PHYSICS 110A DISCUSSIONS

Discussion Notes for Physics 110A

Yutong Du
University of California, Berkeley

Spring 2023

Discussion 5: Conductors

1.1 Properties of Conductors

1. $E = 0$ inside conductors.
   - If the electric field were not zero then the charges would continue moving until the electric field settled down.
   - The charge density is 0 inside conductors.
2. $\rho = 0$ inside conductors (charge density is 0 inside a conductor) redwhy is this true?
3. All net charge of a conductor exists on its surface.
   - This follows directly from the previous part – there's nowhere else for the charges to go.
4. A conductor is an equipotential
   - If the conductor were not an equipotential then $-\vec{\nabla}V = E \neq 0$, violating the first property
5. The electric field $\mathbf{E}$ is perpendicular to the surface with magnitude $E = \frac{\sigma}{\epsilon_0}$
   - From the fact that conductors are an equipotential, so the gradient must be perpendicular. The magnitude follows from calculating the electric field for a Gaussian pillbox.

1.2 Response to Charge

Conductors will respond to the presence of charge by attempting to cancel the electric field generated by the outside charge. If necessary, the conductor will exhibit polarization (when charges inside the conductor are moved around, causing a slight uneven distribution in the charge.

Example 1.1: F

nd $\sigma_a, \sigma_b, \sigma_R$ given the following diagram: