Chem 370 / ENTS 369 **DUE WEDESDAY, April 9, 2003 in class** **Spring Term 2003**
Assignment 1 – The Basics **SHOW YOUR WORK!** **Instructor: R. Rossi**

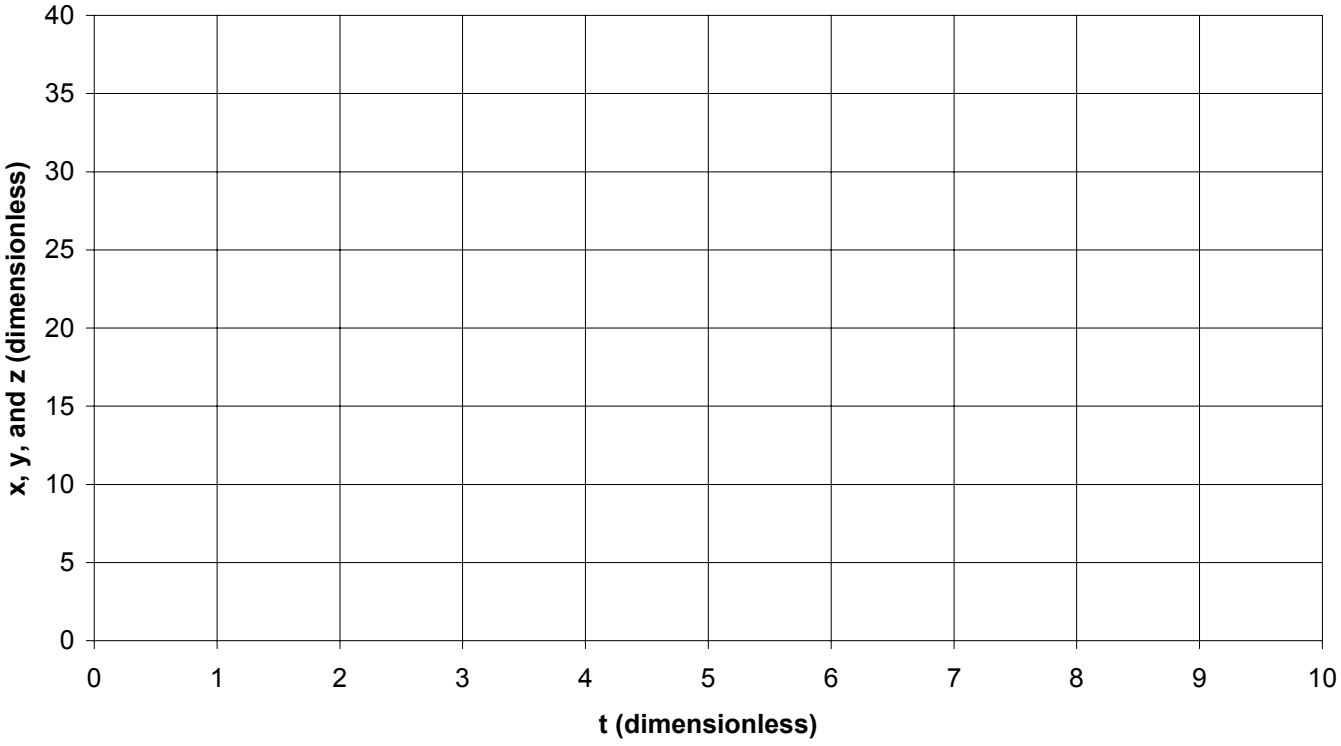
Your "official" name: _____ The name you like to go by: _____

1. **Physics** Consider a 2– point charge located a good distance from two distinct and separate 1+ point charges. All three charges are collinear, like this:

Draw a rough sketch of the electric field lines for this system by indicating with a vector which direction and with what force a *positive* point test charge would like to move if placed at various points. Do this for about 20 points, at least 10 of which are not collinear with the charges shown above. I've done two for you.
Hint: If you need help, look up "electric field" and/or "electric potential" in an introductory physics textbook, like Reese.

2. **Math** Let $\left\{ x = \begin{bmatrix} 0 \text{ for } t < 1 \\ 1 \text{ for } 1 \le t \le 7 \\ 0 \text{ for } t > 7 \end{bmatrix} \right.$ $x = \frac{dy}{dt}$ $y = \frac{dz}{dt}$ Boundary conditions: $\left(\begin{matrix} z = 0 \text{ at } t = 0 \\ y = 0 \text{ at } t = 0 \end{matrix} \right) \Bigg\}$

Sketch x, y, and z as a function of t between t = 0 and t = 10. Make your plots precise to within ±1 (vertical) unit, and draw all three on the axes below. Show your work and explain your logic on a separate paper.



Hint: Don't try to do this purely with written mathematical equations. The discontinuity in x makes that very challenging. Use your understanding of what integrals mean, and carry out semi-quantitative visual integration, and it will be MUCH easier.

3. **Chemistry** I am an electron orbiting a sodium atom, which is in the gas phase. Along comes a chlorine atom, which is also in the gas phase, and doesn't exist as Cl_2 but rather just a single Cl atom. I'm going to jump onto the Cl atom if it gets close enough, yes I will! But why? In terms of electronegativities, electron affinities, ionization potentials, Gibbs free energies, enthalpies of formation, or anything else, how can you predict *with certainty* that I will, in fact, make the jump from my home on the sodium atom onto the chlorine atom, provided I get my chance? There are several different answers to this question, and you need only provide one. But it should be quantitative; a numerical value should indicate that I will, indeed, commit to making this transition. You may use whatever books or references you like, but be sure to cite them.
   Hint: If you want to be rigorous, certain answers will require you to make some assumptions. You are free to assume what you like, provided that you explicitly state your assumptions. For example, you can assume that there is only one sodium atom and one chlorine atom in this scenario, or that there's 1 atm of each flying around. Whatever you like, but if it matters to the justification you give for the electron transfer, you should explicitly state which you are assuming to be the case!