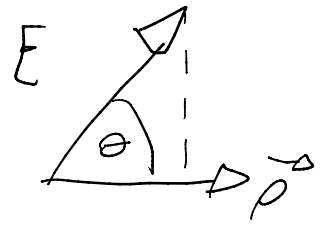
4.7

Tuesday, December 8, 2020 10:27 PM

$U = -\vec{p} \cdot \vec{E}$ $\quad \vec{p} = q \cdot \vec{d}$ $\quad \vec{E} = \frac{1}{4\pi\epsilon_0} \cdot \frac{1}{r^2} \hat{r}$

$W = F \cdot d$ $\quad d = r\theta$ $\quad \tau = Fr$

$W = \tau\theta$



$U = -q\vec{d} \cdot \vec{E}$

$U = -\vec{d} \cdot q\vec{E}$

$U = -r\theta qE$

$U = -\tau\theta$

Sign is from distortion receiving energy

4.6

Tuesday, December 8, 2020 10:51 PM

What is the τ on $\vec{p}$?

If it could rotate, where would it point?

$\tau = \vec{p} \times \vec{E}$ $\quad \vec{E} = \frac{Q}{4\pi\epsilon_0 z^2}\hat{z}$ $\quad \vec{p} = q\vec{d}$

$\tau = \vec{p} \times \frac{Q}{4\pi\epsilon_0 z^2}\hat{z}$

$\tau = \frac{qQ}{4\pi\epsilon_0 z^2}(\vec{d} \times \hat{z}) = \frac{qQ|d|}{4\pi\epsilon_0 z^2}(\hat{d} \times \hat{z}) = \boxed{\frac{qQ|d|}{4\pi\epsilon_0 z^2}\hat{\theta}}$

$Q = 0$ because grounded plate

$\boxed{\tau = 0 \quad \theta}$