Chem 101 Test #1 guidelines: review session: Thursday, Jan. 29, 2009 2-3 pm at PS 607.
ALSO: PLEASE BE PREPARED TO TAKE YOUR ASSIGNED TEST SEATING AS SHOWN IN ATTENDANCE SHEETS

Test#1 is on Friday, Jan 30, 2009 (Friday). Chapters 1-3 will be covered. Be able to do problems such as those in the lecture, recitation & homework (including Chapt 3 homework that may be due on the 5th week) as well as integrated problems in the text book.   The test may include multiple choice+ fill in the blanks+ some problems. Or even essay questions (on historical experiments for instance).

You are expected to know the following very well:
Chapter 1: 1) scientific method, the difference between atoms and molecules, the meaning of chemical formulas, elements vs compounds.
2) Matter: know the physical phases, how they transform, homogeneous vs heterogeneous mixtures, physical vs chemical properties. How do you distinguish these different forms of matter?
3) Historical:Dalton's atomic theory, a historical account (as discussed) about the development of different concepts and discoveries about the atom. The laws it incorporated and predicted.
4. Density and temperature calculations and how they relate to physical state. Know archimedes principle: what is the buoyant force for a floating solid object? What is it equal to (in terms of the liquid and its density?)

Chapt 2:
1) Parts of an atom, isotopes and ionic compounds.
2) Periodic table: know first 20 elements, know the groups and their properties
3) Calculations&Measurements: . significant figures, per cent uncertainty, standard deviation, propagation of errors. Unit conversions
4) Historical: describe and discuss significance of various experiments involving radioactivity, the atom and its subatomic particles.

Chapt. 3:
1) Write chemical formulas and relate them to structural formulas and other models.
2) Know structural formulas and line structures of carbon-based compounds.
3) Name binary compounds , alkanes, cycloalkanes, alky groups, alcohols, lecture. Know the formulas.
4) Ionic compounds: name them. predict the ionic chemical formulas given the ions, know the names of the cations and anions listed in table 3-7. Know also table 3.3, 3.4.
5) Moles: be able to carry out calculations (conversions) given the chemical formula. convert from grams to moles to number of particles.
6) Know how to carry out % composition calculations. From also how to determine empirical formulas from % composition. Know how to interpret combustion analysis.
7) Know how to include waters of hydration in your molar mass calculations.
8) Know isomers

Below are some problems which you can practice on. These problems are meant to give you an idea of the level of difficulty you may expect to encounter in a graded exam. You will not necessarily have a test that looks like the one below but it is good to be prepared.

Warning: Often students see at least some questions that they've never seen before – an important part of testing whether students understand the material or just memorizing solutions.

It is important for you to take the review very seriously. The questions in the actual midterm may be very different from the ones below. Learn problem-solving strategies as opposed to memorizing specific solutions. You need to practice to the point that you can function efficiently under simulated timed graded situations as in the actual test.

For best use of this review sheet, it is suggested that you don't look at the problems until you have reviewed. Then try to solve the problems below within a time period of 8-10 minutes per problem (not including the "additional problems"). This would best simulate the testing situation. If It is taking you much more than that amount of time, you need to Also be prepared to come early for possible assigned seating during the exam.

Practice Questions:

_____ 1) Determine the formula weight for an ionic compound made up of the following isotopes: $^{96}_{42}Mo$ and $^{129}_{52}Te$. The Mo ion has 37 electrons and the Te ion has 55 electrons. (Use the A as the approx atomic mass.)

2) Name the following compounds or give the chemical formula:

a) P_4O_{10} = _____

b) $Fe(ClO_3)_2$ = _____

c) C_5H_{10} (alkane) = _____   (Draw a line structure for this alkane)

d) Potassium dichromate = _____   e) Aluminum carbonate = _____

3) In Paris, today's high was recorded to be 7°C. If the freezing point of a certain substance is 49°F, what is the state of the substance if it is in Paris?

4) Yellow orpiment is a mineral which contains sulfur and another element: X_2S_3, where X is the unknown element which you are to identify from the following information. If 1.52 millimoles (mmol) of yellow orpiment weighs 373.98 milligrams (mg), what is the element X?

5) A) Name 4 postulates of Dalton's Theory. What conservation laws did they incorporate? What law(s) did they predict?

B) What was the difference between Rutherford's Model of the Atom and that of Thomson's? Describe the experiment that supported Rutherford's hypothesis? (no key will be given for this)

6)____ A) (multiple choice) Choose the most correct phrase to complete the sentence: The element radium, $^{226}_{88}Ra^+$, has...   a) 226 neutrons and 88 protons.   b) 226 neutrons and 89 protons

   c) 138 neutrons and 87 electrons   d) an atomic number of 226   e) none of the above

B) A metal cube of volume 1.55± .05 cm is found to weigh 21.0 ± .5 g.

   a) What is the density of the metal in kg/m^3? (correct significant figures only) density = _____ kg/m^3

   b) What is the _relative_ uncertainty? ± _____ (dimensionless)

Additional Problems   (Please work these problems out and don't expect a key – they will be discussed in the review)

1) Consider pentane. and cycloalkane: a) what is its molecular formula? b) what is its % H composition? c) What is its empirical formula? d) draw the line structure for both of these molecules. e) Describe its properties. f) does it boil at a lower temperature than octane? Explain..

2) An aluminum sphere (Al, 2.70g/cm³) weighs 30.26 g. Now consider a beaker filled to the brim with alcohol. The beaker and alcohol together weigh 134.2 grams. By putting the sphere into the beaker some alcohol will spill out. What is the total weight of the beaker, alcohol and sphere together? (use: density of alcohol =0.85 g/cm³). Give your final answer in scientific notation.

3) A cube of metal which looks like gold (Au, 19.32 g/cm³) is suspected by a modern Archimedes of being either iron (Fe, 7.90 g/cm³) coated with gold or aluminum (Al, 2.72 g/cm³) coated with gold.   In air the metal cube is found to have a mass of 34.50 g. When totally immersed in a solvent of ethanol (density = 0.789 g/mL), the apparent mass of the metal cube is 24.49 g. (Recall Archimedes principle) All answers must be in correct # of significant figures.
a) What is the <u>length</u> of the metal cube (in cm) ? length = _____ cm
b) What is the metal cube made up of? (Show full calculations for credit.) _____

4) Consider the following hypothetical atoms: $^{139}_{57}X$ has 54 electrons, while atom $^{209}_{84}Y$ has 87 electrons. What is the approximate formula weight of the ionic compound made up of these atoms? _
   _____

5) a) Determine the empirical and molecular formulas for naphthalene given that its molar mass is 128 g/mole and its composition is: 93.71% carbon and 6.29 % hydrogen. _____
b) Determine the empirical and molecular formulas for vanillin given that its molar mass is 152 g/mole and its composition is: 63.15% carbon, 5.30 % hydrogen and the rest oxygen. _____