CHEM 35

General Chemistry

EXAM #1

September 20, 2000

Name:_____

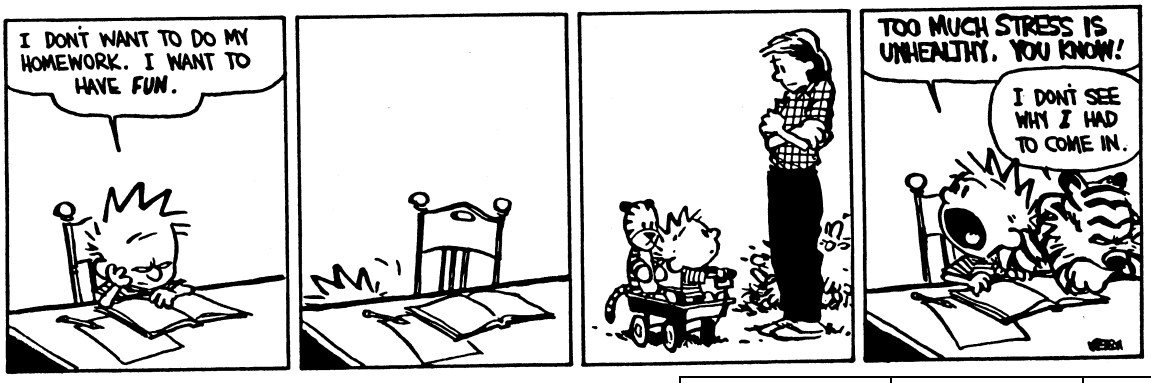
SSN:_____

Lab T.A.:_____

INSTRUCTIONS: Read through the entire exam before you begin. Answer all of the questions. For questions involving calculations, shall **all** of your work -- **HOW** you arrived at a particular answer is **MORE** important than the answer itself! Circle your final answer to numerical questions.

The entire exam is worth a total of 150 points. Attached are a periodic table and a formula sheet jam-packed with useful stuff!

Good Luck!



Page	Possible Points	*Points Earned*
2	15	
3	26	
4	26	
5	17	
6	24	
7	24	
8	18	
TOTAL:	***150***	

1. *(3 pts each)* Carry out the following operations, and express the answer with the appropriate number of significant figures:

    a. 1.24056 + 75.8 =

    b. 320.55 – (6104.5/2.3) =

    c. (0.0045 x 20,000.0) + (2813 x 12) =

2. *(3 pts each)* The all-time record lowest temperature ever recorded on this planet is –57.63 ^{o}C (recorded on July 21, 1983 in Vostok, the Russian Antarctic station).

    a. Express this temperature in ^{o}F.

    b. Express this temperature in Kelvins (K).

3. *(10 pts)* A 26.27-g sample of a solid is placed in a flask. Toluene, in which the solid is insoluble, is added to the flask so that the volume of the solid and liquid together is 50.00 mL. The solid and liquid toluene together weigh 52.65 g. The density of toluene at the temperature of the experiment is 0.864 g/mL. What is the density of the solid?

4. *(16 pts)* Fill in the gaps in the following table:

Symbol	$^{52}Cr^{3+}$		
Protons		47	33
Neutrons		60	42
Electrons		46	
Net Charge			3-

5. *(2 pts each)* From this list of elements: **Ar, H, Ga, Al, Ca, Br, Ge, K, O**; pick the one that best fits each of the following descriptions. You may use each element only ONCE.
    a. an alkali metal:_____
    b. an alkaline earth metal:_____
    c. a noble gas:_____
    d. a halogen:_____
    e. a metalloid:_____
    f. a nonmetal listed in group IA:_____
    g. a metal that forms a 3+ ion:_____
    h. a nonmetal that forms a 2- ion:_____
    i. an element that resembles aluminum:_____

6. *(1 pt each)* Give the atomic symbol for the following elements:
    a. calcium:_____
    b. sodium:_____
    c. mercury:_____
    d. lead:_____

7. *(1 pt each)* Give the name of the element for the following atomic symbols:
    a. Cu:_____
    b. K:_____
    c. H:_____
    d. Ag:_____

8. *(3 pts each)* Write a complete, balanced chemical equation for each of the following reactions:

    a. Solid calcium carbide (CaC_2) reacts with water to form an aqueous solution of calcium hydroxide and acetylene gas (C_2H_2).

    b. $HBr + F_2 \rightarrow HF + Br_2$

    c. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

9. *(8 pts)* The element magnesium consists of three naturally occurring isotopes with masses 23.98504, 24.98584, and 25.98259 amu. The relative abundances of these three isotopes are 78.70, 10.13, and 11.17 percent, respectively. From these data, calculate the average atomic mass of magnesium.

10. *(6 pts)* Show the Lewis structure for CH_3Cl.

a. *(3 pts)* What shape does VSEPR theory predict for this molecule?

b. *(3 pts)* The electronegativity values for C, H and Cl are 2.55, 2.2 and 3.16, respectively. Which bond(s) is(are) the most polar?

c. *(3 pts)* Does this molecule have a net dipole? If so, indicate the positive and negative regions, on the Lewis structure, by the symbols $\delta+$ and $\delta-$, respectively.

11. *(9 pts)* Draw the Lewis and VSEPR structures for SF_6.

12. Ibuprofen, a potent headache remedy, has a molar mass of about 206 grams and has been determined to be 75.69 % C, 8.80 % H, and 15.51 % O by mass.

    a. *(12 pts)* Determine the empirical formula for ibuprofen.

    b. *(6 pts)* Determine the molecular formula for ibuprofen.

    c. *(6 pts)* Calculate the molar molecular mass of ibuprofen to the nearest mg/mol.

13. *(9 pts each)* A tablet of Advil™ contains 200. mg of ibuprofen.

    a. How many molecules of ibuprofen are in a single Advil™ tablet?

    b. How many moles of oxygen (from the ibuprofen) are there in a single Advil™ tablet?

EXTRA CREDIT! – 10 points

We've been claiming all semester that, for atomic- and molecular-sized systems, electromagnetic forces between and with atoms are much greater than gravitational forces between atoms and sub-atomic particles. Ok, let's demonstrate that with some calculations!

Calculate:

1) The magnitude of the *coulombic attractive force* between the proton in the nucleus of a hydrogen atom and the electron whirling around it. For the purposes of this calculation, assume that the distance separating the proton and the electron is 5 Å.
2) The magnitude of the *gravitational attractive force* between the same two particles in a hydrogen atom.

Based on your calculations, is our assumption justified?