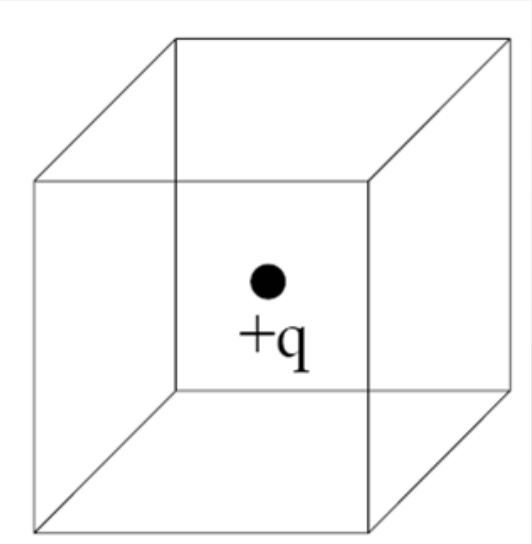
PHYS102 - Gauss's Law.

Dr. Suess

February 2, 2007

Question #1

Consider the Gaussian surface of a cube which encloses a charge of $+q$ that is located in the exact middle of the cube. What is the electric flux through one side of the cube?



1. 0.
2. q/ε_0
3. $q/6\,\varepsilon_0$
4. There is enough information, but none of the above are correct.

5. There is not enough information.

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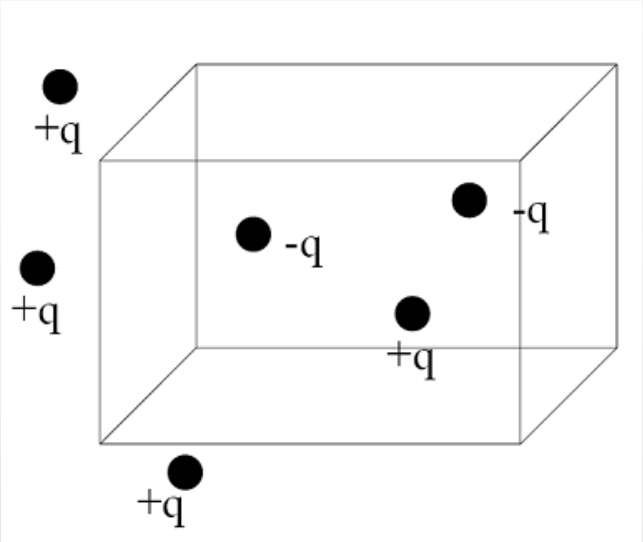
- The answer is 3.

Question #2

What is the total flux through the rectangular prism surface due to the charge configuration below?



1. 0.
2. $-q/\varepsilon_0$
3. q/ε_0
4. $2q/\varepsilon_0$
5. There is not enough symmetry to answer the question.

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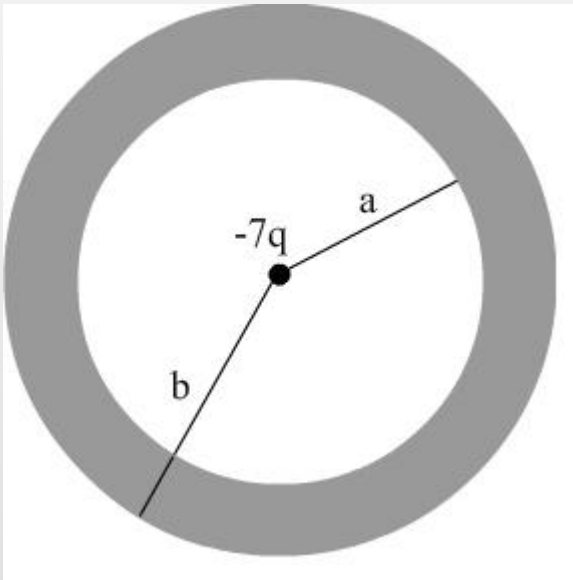
- The answer is 2.

Question #3

A net charge of $+Q$ is transferred to a spherical ***conducting*** shell of inner radius a and outer radius b. A charge $(-7q)$ is placed in the center of the shell. What is the charge on the inside of the conducting shell?



1. $-7q$.
2. $-Q$.
3. $7q$.
4. Q.
5. $Q - 7q$.
6. $Q + 7q$.
7. $7q - Q$.

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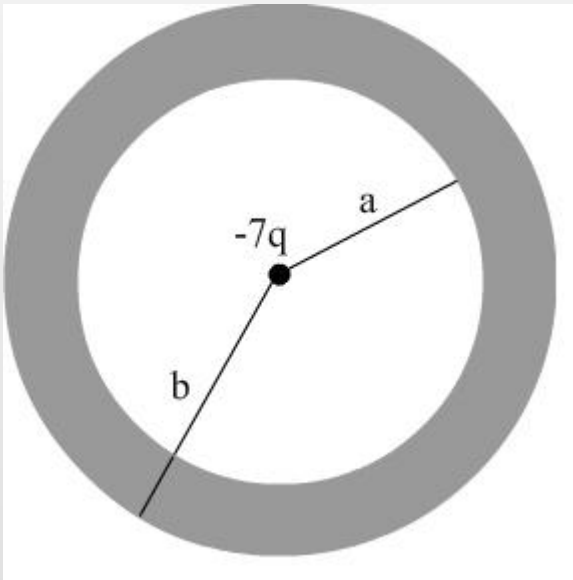
Question #4

A net charge of $+Q$ is transferred to a spherical ***conducting*** shell of inner radius a and outer radius b. A charge $(-7q)$ is placed in the center of the shell. What is the charge on the outside of the conducting shell?



1. $-7q$.
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- The answer 5.

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- The answer 5.
  NOTE: The sum of charges over the inner surface and the outer surface of the conductor must be equal to the total net charge on the conductor.

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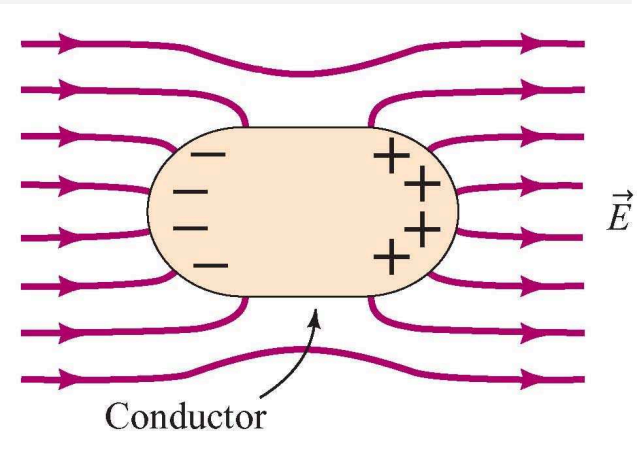
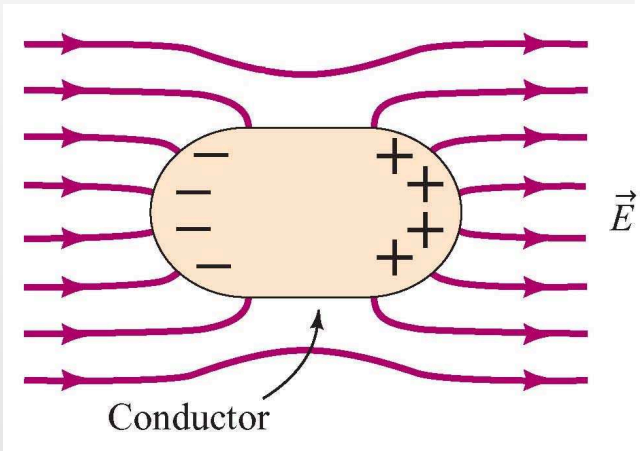
  - No net motion of charge implies that the conductor is in electrostatic equilibrium.



Conductors in Electric Fields II

- The charges within the conductor arrange in such a way as to produce no electric field within the conductor.



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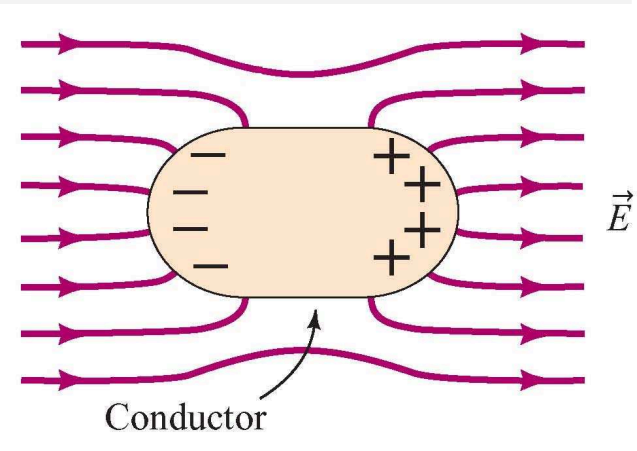

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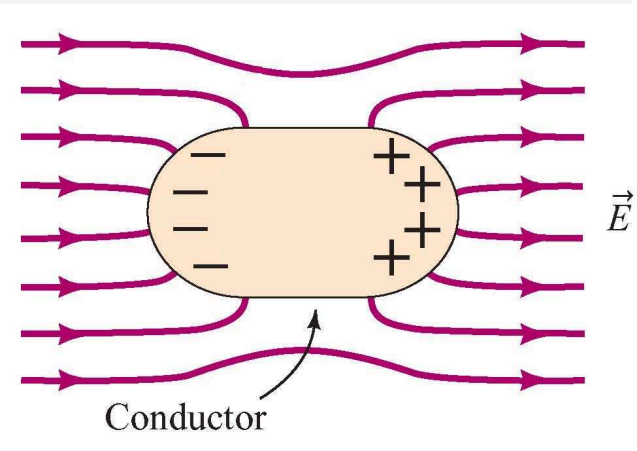
- Question: *What happens when a net charge is deposited on a neutral conductor?*



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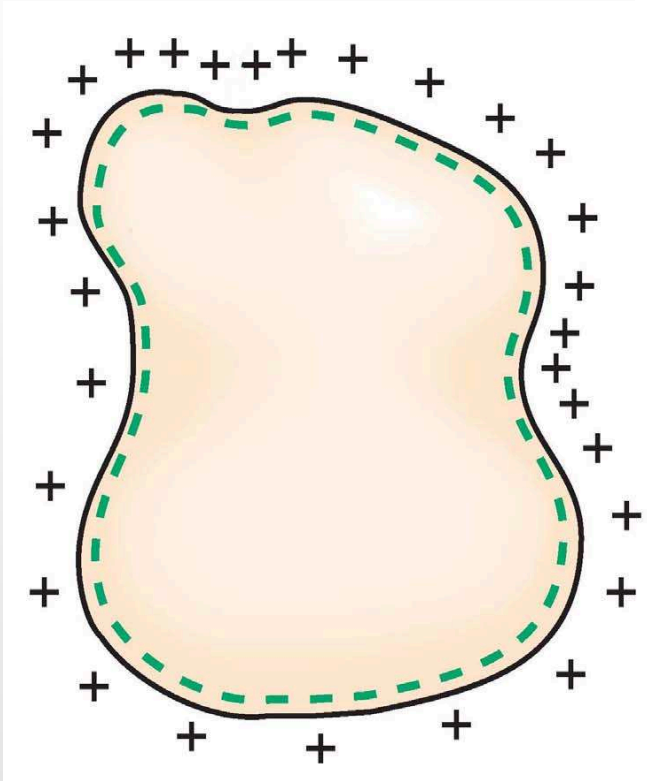
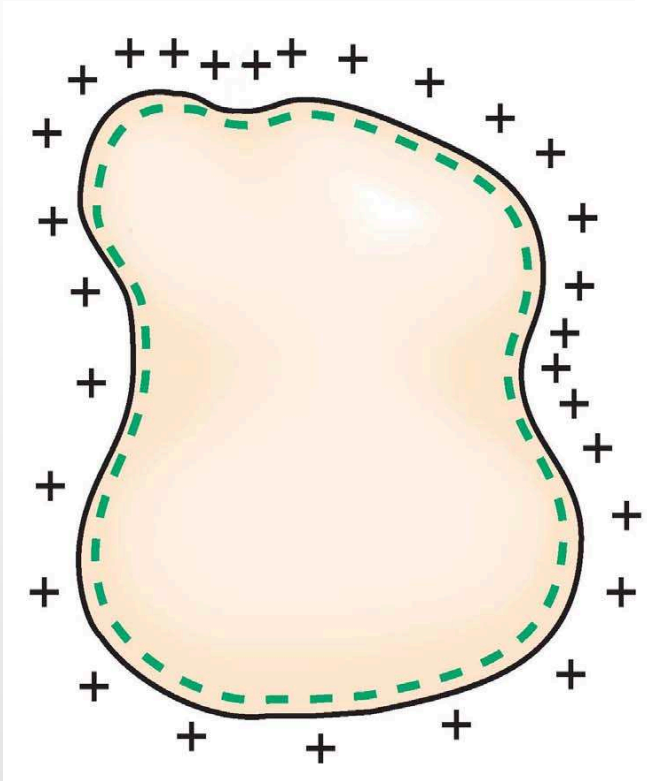
    - How far can the charges move?Answer: to the surface of the conductor.



Conductors - Summary

- Any net excess charge on a conductor will reside on its surface.
- The electric field within a conductor is zero.
- The electric field immediately outside a conductor must be perpendicular to the conductor's surface.



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  - If there exists an electric field component parallel to the conductor's surface, then the charges on the surface will experience a force.