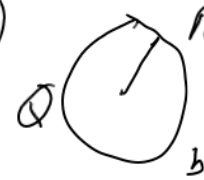
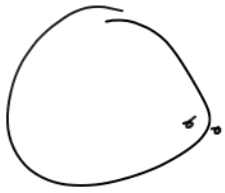
Feb 11

Get Clickers and Whiteboards

Finish VPython: Electric field of a rod

1) a)





$\oint \vec{E} \cdot d\vec{l}$

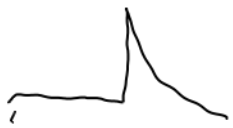
$$\Delta V = -\int_a^b \vec{E} \cdot d\vec{l}$$

$$= -\int_\infty^R \frac{Q}{4\pi\varepsilon_0} \frac{1}{r^2} dr = -\frac{Q}{4\pi\varepsilon_0} \left(-\frac{1}{r}\right)_\infty^R = \frac{Q}{4\pi\varepsilon_0} \frac{1}{R}$$

b) $\vec{E} = 0 \Rightarrow \Delta V = -\int \vec{E} \cdot d\vec{l} = 0$

$$V = \frac{Q}{4\pi\varepsilon_0} \frac{1}{R}$$

$$\Delta V = -\int_a^b \vec{E} \cdot d\vec{l}$$



Tangible: Dielectrics

torque on dipole due to field

"Ease of polarization" is the dielectric const

Materials that do not polarize easily have dielectric constant near 1

More easy to polarize, large dielectric const

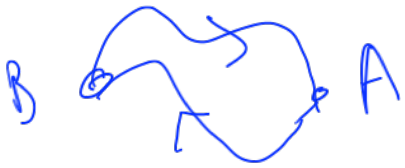
$$\vec{E}_{insulator} = \vec{E}_{applied} + \vec{E}_{dipole} < \vec{E}_{applied}$$

$$E_{insulator} = E_{applied} / K$$

K: dielectric constant

K from 1 ~ 300

Tangible: Measuring potentials using a voltmeter



$\Delta V = 0$

around closed loop

Discussion: Review of cross products

$$\vec{A} \times \vec{B} = \langle A_y B_z - A_z B_y,\ A_z B_x - A_x B_z,\ A_x B_y - A_y B_x \rangle$$

$$|\vec{A} \times \vec{B}| = |\vec{A}|\,|\vec{B}| \sin\theta$$

θ = angle between

RHR, fingers in direction of $\vec{A}$, curl to $\vec{B}$

thumb in direction of $\vec{A} \times \vec{B}$

$$\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$$

VPython Demo: Moving charge

$$\vec{B} = \frac{\mu_0}{4\pi} q \frac{\vec{v} \times \hat{r}}{r^2} \qquad \vec{r} = \vec{r}_{obs} - \vec{r}_{source}$$