PHYS 1512 Discussion Section: Week 2

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My Introduction

- My name is Connor Feltman
- Email: cfeltman@uiowa.edu
- Office is VAN 409
- Office hours are Tuesdays 2-3pm
- Tutorial Center is in VAN 310 for homework questions
- Structure of these sessions:
    1) Get into groups of no more than 2-3 people
    2) I will present a problem for you to work out with your group
    3) The TA's will walk around to see how you are doing
    4) After some time I will present another problem
    5) Last few minutes of class will be left for individual questions

The purpose of discussion

This is a time for practice. For you to make mistakes and know that it's perfectly fine to do so. This time is yours to ask conceptual questions or clear up confusion.

ASK QUESTIONS. PLEASE!

Things to bring to discussion

- Something to write on
- Something to write with
- The Textbook

Your Introduction

Take some time to familiarize yourself with the people around you:

- Introduce yourself
- Give your major/field of interest
- If you were a meme, which meme would you be?

Useful Equations

$$\vec{F} = \frac{k|q_1 q_2|}{r^2} \quad \text{(Force between point charges)} \tag{1}$$

$$\vec{E} = \frac{kq}{r^2} \quad \text{(Electric field from point source)} \tag{2}$$

$$E = \frac{\sigma}{\epsilon_o} \quad \text{(Electric field inside parallel plates)} \tag{3}$$

$$\vec{E} = \frac{\vec{F}}{q_o} \quad \text{(Force on point charge in E-Field)} \tag{4}$$

$$V = \frac{U}{q} = \frac{kq}{r} \quad \text{(Voltage: Definition and point source)} \tag{5}$$

(Recall: $W = -\Delta U = \Delta KE$)

Question #1

Cumulative Physics

An electron is released from rest at the negative plate of a parallel plate capacitor. The charge per unit area on each plate is $\sigma = 1.8 * 10^{-7} C/m^2$.
a) What is the magnitude of the force the electron experiences?
b) What is the magnitude of the acceleration the electron experiences?

$q_e = 1.602 * 10^{-19} C$
$\epsilon_o = 8.854 * 10^{-12}$

Question #2

Triangle Configuration

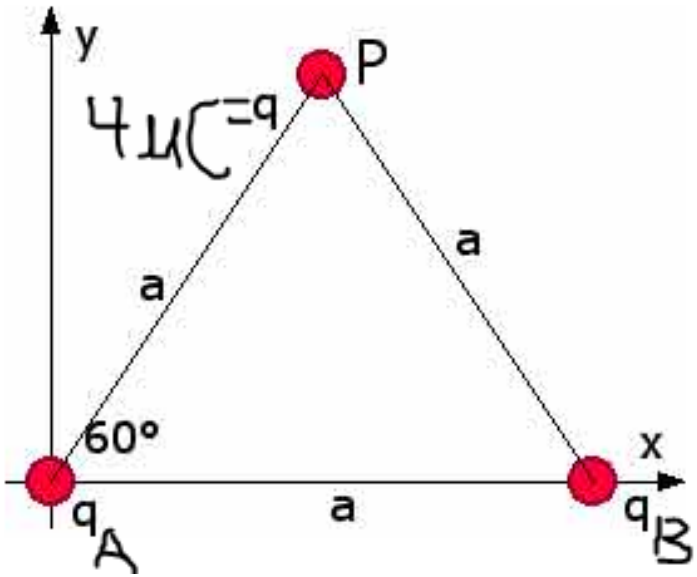
The drawing below shows an equilateral triangle with point charges on the vertices. The charge at the peak has $q_p = +4.00\mu C$ while q_A and q_B are unknown. If the net force acting on q_p is vertically downward:

a) What are the signs of charges q_A and q_B?

b) How do they compare?

c) Draw the force diagram for charge q_p. Include: F_{Ap}, F_{Bp} and F_{net}

d) What is the magnitude of F_{net} if $a = 0.5\mu m$ and $q_A = 3\mu C$?



Question #3

Gauss' Law:

$$\Phi_E = \Sigma(E cos\phi)\Delta A = \frac{Q_{enc}}{\epsilon_o}$$

Electric Flux through different Gaussian Surfaces

A surfaces completely surrounds a charge +q. Find the electric flux through this surface when the surfaces is:

a) A sphere using $\Phi_E = \Sigma(E cos\phi)\Delta A$

b) A cube using $\Phi_E = \frac{Q_{enc}}{\epsilon_o}$

c) How do your answers compare? Why are they this way?

Question #4

Potential at a point

Consider a square with side length L = 0.25m. On the two bottom vertices are fixed different positive charges q_1 and q_2. If q_1 =1.5*$10^{-9}C$ and q_2 =4.0 * $10^{-9}C$ find the electric potential energy at:

a) The top left corner

b) The top right corner

c) If one were to move $q_3 = -6.0 * 10^{-9}C$ from the top left to the top right, how much work would be done on the particle?

Question #5

Capacitor Fundamentals

A parallel plate capacitor has a capacitance C_1 with no dielectric. When filled with a dielectric with constant κ, it now has a capacitance of C_2.
a) Find an expression for κ
b) Find an expression for the amount of charge stored on C_2's plates if a known voltage V is applied. Write your expression in terms of V,κ and C_1

Figure: This is it Marty! The flux capacitor!

Question #6

Capacitors....Again!

Two capacitors have the same plate separation, but one has square plates and the other has circular plates. The square plates are a length L per side, while the circle plate has a radius L. The both have the same capacitance due to having different dielectric materials. The square plate has a dielectric constant of κ_{square}. Find an expression for $\kappa_{circular}$ in terms of κ_{square}