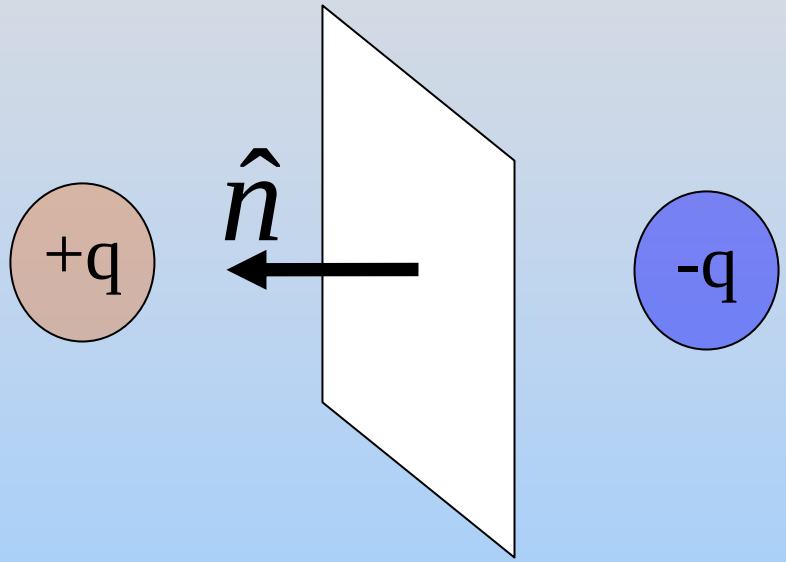
Concept Question: Flux

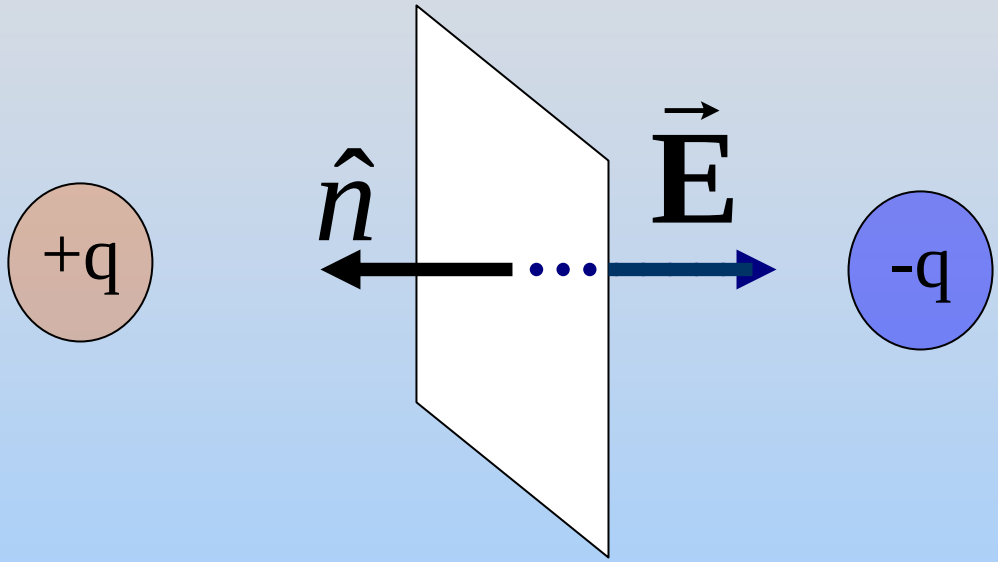
The electric flux through the planar surface below (positive unit normal to left) is:



1. positive.
2. negative.
3. zero.
4. I don't know

Concept Question Answer: Flux

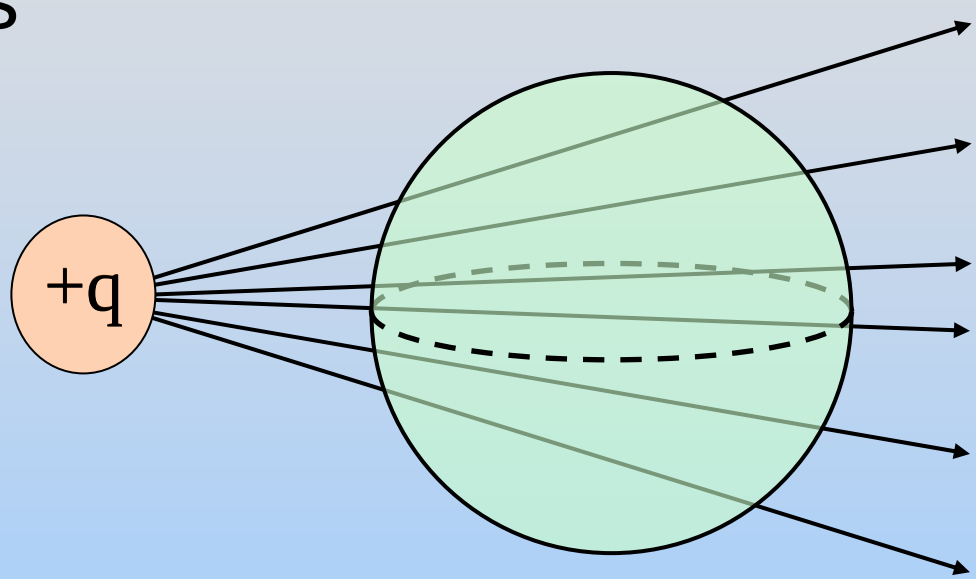
Answer: 2. The flux is negative.



The field lines go from left to right, opposite the assigned normal direction. Hence the flux is negative.

Concept Question: Flux thru Sphere

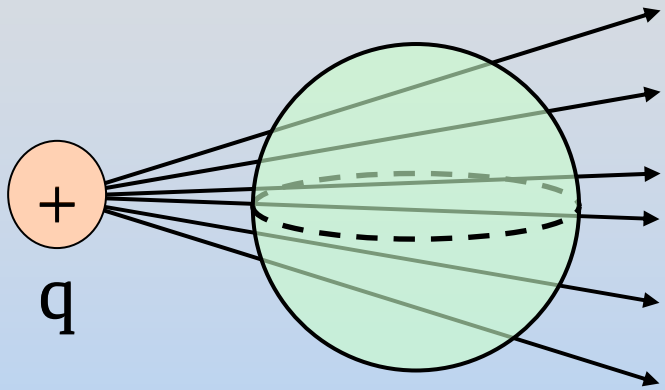
The total flux through the below spherical surface is



1. positive (net outward flux).
2. negative (net inward flux).
3. zero.
4. I don't know

Concept Question Answer: Flux thru Sphere

Answer: 3. The total flux is zero



We know this from Gauss's Law:

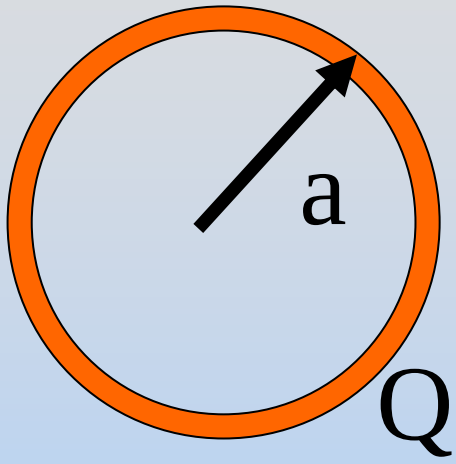
$$\Phi_E = \oiint_{\substack{\text{closed}\\ \text{surface}\quad S}} \vec{\mathbf{E}} \cdot d\vec{\mathbf{A}} = \frac{q_{in}}{\varepsilon_0}$$

No enclosed charge → no net flux.

Flux in on left cancelled by flux out on right

Concept Question: Spherical Shell

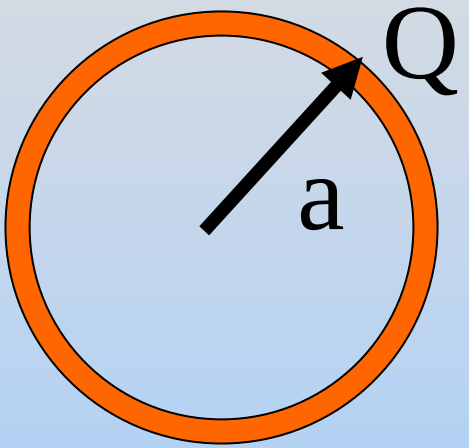
We just saw that in a solid sphere of charge the electric field grows linearly with distance. Inside the charged spherical shell at right (r<a) what does the electric field do?



1. Constant and Zero
2. Constant but Non-Zero
3. Still grows linearly
4. Some other functional form (use Gauss' Law)
5. Can't determine with Gauss Law

Concept Question Answer: Flux thru Sphere

Answer: 1. Constant and Zero



Spherical symmetry

→ Use Gauss' Law with spherical surface.

Any surface inside shell contains no charge

→ No flux

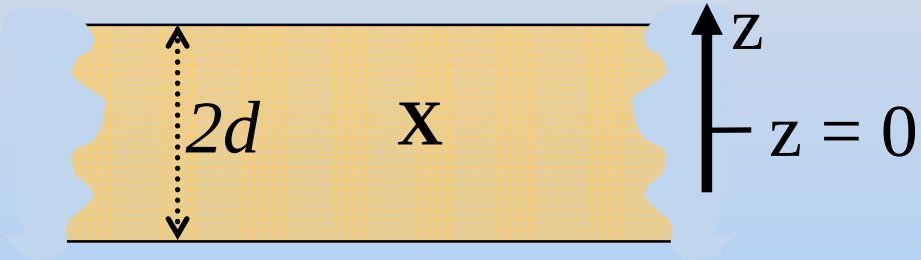
E = 0!

Concept Question: Slab of Charge

Consider positive, semi-infinite (in x & y) flat slab

z-axis is perp. to the sheet, with center at z = 0.

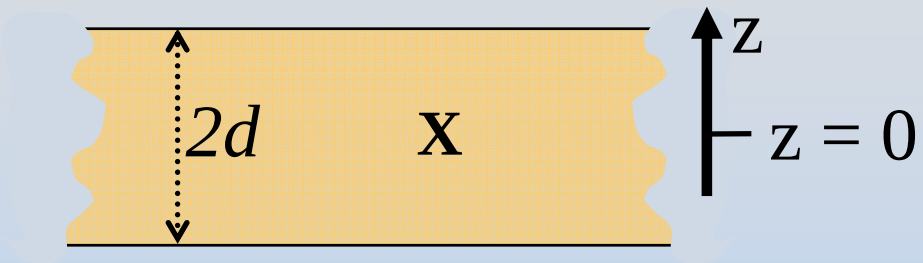
At the plane's center (z = 0), **E**



1. points in the positive z-direction.
2. points in the negative z-direction.
3. points in some other (x,y) direction.
4. is zero.
5. I don't know

Concept Question Answer: Slab of Charge

Answer: 4. **E**(z=0) is zero



- Symmetry tell us this – the amount of charge above and below the center of the plane is equal hence the fields cancel.
- **Another way of thinking about this:**
- Since you can't tell which way the field would point it must be 0.

8.02SC Physics II: Electricity and Magnetism

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