CHEMISTRY 0110 Exam 1, Fall 2002
Time limit 75 minutes

DO NOT START THIS EXAM UNTIL DIRECTED

The University of Pittsburgh Honor system strongly condemns all forms of academic dishonesty. If you are convicted of receiving aid or helping others on this test, including discussion of this material with other students that have not taken the exam, you will be issued a failing grade for the test and you will be required to participate in the legal procedural process as outlined in the University Guidelines on Academic Integrity.

Instructions:

1. There are a total of 20 questions and 100 points on this Exam. Individual point amounts are stated at each of the questions.
2. Record your answers to the multiple-choice problems on the second page of this exam.
3. Refer to the periodic table and information sheet supplied with this Exam when answering the questions.
4. Write LEGIBLY and SHOW ALL YOUR STEPS in the problems. Use the back of the pages for "scratch" or initial calculations.
5. Report answers to calculations with a reasonable number of significant digits.
6. Calculators may not be shared during the exam.
7. TURN IN ALL EXAM MATERIALS (exam, scratch sheets, periodic table) when you have completed the exam. You are allowed to turn in your exam and leave early.
8. This exam is administered under the University of Pittsburgh Code of Academic Integrity. After you finish the exam, sign the statement at the bottom of this page. Your exam will not be graded unless you sign this statement.
9. All complaints concerning tabulation errors of this Exam must be submitted in writing by Oct 11th.

I have neither given nor received unauthorized help or information on this exam.

Exam score (points)

_____
Your name (printed)

_____
Your Signature

Circle your recitation section:

MA209	MA214	MP217	WA306	WP306
HA209	FA214	FA209	FP301	FP209

MULTIPLE CHOICE ANSWER SHEET: Record your answer for questions 1 through 13 by filling in the circle corresponding to your answer choice. You must record your answers here. No other marking for answers will be accepted. (4 points each)

1.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
2.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
3.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
4.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
5.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
6.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
7.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
8.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
9.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
10.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
11.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
12.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ
13.	ⓐ	ⓑ	ⓒ	ⓓ	ⓔ

MC total

MULTIPLE CHOICE: record your answers on the MC answer sheet. (4 points each)

1. A sample that cannot be separated into two or more substances by physical means is
   a) a compound.
   b) an element.
   c) either a compound or an element.
   d) a homogeneous mixture.
   e) a heterogeneous mixture.

2. All the following are characteristic properties of phosphorus. Which **ONE** is a chemical property?
   a) Red phosphorus and white phosphorus are solids with different arrangements of the atoms.
   b) The red form melts at about 600ºC, and the white form melts at 44º C.
   c) The white form is soluble in liquid carbon disulfide but is insoluble in water.
   d) When exposed to air, white phosphorus will burn spontaneously, but red phosphorus will not.
   e) The red form of phosphorus is insoluble in both water and carbon disulfide.

3. The following species, $_{34}Se^{2-}$, $_{36}Kr$, and $_{38}Sr^{2+}$, all have the same number of
   a) protons.
   b) electrons.
   c) neutrons.
   d) isotopes.
   e) nucleons.

4. There are only two naturally occurring isotopes of copper, ^{63}Cu and ^{65}Cu. The natural abundance of the ^{65}Cu must be about
   a) 15%
   b) 25%
   c) 50%
   d) 66%
   e) 85%

5. From the thermal decomposition of a pure solid, we obtained a solid and a gas, each of which is a pure substance. From this information, we can conclude with certainty that
   a) the original solid is not an element.
   b) at least one of the products is an element.
   c) both products are elements.
   d) the solid is a compound and the gas is an element.
   e) the solid is an element and the gas is a compound.

6. Choose the name-formula pair that does **NOT** match.
   a) sodium sulfite, Na_2SO_3
   b) calcium fluoride, CaF_2
   c) potassium permanganate, K_2MnO_4
   d) aluminum oxide, Al_2O_3
   e) iron(III) oxide, Fe_2O_3

7. Energy from the following chemical reaction provided the lift for the moon lander:

___ $(CH_3)_2N_2H_2$ + ___ N_2O_4 → ___ N_2 + ___ H_2O + ___CO_2

When this equation is balanced, the coefficient of nitrogen is

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

8. A sample of 124 g of white phosphorus, P_4, contains the same number of atoms as

a) 23.0 g of sodium
b) 32.0 g of oxygen (O_2)
c) 48.0 g of ozone (O_3)
d) 30.0 g of formaldehyde (CH_2O)
e) 14.0 g of nitrogen

9. Which of the following reactions is an oxidation-reduction reaction?

a) $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

b) $NH_4NO_3 \rightarrow N_2O + 2H_2O$

c) $AgNO_3 + KI \rightarrow AgI + KNO_3$

d) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

e) $CaO + SO_3 \rightarrow CaSO_4$

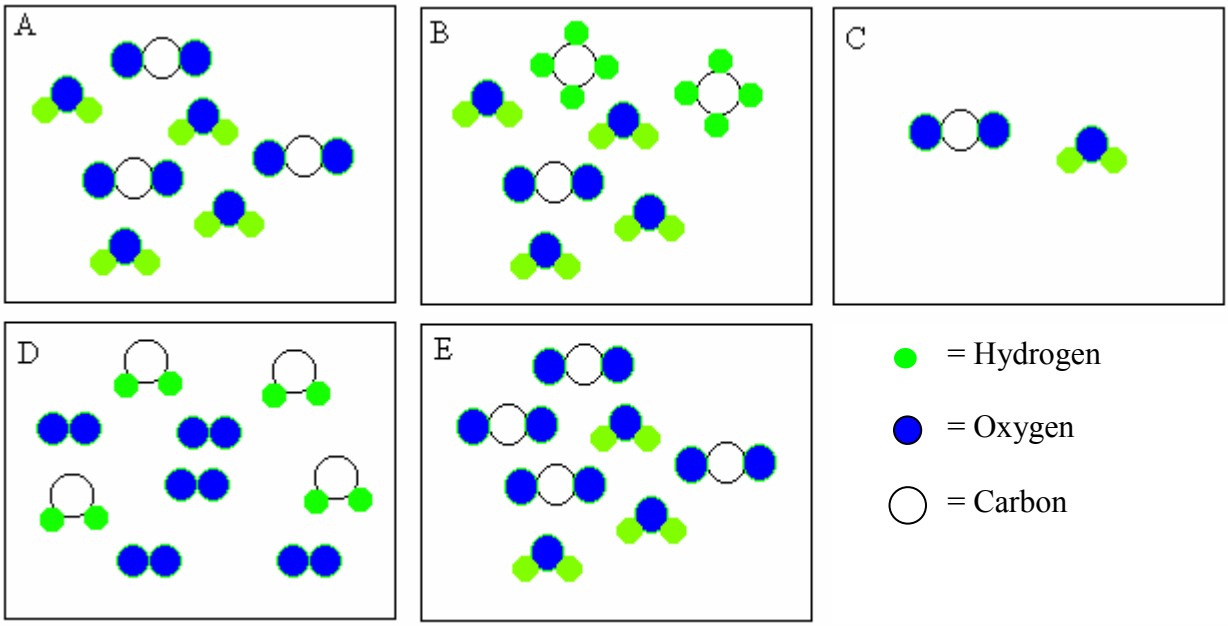
10. Which one of the elements below would be the best choice for lining a tank intended for use in the storage of HCl?

a) Iron (Fe)
b) Copper (Cu)
c) Zinc (Zn)
d) Tin (Sn)
e) Nickel (Ni)

11. Which one of the following contains 9.03×10^{23} atoms?

a) 16.0 g O_2
b) 4.00 g He
c) 28.0 g N_2
d) 22.0 g CO_2
e) 8.0 g CH_4

12. Which of the following drawings quantitatively represents the products formed in the complete combustion of 1 molecule of propane (C_3H_8)?



13. What is the molar concentration of NaOH in a solution prepared by mixing 25.0 mL of 0.100 M NaOH with 50.0 mL of water and 0.08 grams of NaOH?

a) 0.180 M
b) 0.090 M
c) 0.060 M
d) 0.050 M
e) 0.333 M

SHORT ANSWER: Write your answer to each question in the space provided. Point values are listed next to each problem.

14. Write the balanced net ionic equation for the following reactions. Show all intermediate steps (i.e. molecular equation, complete ionic equation). If you think there is no chemical reaction, state your reasoning. Make sure to indicate the physical state of each product (s, l, g, aq). (4 points each)

$Rb_2S\ (aq) + CuSO_4\ (aq) \rightarrow$

$(NH_4)_2SO_4\ (aq) + ZnCl\ (aq) \rightarrow$

page total

15. Write the balanced chemical equation for the following reactions. Make sure to include the physical state of every compound. (4 points each)

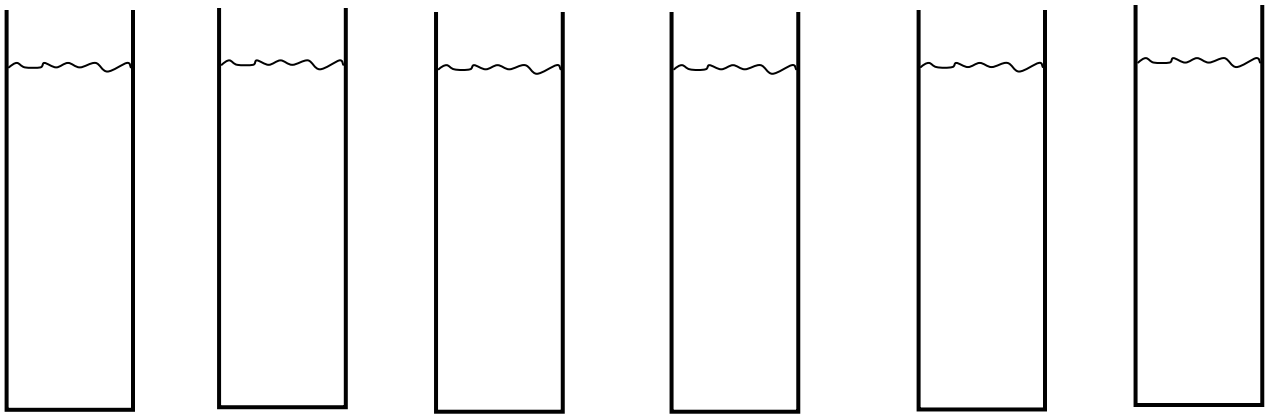
Solid ammonium nitrate decomposes into gaseous dinitrogen oxide and water.

A solution of lead (II) nitrate and a solution of potassium iodide are mixed and create a yellow precipitate.

The neutralization of phosphous acid with calcium hydroxide

16. Sketch a molecular level drawing of the resulting solution when <u>one molecule</u> of each of the following compounds is added to its respective container of water. (6 points)

$HC_2H_3O_2$ HCl C_2H_5OH $Cu(OH)_2$ $C_6H_{12}O_6$ NaOH



CALCULATIONS: Show all of your work for each calculation and write your answer in the space provided. Point values are listed next to each problem. Report answers with an appropriate number of significant figures.

17. A compound contains only carbon, hydrogen, and oxygen. Combustion of 10.68 g of the compound yields 16.01 g of CO_2 and 4.37 g of water. The molar mass of the compound is somewhere between 160 and 180 g/mol. What is the molecular formula for the unknown substance? (5 points)

page total

18. How many milliliters of a 2.0 M solution of potassium hydroxide is needed to completely neutralize 500 mL of a 2.5 M sulfuric acid solution? (5 points)

page total

19. Over the years, the thermite reaction has been used for welding railroad rails, in incendiary bombs, and to ignite solid fuel rocket motors. The reaction is

$$Fe_2O_3(s) + 2Al(s) \longrightarrow 2Fe\ (l) + A1_2O_3(s)$$

a) What mass of iron(III) oxide must be used to produce 15.0 g iron?

b) If you started with 10.0 g of Al and the amount of iron(III) oxide calculated in part a, how much aluminum metal is left over?

(6 points)

page total

20. When 50.0 g of NaOH(aq) and 50.0 g $MgCl_2$(aq) reacted in a laboratory experiment, 25.0 g of precipitate was obtained. What is the identity of the precipitate? What is the percent yield of this reaction? (6 points)

page total