Homework 5

Due Friday, February 25

1) Three point charges are arranged in fixed positions on the x axis. A charge of $-10\,\mu C$ is located at the origin. A second charge of $-10\,\mu C$ is located at x=-1 meter. A third charge of $-10\,\mu C$ is located at x= 1 meter. Find all of the points x between -1 m and 1 m where a positive charge $Q = 20\,\mu C$ can be located so that it is in stable equilibrium (experiencing no net force from the other three charges - and forced back to x if nudged to either the right or the left).
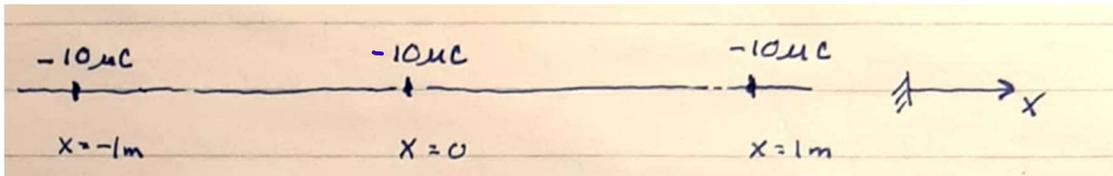

2) Three point charges are respectively located at the three vertices of an equilateral triangle with sides of length 1 meter. Two of the charges are $10\,\mu C$, and the third charge is $-10\,\mu C$. What is the magnitude of the force on one of the two $10\,\mu C$ charges by the other two?
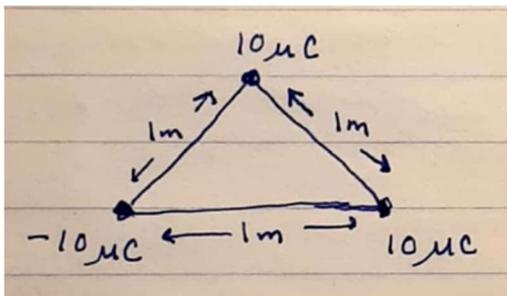
3) A neutral molecule has a dipole moment of 5 Debye (1.6E-29 Cm) pointing in the x direction. It can be modeled as two charges +e and -e located on the x axis at x=0, separated from one another by 1E-10 meters (1 angstroms). A second molecule with a 5 D dipole that is aligned in the same direction as the first is located along the x axis at x= 1 nm (1 nm = 1E-9 m). What is the force of attraction between the two molecules?
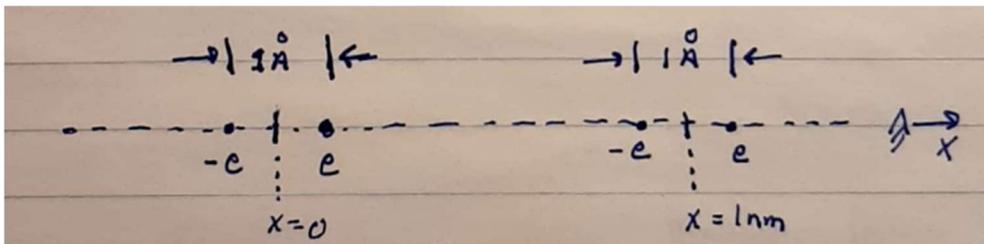
4) Just as in problem 3 above, a neutral molecule has a dipole moment of 5 Debyes (1.6E-29 Cm) pointing in the x direction. It can be modeled as two charges +e and -e separated from one another by 1E-10 meters (1 angstrom), straddling the origin along the x axis, at x=0. An electron is located <u>on the y axis</u> at y=10 angstroms. What is the force (both magnitude and direction) on the electron by the dipole?
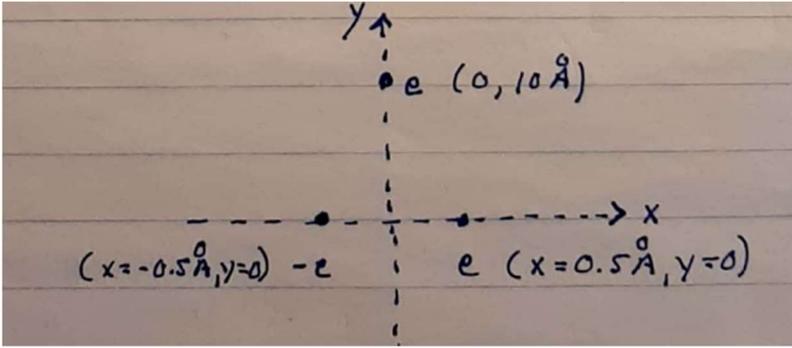
5) A uniformly charged ring lies in the xy plane. The radius of the ring is 1 m, and the total charge on the ring is 10 micro Coulombs. Suppose that a 10 micro Coulomb point charge is located on the z axis (passing through the center of the ring) and some arbitrary height z. Use the computer to make a graph showing the force on the point charge by the ring as a function of z. At what point does the force reach a maximum?