Interactive Problem Set 10, SP212 Spring 2013

Topic: 24.6 - 24.9, Electric Potential Due to Charges

IPS 10.1 (in-class) Imagine a single point charge q nailed down to the origin. Take the electric potential due to this charge at infinity to be 0. Derive an expression for the electric potential due to this charge at any point in space starting from the basic definition.

IPS 10.2 (in-class) A charge $+q$ is located at $(0, 0, d/2)$. A charge $-q$ is located at $(0, 0, -d/2)$.

- What is the electric potential at the point $(0, 0, z)$ where $z > d/2$?
- What is the electric potential at the point $(x, 0, 0)$?
- What is the electric potential at the point $(x, 0, z)$?
- How are electric potential calculations different from electric field calculations?

IPS 10.3 (homework) Let's put some numbers to the dipole problem above. Suppose $q = 0.300e$ and $d = 2.70$ Angstroms.

- What is the electric potential at $(0, 0, 4.40)$ nm?
- If I drag a proton in from infinity to this location, by how much did it's electrostatic potential energy change? What if I dragged in an electron instead?

IPS 10.4 (homework) Imagine a square with edge length a You have four charges, two are of charge $+Q$ and two are of charge $-Q$. There is a charge at each corner with each charge having a nearest neighbor of each charge.

- How are these charges arranged?
- What is the electric potential at the center of the square? Does how you arrange the charges on corners matter for this electric potential calculation? Why?
- What is the magnitude of the electric field at the center of the square? Does how you arrange the charges on corners matter for this electric field calculation? Why?

Go back and reread WPC chapters 22 and 24 on electric fields and electric potential paying special note to similiarities and differences.