At the beginning of discussion Shusaku announced that this Thursday he has an appointment at 8 AM in Milwaukee so there is a chance he will not be able to make it to discussion that day, if this is the case there will be a note on the door. Either way lab will still take place at 1:10 PM. He also requested that the problems we choose for discussion to only be from material that we have covered.

We split into our groups and first worked on the 4 conceptual problems.

Problem #1 Why should a ground wire be connected to the metal support rod for a television antenna?
- The metal rod allows the charge from a lightening bolt to be grounded. It allows any excess charge to escape into the ground, this is not harmful to the ground because our earth has an infinite charge for excess electrons to flow into.

Problem #2 A charged comb often attracts small bits of dry paper that then fly away when they touch the comb. Explain.
- The comb has a negative charge and the paper bits are neutral. The paper becomes polarized by conduction and the paper is left negative in the end, the same as it’s source of charge was (the comb). The negative charges from the comb cause the charges in the paper to line up with the positive charges being attracted to the comb and the negative charges as far away from the comb as possible. Then the excess charge from the comb goes onto the paper, leaving it negative.

Problem #3 Would life be different if the electron were positively charged and the proton were negatively charged? Does the choice of signs have any bearing on physical and chemical reactions?
- This designation of sign is arbitrary, all we know is that like charges repel and unlike charges attract. The names don’t effect how two equal and opposite charges react in physical and chemical reactions. It wouldn’t change anything.

Problem #4 A balloon negatively charged by rubbing clings to a wall. Does this mean that the wall is positively charged? Why does the balloon eventually fall?
- Before

| +      | -
| +      | -

The wall becomes polarized, but not through conduction. There is excess negative charge on the balloon at the beginning. When the balloon gets close to the wall it polarizes the wall. The balloon eventually falls because it is an insulator so the electrons can’t be transferred onto...
the wall. The electrons will most likely leave through the air, the more humid it is, the faster it will fall.

- After

| + - |
| + - |
| + - |
| + - |
| + - |

We then moved on to the three quantitative problems:
Page 409 in your text book #2
This problem you needed the mass of the moon and earth and the radius, but they are both listed in the back of your text book.

- $F = \frac{(K_e|q_1||q_2|)}{r^2}$
  $K_e = 9 \times 10^9$
  $r = 3.84 \times 10^8$

$F = \frac{(GmM)}{r^2} = \frac{((6.672 \times 10^{-11}) (6 \times 10^{24} )(7.36 \times 10^{22}))}{(3.84 \times 10^8)^2} = 2 \times 10^{20}$

$2 \times 10^{20} = \frac{(9 \times 10^9)(q_2)}{(3.84 \times 10^8)^2}$  \[ q = 5.71 \times 10^{13} \]

**Note** Shusaku pointed out that an easier way to solve this problem would be to set $F = \frac{(K_e|q_1||q_2|)}{r^2}$ equal to $F = \frac{(GmM)}{r^2}$ then solve for $q$ using $q = \sqrt{\frac{(GmM)}{K_e}}$

Page 409 # 11
- $F = \frac{(K_e|q_1||q_2|)}{r^2}$
  - $K_e = 9 \text{ Nm}^2/\text{nc}$
  - $F(6x) = \frac{((9)(5)(6))}{(.1)^2} = 3000$  \[ F(6y) = 0 \]
  - $F(-3x) = 0$  \[ F(-3y) = \frac{((9)(5)(-3))}{(.1)^2} = -13500 \]

$F_{net} = \sqrt{(3000)^2 + (-13500)^2} = 13,829.3 \text{ N}$

$\tan^{-1}(13500/3000) = 257.47^\circ = \theta$

We ran out of time for the last problem, but we will go over the answer tomorrow in discussion