

**Chem 101 Test #1 guidelines: PLEASE READ!**

**Test#1 is on Friday , January 26, 2007.** Chapters 1-3 will be covered. Be able to do problems such as those in the lecture, lab & homework (including Chapt 3 homework that may be due on the 5th week) as well as integrated problems in the text book.

**BRING A SCANTRON (FORM NO. 882-E, the usual with length 11 inches, width 4.25 inches)**

You are expected to know the following 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.

3) Calculations&Measurements: temperature, density calculations. significant figures, propagation of errors. Unit conversions

Chapt 2: 1) Historical: Dalton's atomic theory, a historical account (as discussed) about the development of different concepts and discoveries about the atom.

2) Parts of an atom, isotopes and ionic compounds.

3) Periodic table: know first 20 elements, know the groups and their properties,

Chapt. 3: 1) Write chemical formulas and relate them to structural formulas and other models.

2) Know structural formulas and line structures of alkanes.

3) Name binary compounds , and alkanes and alcohols lecture.

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 there, determine empirical formulas from composition. Know how to interpret combustion analysis.

Below are some problems from previous Chem 101 midterms. These problems are meant to give you an idea of the level of difficulty you may expect to encounter in a graded exam. 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.

### SAMPLE MIDTERM#1:

\_\_\_\_\_ 1) Determine the formula weight for an ionic compound made up of the following isotopes:  $^{96}_{42}\text{Mo}$  and  $^{129}_{52}\text{Te}$ .

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)  $\text{P}_4\text{O}_{10}$  = \_\_\_\_\_

b)  $\text{HClO}$  (in water) = \_\_\_\_\_

c)  $\text{C}_4\text{H}_{10}$  (alkane) = \_\_\_\_\_ (Draw all possible line structures for this alkane)

d) Potassium dichromate = \_\_\_\_\_ e) Aluminum carbonate = \_\_\_\_\_

3) In Paris, today's high was recorded to be  $18^\circ\text{C}$ . If the freezing point of a certain substance is  $69^\circ\text{F}$ , what is the state of the substance if it is in Paris?

4) Yellow orpiment is a mineral which contains sulfur and another element:  $\text{X}_2\text{S}_3$ , 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 imply?

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,  $^{226}_{88}\text{Ra}^+$ ,

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  $1.55 \pm .05 \text{ cm}^3$  is found to weigh  $21.0 \pm .5 \text{ g}$ .

- a) What is the density of the metal in  $\text{kg/m}^3$ ? (correct significant figures only)      density = \_\_\_\_\_  $\text{kg/m}^3$
- b) What is the relative uncertainty?  $\pm$  \_\_\_\_\_ (dimensionless)

Additional Problems      (We will try to supply a key for the following questions on time)

1) A 156.0 mg sample of a pure but unknown alcohol is analyzed by complete combustion. The carbon dioxide and water formed were collected and were found to have the following masses: 223.5 mg  $\text{CO}_2$  and 120.7 mg  $\text{H}_2\text{O}$ . It is known that alcohols have the following general formula:  $\text{C}_x\text{H}_y\text{O}_z$  where of course, the subscripts x, y and z are unknowns in this problem.

- a) How many moles of carbon and how many mgs of carbon are there in the 156.0 mg sample?
- b) How many moles of hydrogen and how many mgs of hydrogen are there in the 156.0 mg sample?
- c) What is the empirical formula of this alcohol? \_\_\_\_\_

3) A cube of metal which looks like gold ( $\text{Au}$ ,  $19.32 \text{ g/cm}^3$ ) is suspected by a modern Archimedes of being either iron ( $\text{Fe}$ ,  $7.90 \text{ g/cm}^3$ ) coated with gold or aluminum ( $\text{Al}$ ,  $2.72 \text{ g/cm}^3$ ) 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 =  $0.789 \text{ g/mL}$ ), 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 length 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:  $^{139}_{57}\text{X}$  has 54 electrons, while atom  $^{209}_{84}\text{Y}$  has 87 electrons. What is the approximate formula weight of the ionic compound made up of these atoms? \_\_\_\_\_

6) 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. \_\_\_\_\_