HW #1 Solutions

Q6) The net charge on a conductor refers to the *difference* between the number of protons and the number of electrons. Neutral: difference =0; Positive: more protons than electrons; Negative: more electrons than protons.

The free charge refers to the electrons that are only very loosely associated with any particular atom and are able to move freely throughout the conductor. For more information about why a metal has free electrons, see p. 825 in your text.

Q10) Gravitational force is very weak for ordinary masses. Ordinary matter is electrically neutral so electrical forces cancel out. Earth creates weight. Earth has a lot of mass. Clothes taken out of a dryer stick together. During tumbling of clothes charges are transferred from one material to another.

P1) $F = \dfrac{9\times10^{9}(3.6\times10^{-6})^{2}}{0.093^{2}} = 13.5N$

P7) Force gets stronger by a factor of 3 so charges must get closer together. Force is proportional to $1/R^2$, so $\dfrac{F_2}{F_1} = \dfrac{R_1^{\,2}}{R_2^{\,2}} = 3$. Thus $\dfrac{R_1}{R_2} = \sqrt{3} \Rightarrow R_2 = \dfrac{R_1}{\sqrt{3}} = 4.88.$

P10) $F_e = \dfrac{9\times10^{9}(1.6\times10^{-19})^{2}}{(0.53\times10^{-10})^{2}} = 8.2\times10^{-8}N$

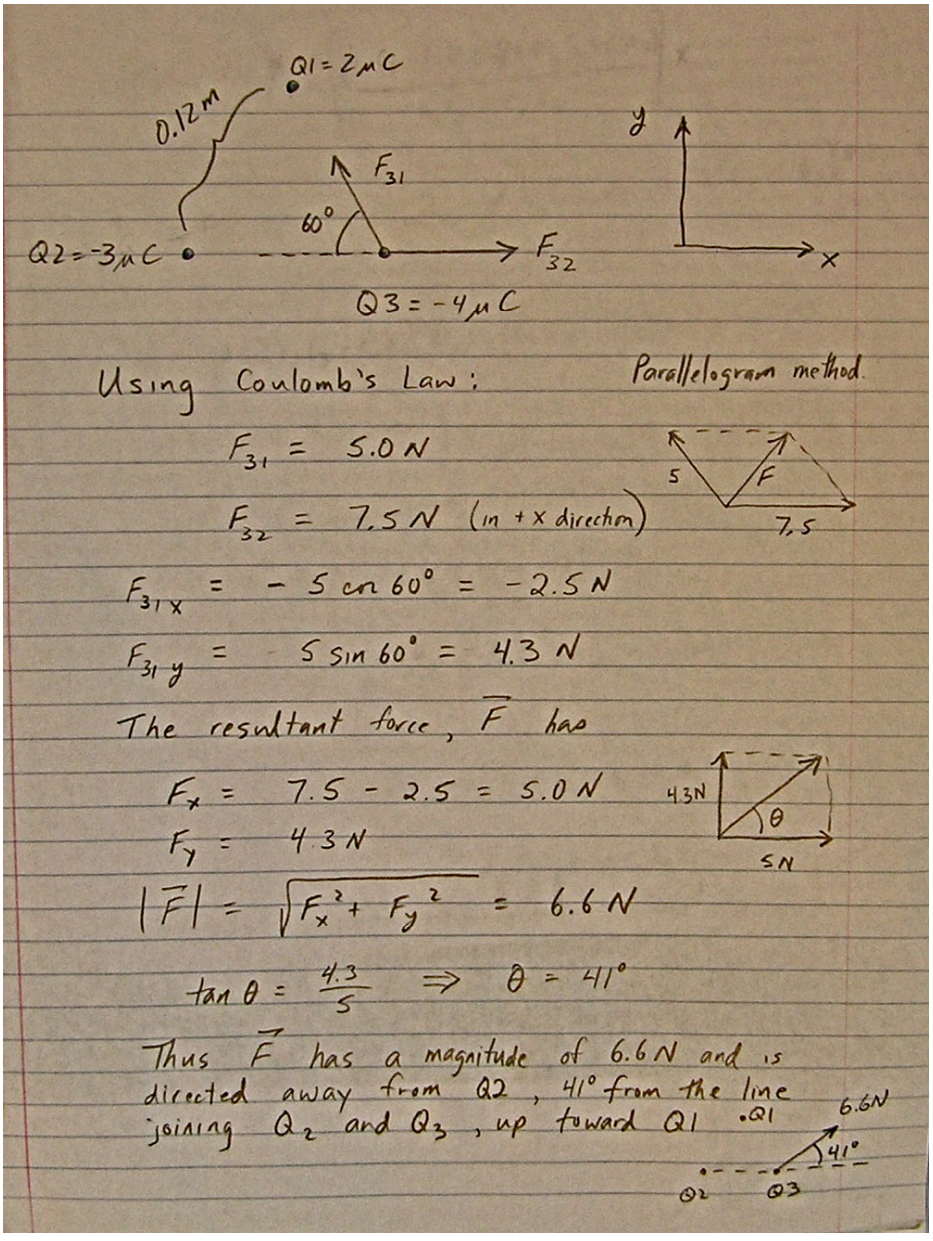
$$F_g = \frac{6.7\times10^{-11}(9.11\times10^{-31})\cdot(1.67\times10^{-27})}{(0.53\times10^{-10})^{2}} = 3.6\times10^{-47}N$$

Ratio is 2.3×10^{39}, so for the atom gravity is negligible compared to electric force.

ADDITIONAL PROBLEMS:

1) a) $3.8\times10^{-6}C$ b) $\dfrac{3.8\times10^{-6}C}{1.6\times10^{-19}C/electron} = 2.4\times10^{13}electrons$

AP2)



Depending on your choice of coordinate axes and how you set up the charges, you may get different components and a different value for the angle, but you should still get that the magnitude of $\vec{F}$ = 6.6 N and the direction relative to the 3 charges should be the same.