4 Gauss' Law Calculations, Conductors and Electric Fields

4.1 Book Notes

- Whether there is a net outward or inward electric flux through a closed surface depends on the sign of the enclosed charge.
- Charges outside the surface do not give a net electric flux through the surface.
- The net electric flux is directly proportional to the net amount of charge enclosed within the surface but is otherwise independent of the size of the closed surface.
- Gauss's law states that the total electric flux through any closed surface (a surface enclosing a definite volume) is proportional to the total (net) electric charge inside the surface.
- When excess charge is placed on a solid conductor and is at rest, it resides entirely on the surface, not in the interior of the material.
- Electrostatic equilibrium means there is no net motion of tne charges inside the conductor.
  - The electric field inside the conductor must be zero.
  - If this were not the case, charges would accelerate.
- Any excess charge must reside on the outside surface of the conductor.
- The electric field just outside a charged conductor must be perpendicular to the conductor's surface.
- The magnitude of the electric field just outside a charged conductor is equal to $\frac{|\sigma|}{\epsilon_0}$, where $|\sigma|$ is the magnitude of the local surface charge density.

4.2 Lecture Notes

- The electric field inside the conductor must be zero.
  - If not, the system would accelerate.

4.3 Recitation

- We're doing some vector review.
  - $\vec{A} \cdot \vec{B} = AB\cos\theta$
    - max at $\theta = 0$
    - min at $\theta = \pi$

  - $|\vec{A} \times \vec{B} = |AB \sin\theta|$
    * max at $\theta = \frac{\pi}{2}$
    * min at $\theta = 0$

- Back to physics. $\vec{F} = q\vec{E}$
- Inside conductor, $E = 0$. Otherwise electrons would still be moving.
  - This brings us to Gauss's law.
- A good way to calculate charge would be to start at the inner most surface and work on the way out.