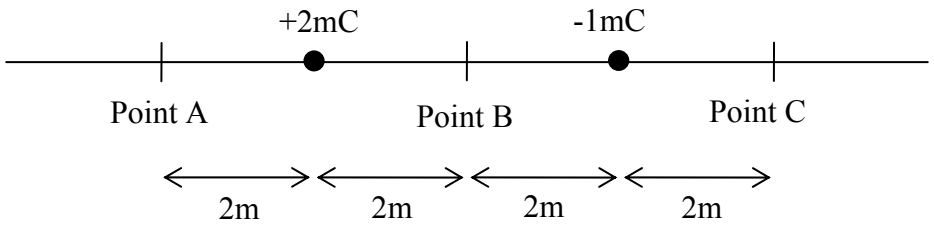
Practice Problems for Exam #1

1) Chapter 16

A) Qualitative understanding of the electric force law.



The two charges above are stuck in the locations shown. I can put a -2mC charge down at points A, B, or C.

- For which point is the force on the -2mC charge the largest and to the left?
  - B
- Is it possible to choose a non-zero charge that would feel no force when placed at point A?
  - No

B) Analyze the behavior of an electroscope.

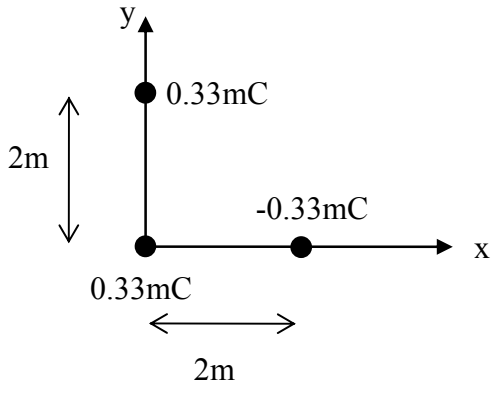
Suppose that I have an electroscope the carries a positive charge.

- Draw a sketch of it showing what the leaves do and indicating why they do that. See your class notes.
- A negatively charged rod is brought near to the top of the electroscope but no charge is transferred. Draw a picture that shows what the leaves do and that indicates why they do it. Your picture should show the top becoming more positive and the leaves becoming more negative.

C) Use Coulomb's law.

i) Find sizes of forces

ii) Break into components and add



Find the total force on the negative charge due to the positive charges. Give the total force in component form.

$3.32 \cdot 10^{-4}$N in the negative x direction plus $8.66 \cdot 10^{-5}$N in the positive y direction.

D) Relate the electric field to charge and force.

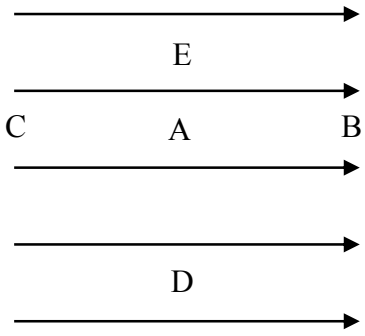
A small mass ($1.0 \cdot 10^{-6}$kg) carries a charge Q. Near the surface of the Earth, I create a strong, uniform electric field. I put the small mass into the field some distance above the floor and it just floats there; it does not rise and it does not fall. If the strength of the electric field is 10^{4}N/C and it points downward, find the size of the charge Q. Is Q positive or negative? Q = $-9.8 \cdot 10^{-10}$C

E) Relate electric field lines to point charges.

Consider the drawing in 1) A). Only the two charges shown in the drawing are to be considered. Say what direction the total electric field will be at each of the three indicated points, A, B, and C. A left, B right, C left

2) Chapter 17

A) Relate ΔPE to ΔV



The arrows in the drawing above represent a constant electric field.

- Relative to point A, which point has the highest electric potential? C
- Relative to point A, which point has the lowest electric potential? B
- Relative to point A, are there any points that have the same electric potential? E and D
- Consider a negative charge placed at point A.
  - If it moves to point B will its potential energy increase, decrease, or stay the same? Increase
  - If it moves to point D will its potential energy increase, decrease, or stay the same? Stay the same

B) Relate electric field lines to lines of equipotential.

Suppose that I have a uniform electric field of 5.0V/m that points up and to the right at 45° to the horizontal.

- Describe lines of constant electric potential. Perpendicular to the field lines – top left to bottom right
- If I move up and to the right by 3m, how does the electric potential change? It decreases by 15 Volts

C) Work-Energy problem with electric potential

I toss a charged rock straight up into the air with a speed of 20m/s. It has a mass of 0.10kg and it carries a charge of 0.020C. There is a vertical electric field throughout this region. If the rock slows to 10m/s when it has reached an altitude of 5m above its launch point and I take the electric potential to be 100Volts at the launch point, what is the electric potential at an altitude of 5m? 605 Volts

D) Use the definition of capacitance and the expression for the energy stored on a capacitor.

A capacitor carries a charge of 0.05C when the voltage drop across it is 25Volts. How much energy is stored on the capacitor when the voltage drop is 50Volts? 2.5J

There are about 8 problems represented here.
There will be about 6 problems on the exam.