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Quiz 9

Section 7 | 2a) $\rho_b = -\nabla \cdot P$ $\quad \vec{r} = \vec{r}, r$

$P, \vec{r}$

$$= -\left[\frac{1}{r^2} \cdot \frac{\partial}{\partial r}\left((P_0 \hat{r}) r^2\right)\right]$$

$$\boxed{\rho_b = -3P_0}$$

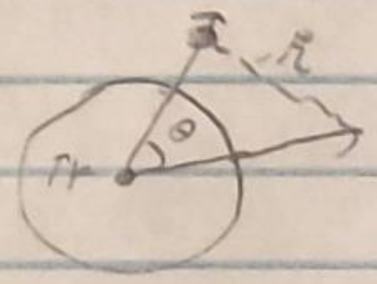
2b) $\vec{P} = P_0 P_2(\cos\theta)\hat{\theta}$

$$\nabla \cdot \vec{P} = 1/r \sin\theta \cdot \left[\partial/\partial\theta \left(\sin\theta (P_0 P_2 \cos\theta)\right)\right]$$

$$= 1/r \sin\theta \left[P_0 P_2 \cos(2\theta)\right]$$

$$\boxed{\rho_b = -\frac{P_0 P_2 \cos(2\theta)}{r \sin\theta}}$$

Section 7/9) $\sigma_b = P \cdot \hat{n}$ $\quad$ bound surface charge density



$$\sigma_b = \vec{P} \cdot \hat{r} = \boxed{P \cos\theta}$$

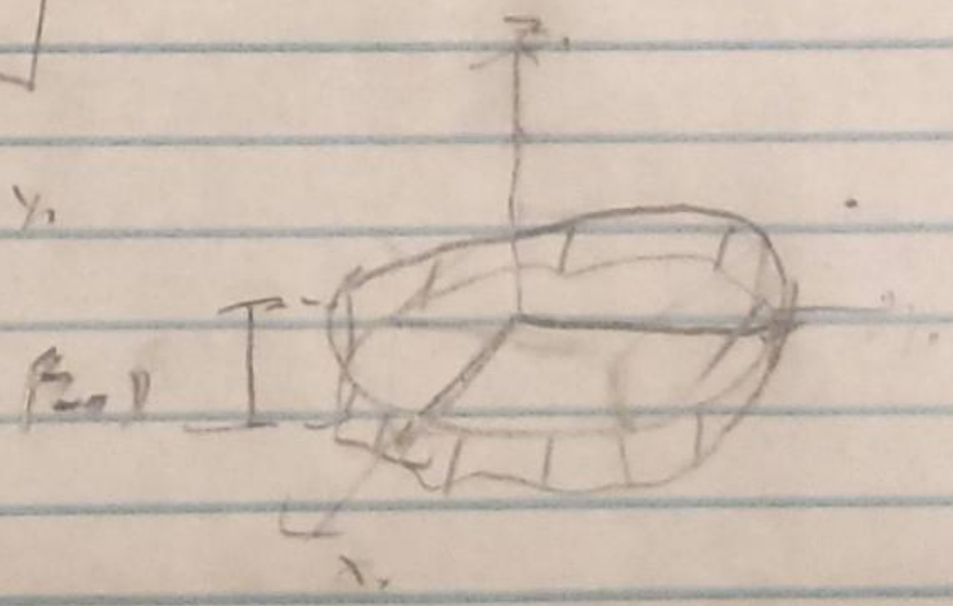
16) $\sigma_b = \frac{Q}{A_{cyl}} = \frac{Q}{X_0 Y_0}$

Z_0 = thickness

X_0, Y_0 - dimensions

P = polarization

$A_{cyl} = X_0 Y_0$



Section 7 1a)

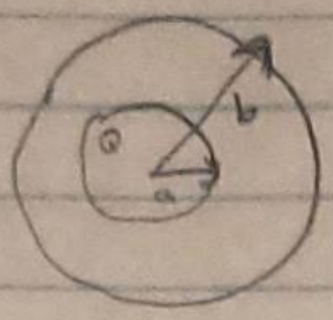
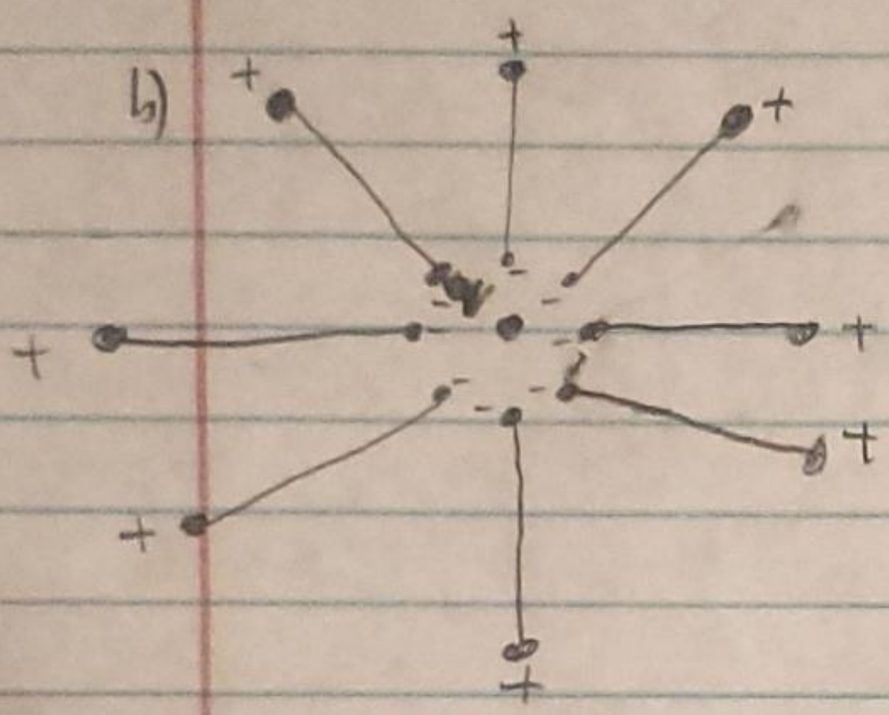


Fig. 1 : $a < r < b$

$$E = \frac{Q}{4\pi\varepsilon r^2}\hat{r} \; ; \; a < r < b$$

$$D = \frac{Q}{4\pi r^2}\hat{r} \; ; \; w/(r > a) \; ; \; thus \; D = E$$

b)



$D = \varepsilon_0 E_{vac}$, $E = D/\varepsilon = \varepsilon_{vac}/\varepsilon_r$

$$E = \frac{q}{4\pi\varepsilon r^2}\hat{r} \quad (4.36)$$

↳ Free charge q is embedded in a large dielectric, then produces $\vec{E}$