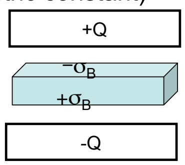
4.6 g

An ideal (large) capacitor has charge Q. A neutral *linear* dielectric is inserted into the gap (with given dielectric constant)

Where is D discontinuous?



i) near the free charges on the plates
ii) near the bound charges on the dielectric surface

A) i only
B) ii only
C) both i and ii (but nowhere else)
D) both i and ii but also other places
E) none of these/other/???

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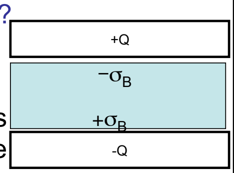

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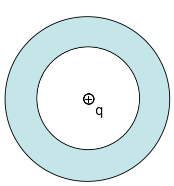
MD8-5

A point charge +q is placed at the center of a neutral, linear, dielectric shell.
Can D be computed from its divergence?

$$\oint \vec{D} \cdot d\vec{a} = Q_{free}$$



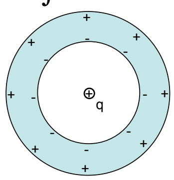
A) Yes
B) No
C) Need to know the inner and outer radius of the dielectric.

MD8-6

A point charge +q is placed at the center of a neutral, linear, dielectric shell. The shell polarizes due to the point charge.

Is the curl of the polarization **P** zero everywhere?

$$\oint \vec{P} \cdot d\vec{l} = 0 \quad \text{for every possible loop?}$$



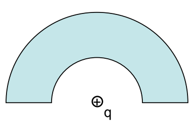
A) Yes
B) No
C) Depends on the inner radius of the dielectric.

MD8-7

A point charge +q is placed at the center of a neutral, linear, dielectric **hemispherical** shell.

Can D be computed from its divergence?

$$\oint \vec{D} \cdot d\vec{a} = Q_{free}$$



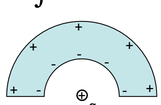
A) Yes
B) No
C) Depends on the inner radius of the dielectric.

MD8-8

A point charge +q is placed at the center of a neutral, linear, dielectric shell. The shell polarizes due to the point charge.

Is the curl of the polarization **P** zero everywhere?

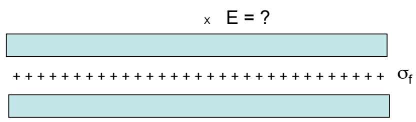
$$\oint \vec{P} \cdot d\vec{l} = 0 \quad \text{for every possible loop?}$$



A) Yes
B) No
C) Depends on the inner radius of the dielectric.

MD8-9

An infinite plane of charge with surface charge density σ_f is between two infinite slabs of neutral linear dielectric (of dielectric constant ε_r), as shown. The "bare" E-field, due only to the plane of free charge, has magnitude $E_o = \sigma_f / 2\varepsilon_0$



What is the magnitude of the E-field in the space above the top dielectric at the point x ?

A) $E = E_0$ B) $E > E_0$ C) $E < E_0$

4.10
a

You have a straight boundary between two linear dielectric materials (ε_r has one value above, another below, the boundary)

There are no free charges in the regions considered.

What MUST be continuous across the b'ndary?

i) E(parallel) ii) E(perpendicular)

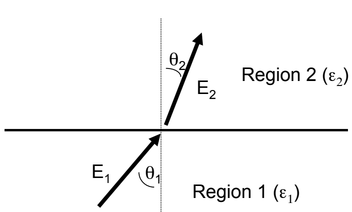
iii) D(parallel) iv) D(perpendicular)

A) i and iii B) ii and iv

C) i and ii D) iii and iv

E) Some other combination!

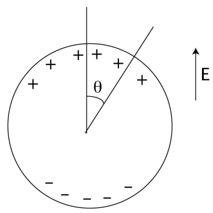
Two different dielectrics meet at a boundary.
The E field in each region near the boundary is shown.
There are no free charges in the region shown.
What can we conclude about $\tan(\theta_1)/\tan(\theta_2)$?



A) Done with I
B) Not yet…

4.2
a

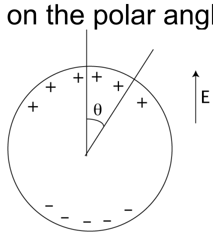
You put a conducting sphere in a uniform E-field. How do you expect the surface charge to depend on the polar angle (θ)?



a) Constant
b) cos(θ)
c) sin(θ)
d) Nothing simple, it will have to be an infinite series of sin's and cos's with coefficients.

4.2
b

Now what if the sphere is a dielectric? How do you expect the bound surface charge to depend on the polar angle (θ)?



a) Constant
b) cos(θ)
c) sin(θ)
d) Nothing simple, it will have to be an infinite series of sin's and cos's with coefficients.