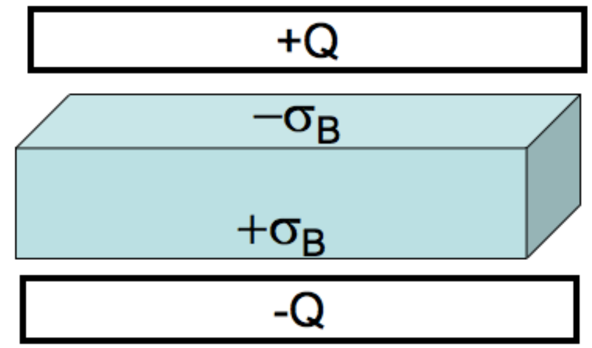
When there are no free charges, ρ_{free} = 0, in a linear dielectric material, the electric potential, V, in that material satisfies Laplace's equation?

$$\nabla^2 V = 0$$

A. True
B. False
C. ???

A very large (effectively infinite) capacitor has charge Q. A neutral (*homogeneous*) dielectric is inserted into the gap (and of course, it will polarize). We want to find $\mathbf{E}$ everywhere.



Which equation would you head to first?

A. $\mathbf{D} = \varepsilon_0 \mathbf{E} + \mathbf{P}$
B. $\oint \mathbf{D} \cdot d\mathbf{A} = Q_{free}$
C. $\oint \mathbf{E} \cdot d\mathbf{A} = \frac{Q}{\varepsilon_0}$
D. More than one of these would work
E. Can't solve unless we know the dielectric is linear.

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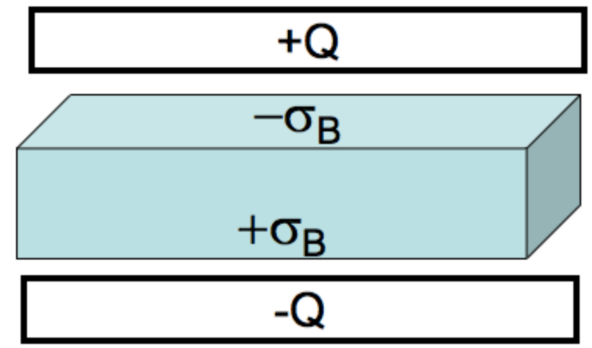

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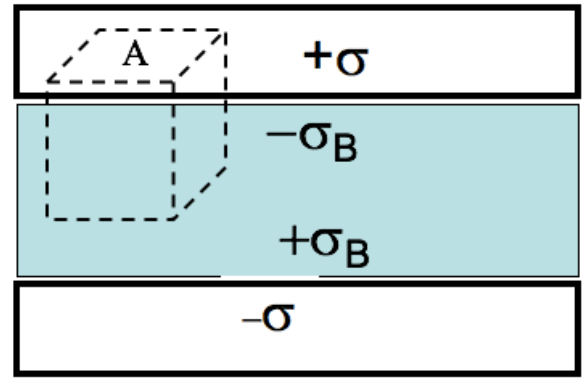
An ideal (large) capacitor has charge Q. A neutral linear dielectric is inserted into the gap. We want to find $\mathbf{D}$ in the dielectric.



$$\oint \mathbf{D} \cdot d\mathbf{A} = Q_{free}$$

For the Gaussian pillbox shown, what is $Q_{free,enclosed}$?

A. σA
B. $-\sigma_B A$
C. $(\sigma - \sigma_B)A$
D. $(\sigma + \sigma_B)A$
E. Something else

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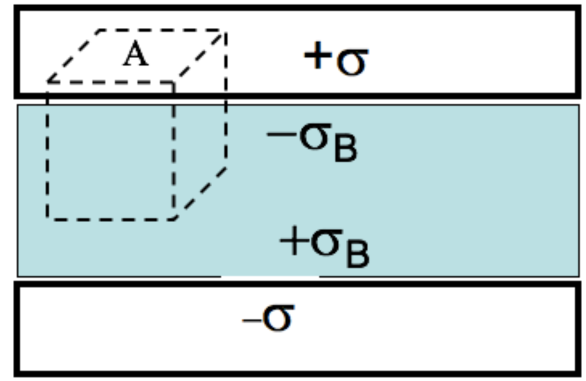

$$\oint \mathbf{D} \cdot d\mathbf{A} = Q_{free}$$

Is $\mathbf{D}$ zero INSIDE the metal? (i.e., on the top face of our cubical Gaussian surface)

A. It must be zero in there.
B. It depends.
C. It is definitely not zero in there.

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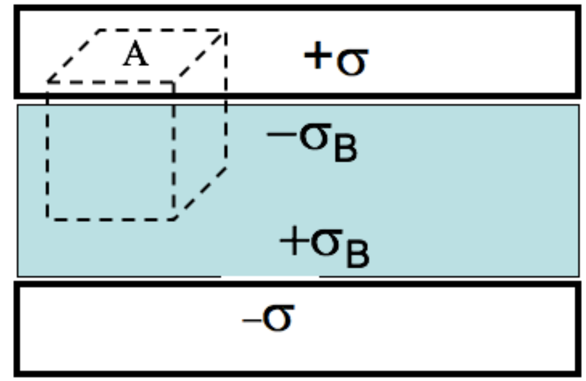
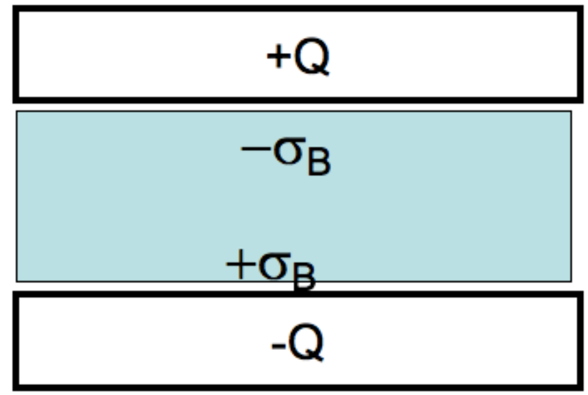


$$\oint \mathbf{D} \cdot d\mathbf{A} = Q_{free}$$

What is $|\mathbf{D}|$ in the dielectric?

A. σ
B. 2σ
C. $\sigma/2$
D. $\sigma + \sigma_b$
E. Something else

An ideal (large) capacitor has charge Q. A neutral linear dielectric is inserted into the gap. Now that we have $\mathbf{D}$ in the dielectric, what is $\mathbf{E}$ inside the dielectric?



A. $\mathbf{E} = \mathbf{D}\varepsilon_0\varepsilon_r$

B. $\mathbf{E} = \mathbf{D}/\varepsilon_0\varepsilon_r$

C. $\mathbf{E} = \mathbf{D}\varepsilon_0$

D. $\mathbf{E} = \mathbf{D}/\varepsilon_0$

E. Not so simple! Need another method