Exam 1 Chem 111, Section 2 (Martin, 10:10am) Fall 1998

This test is closed book, closed notes, and closed neighbors. A periodic table and other useful information is available at the end of the test. When told to begin, read through the entire exam, and decide which questions you can answer quickly. After you have answered those questions, return to the more involved questions and answer them.

Do the following NOW

1) Place your name where indicated.

2) Place your student ID number where indicated.

3) Place a "**1**" in column "**K**" of the special codes section.

4) Fill in the bubbles corresponding to the above.

Failure to correctly enter any of the above 3 items will result in the deduction of 5 points from your exam.

Tear this page off and return with your completed answer sheet. You should take the rest of your exam home with you because

As a homework assignment, you may earn up to 10% of the points you missed on this exam (eg., if you scored a 60 on the exam, you can earn up to an extra 4 points), by doing the following:

1) Pick up an extra Op-Scan sheet when you turn in your exam.

2) Work through all of the problems at home (consultation with others is OK, but you should answer the questions yourself). Answer all of the questions. Turn in the Op-Scan sheet in class on Friday, October 2 (***no later!***).

Your revised exam will be scored and credit applied proportional to the total number of questions answered correctly. Complete the exam exactly as you did previously (except with all correct answers, of course!), including name, ID, and code.

Answers and scores for the original exam will be available by October 2, after the deadline for turning exam re-takes in. Check our home page.

---------- Tear off here and hand in the form below ----------

By signing below, I agree to abide by the University rules and regulations regarding honesty on exams. I understand that I am not to look at others' exams nor allow others to view mine. I hereby state that all answers on the answer sheet are my own.

I understand that Professor Martin considers academic honesty to be central to the goals of the University and that dishonest behavior will be dealt with very seriously.

Printed Name: _____

Signature: _____

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1a. (6 points) Which atom below contains exactly 14 protons?

(a) C (b) N (c!) Si (d) O (e) Na

2a. (6 points) The number of atoms of phosphorous in 0.20 moles of $Ca_3(PO_4)_2$ is:

(a) 6.0×10^{23} atoms (b!) 2.4×10^{23} atoms (c) 1.2×10^{23} atoms
(d) 2.0×10^{22} atoms (e) 3.6×10^{23} atoms

3a. (6 points) How many neutrons are in the nucleus of the isotope ^{14}C?

(a) 14 (b!) 8 (c) 6 (d) 12 (e) 0

4a. (6 points) Mg reacts with Cl_2 to form a salt. How many moles of Cl_2 are required to completely react with 2 moles of Mg?

(a) 0.5 (b) 1 (c!) 2 (d) 3 (e) 6

5a. (6 points) In the ionic compound, Mn_2O_3, produced in alkaline batteries, the Mn has a charge of:

(a) +6 (b) +2 (c) -6 (d!) +3 (e) -3

6a. (6 points) In the ionic compound, NiO(OH), found in "Ni-Cad" batteries, the Ni has a charge of:

(a) +6 (b) +2 (c) -6 (d!) +3 (e) -3

Ni^{3+} + (OH^{-}) + O^{2-} = balanced (0) charge

7a. (6 points) Which of the following is the proper designation for calcium hydroxide?

(a) CaO (b) CaOH (c) CaO_2 (d!) $Ca(OH)_2$ (e) KO

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8a. (8 points) The radii of a number of ions are given in the table at right. In which ionic compound below are the forces of attraction between cation and anion stronger?

Ion	Radius (pm)
Na^+	116
Li^+	90
F^-	119
Cl^-	167
Br^-	182

(a) NaCl (b) LiBr (c) NaF (d) LiCl (e!) LiF

The distances of closest approach between the ions are:

283 pm 272 pm 235 pm 257 pm 209 pm

So, LiF allows the charges to approach the closest - strongest attraction.

9a. (8 points) Balance the following equation: SO_2 (g) + HF (l) → SF_4(g) + H_2O (l)

What is the coefficient of stoichiometry for HF?

(a) 1 (b) 2 (c) 3 (d!) 4 (e) 5

SO_2 + 4 HF → SF_4 + 2 H_2O

10a. (8 points) Write the properly balanced equation describing the complete oxidation (combustion) of the sugar substitute sorbitol (formula $C_6H_{14}O_6$) to CO_2. What is the coefficient of stoichiometry for O_2?

(a) 1 (b) 6 (c) 19 (d) 12 (e!) 13

2 $C_6H_{14}O_6$ + 13 O_2 → 12 CO_2 + 14 H_2O

11a. (8 points) When you heat popcorn, it pops because it loses water explosively (goes off as a gas). Assume a kernel of corn ,weighing 0.125g, weighs only 0.106 g after popping. What percent of its mass did the kernel lose on popping?

(a) 52.5% (b) 0.848% (c!) 15.2% (d) 84.8% (e) 0.152%

(100%)(0.125 g - 0.106 g) / 0.125 g = 15.2 %

12a. (8 points) In a move which is hoped to improve the air in New England, the EPA last Thursday imposed tighter restrictions on the allowable levels of nitrogen oxides emitted in the Midwest. Nitrogen and oxygen form an extensive series of such oxides with the general formula N_xO_y. One of these contains 36.35% oxygen. What is the empirical formula of this oxide?

(a) NO (b!) N_2O (c) NO_2 (d) N_2O_3 (e) N_2O_5

Using 100 g total for our calculation, the sample then contains
(36.35 g)(mol/15.9994g) = 2.272 mol O.
(100g - 36.35g)(mol/14.0067g) = 4.544 mol N
Ratio mol N/ mol O = 2.00

13a. (8 points) A different nitrogen oxide (N_xO_y) contains 36.85% nitrogen. What is the empirical formula of this oxide?

(a) NO (b) N_2O (c) NO_2 (d!) N_2O_3 (e) N_2O_5

Using 100 g total for our calculation, the sample then contains
(36.85 g)(mol/14.0067g) = 2.631 mol N.
(100g - 36.85g)(mol/15.9994g) = 3.947 mol O
Ratio mol O/ mol N = 1.50

14a. (10 points) 0.2709 g of unknown metal reacts with oxygen to yield 0.4520 g of the metal oxide, MO_2. What is the metal, M?

(a) Cu (b!) Ti (c) Cr (d) Fe (e) Ni

Let x = molar mass of the metal M

Then, # moles M = 0.2709g / (x g/mol)

and, # moles MO_2 = 0.4520g / ((x + 2(15.9994))g/mol)

Setting # moles M = # moles MO_2 yields x = 47.85 g / mol --> Ti