

Like friction the stripping process is not very well understood (no accurate model)

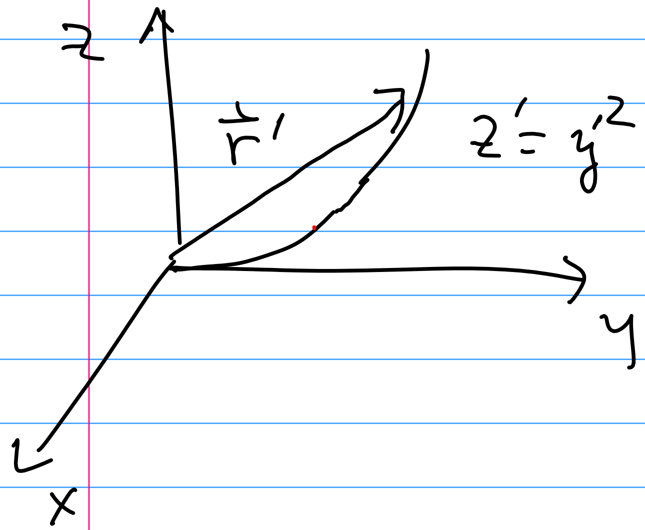
Types of questions you choose to answer → personality

$\vec{F} = q\vec{E}$ $\vec{E} = \int k \frac{dQ}{r^2}\hat{r}$

Questions?



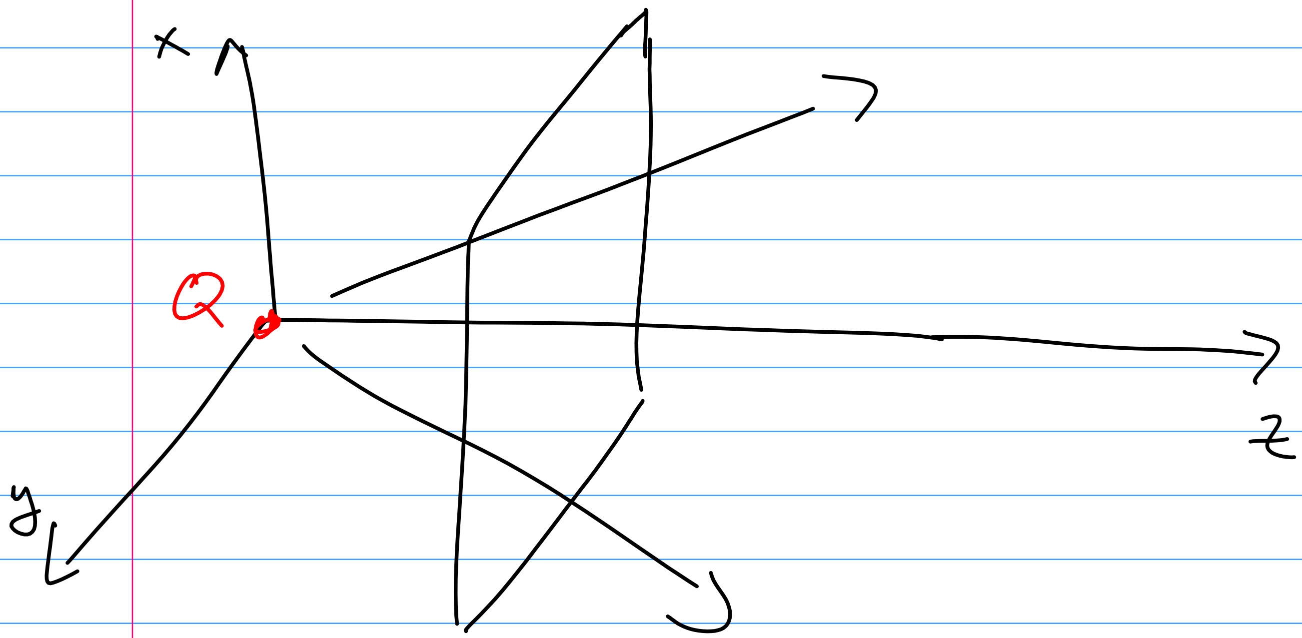
$dQ =$

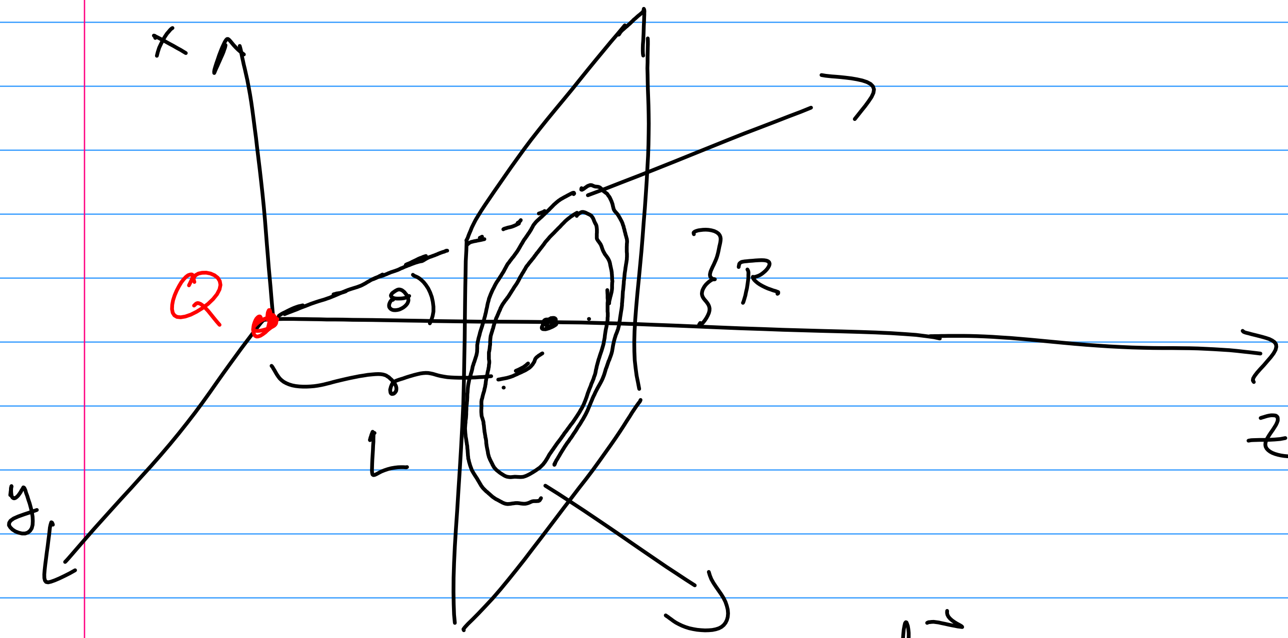


Flux : $\Phi \equiv \int \vec{E} \cdot d\vec{a}$

Questions :

http://en.wikipedia.org/wiki/Flux





$$d\vec{a} = \underline{\hspace{3cm}}\ \hat{z}$$

$$\int \frac{kQ}{\mathscr{r}^2}\,\hat{\mathscr{r}} \cdot d\vec{a} \qquad \vec{\mathscr{r}} = \underset{\shortparallel}{\vec{r}} - \vec{r}\,'$$

$$|\vec{\mathscr{r}}| =$$

$$\hat{\mathscr{r}} = \hat{r} = \sin\theta\cos\varphi\,\hat{x} + \sin\theta\sin\varphi\,\hat{y} + \cos\theta\,\hat{z}$$

$$\hat{\mathscr{r}} \cdot d\vec{a} = \hat{r} \cdot da\,\hat{z} = \hat{r} \cdot \hat{z}\,da = \cos\theta\,da$$

$$\Phi_E = \int_0^{?} \underbrace{\frac{k\,\overbrace{2\pi R}^{\int_0^{2\pi} R\,d\varphi}\,dR}{(R^2+L^2)}}_{|\vec{E}||d\vec{a}|} \overbrace{\frac{L}{\sqrt{R^2+L^2}}}^{\cos\theta}$$

OFFICE HOURS CHANGE

FROM 11-12 MWF

TO 12-1 MWF

$\frac{1}{2}$ EXAM MONDAY JAN 20

(30 minutes)

- Setting up $\vec{E}$ from a continuous charge distribution: dQ, $\vec{r}$, limits
- Area & volume of cylindrical & spherical geometrical objects