Chem1210: General Chemistry I Name: _____
Chapters 4 & 5 Practice Exam #2 2007

Show all of your work. Make use of the conversion factor method (factor label method, dimensional analysis) throughout and express answers in scientific notation with the appropriate number of significant figures.

1. (a) What are the three fundamental particles from which atoms are built?
   (b) What are their electric charges?
   (c) Which of the particles constitute the nucleus of the atom?
   (d) Which is the least massive of the three?
   (e) How many of each of the fundamental particles are there in an atom of ^{24}Mg?

2. (a) Write down the molar mass of aluminum in g/mol.
   (b) Calculate the mass in grams of one atom of aluminum metal.
   (Avogadro's number = 6.022 x 1023 atoms/mole).

3. In each case, decide which represents more mass: (circle your answer)
   (a) 0.5 mol Na or 0.5 mol Si
   (b) 9.0 g Na or 0.50 mol Na
   (c) 10 atoms of Fe or 10 atoms of K

4. (a) How many electrons are in a calcium atom (Ca)?
   (b) Does an atom of Ca gain or lose electrons when forming an ion?
   (c) How many electrons are gained or lost by the atom?
   (d) When Ca forms an ion, the ion has the same number of electrons as which one of the noble gases?

5. Lithium has two stable isotopes: ^{6}Li and ^{7}Li. One of them has an abundance of 92.5 %, and the other has an abundance of 7.5 %. Knowing that he atomic mass of lithium is 6.941 which is the more abundant isotope? (circle your answer)

6. Gallium has two naturally occurring isotopes, 69Ga (isotopic mass 68.9256 amu, abundance 60.11 %) and 71Ga (isotopic mass 70.9247 amu, abundance 39.89 %). Calculate the atomic mass of gallium.

7. The compound $(NH_4)_2SO_4$ consists of two different polyatomic ions.
   (a) What are the names and electric charges of these ions?
   (b) What is the molar mass of this compound?

8. Give the symbol, including the correct charge for each of the following ions:
   (a) barium ion
   (b) titanium (IV) ion
   (c) sulfide ion
   (d) sulfate ion

9. According to the following balanced reaction, how many moles of NO are formed from 8.44 moles of NO_2 if there is plenty of water present?

$$3\ NO_2(g) + H_2O(l) \rightarrow 2\ HNO_3(aq) + NO(g)$$

10. Consider the following reaction. How many moles of oxygen are required to produce 2.33 moles of water? Assume that there is excess C_3H_7SH present.

$$C_3H_7SH(l) + 6\ O_2(g) \rightarrow 3\ CO_2(g) + SO_2(g) + 4\ H_2O\ (g)$$

11. According to the following balanced reaction, how many moles of KO are required to exactly react with 5.44 moles of H_2O?

$$4\ KO(s) + 2\ H_2O(l) \rightarrow 4\ KOH(s) + O_2(g)$$

12. According to the kinetic theory of gases, particles of a gas
    a. are very large.
    b. are very far apart.
    c. lose their valence electrons.
    d. move slowly.
    e. decrease in kinetic energy as the temperature increases.
    f.
13. The pressure exerted by a gas on its container is directly proportional to
    A) the volume of the container.
    B) the mass of the individual gas molecules.
    C) the centigrade temperature of the gas in the sample.
    D) the number of molecules of gas in the sample.
    E) the Fahrenheit temperature of the gas in the sample.

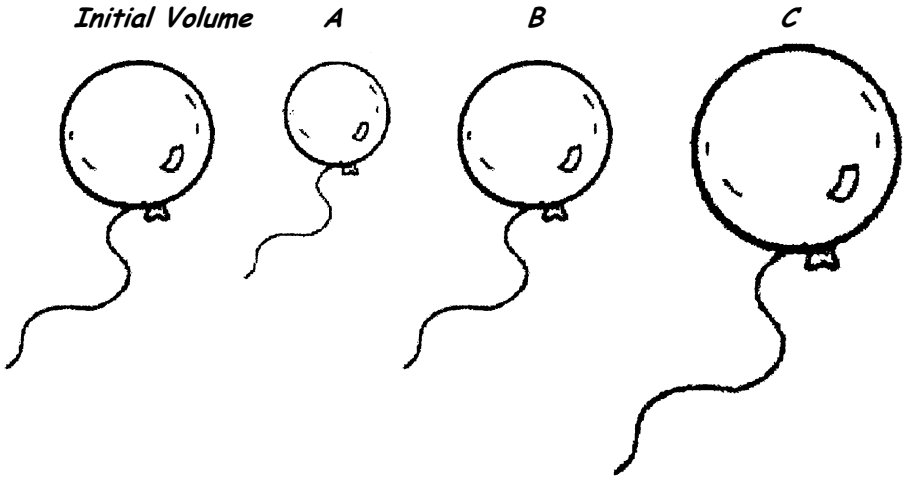
14. TRUE or FALSE: The volume of 1 mole of any gas at STP is 22.4L

15. In Gay-Lussac's Law, the pressure of a gas increases due to an increase in temperature because
    A) the molecules strike the walls of the container less often.
    B) the molecules strike the walls of the container more often.
    C) the molecules get bigger.
    D) there is a decrease in the volume of the container.
    E) there is an increase in the number of gas particles.

16. Which of the following samples has the greatest density at STP?
    A) NO_2
    B) Xe
    C) SO_2
    D) SF_6
    E) All of these samples have the same density at STP.

17. Determine the density of CO_2 gas at STP.
    A) 1.96 g/L
    B) 1.80 g/L
    C) 2.24 g/L
    D) 4.46 g/L
    E) 5.10 g/L

A balloon is filled with helium gas. For the next two questions, select the letter of the balloon diagram that corresponds to the given change in conditions.



18. The balloon is placed into a chamber whose pressure is less than atmospheric pressure.
    A) A B) B C) C
19. The temperature is changed from 50 °C to -150 °C at constant pressure.
    A) A B) B C) C

Short Answer Problems (4 points each)

For each problem below, write the equation and show your work. Always use units and box in your final answer.

20. A 5.00 liter tank contains Nitrogen gas at 1.5 atm. What is the pressure of the gas in mm Hg?

21. Methane gas, CH_4, reacts with oxygen according to the following balanced chemical reaction:

    $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

    If 2 moles of methane gas are allowed to react, how many grams of water will be formed?

22. a. How many kilograms of carbon dioxide are obtained when a sample of $0.15m^3$ of C_8H_{18}, whose density is 0.69 g/mL is combusted air?

    b. how many molecules of carbon dioxide is this?

23. If a sample of gas has a volume of 100 mL when the pressure is 150 torr, what will the volume of the gas be if its pressure is increased to 200 torr?

24. Which of the following samples will have the greatest average speed at 355 K?
    A) Ne
    B) C_2H_4
    C) Cl_2
    D) CH_4
    E) All of these samples will have the same average speed at the same T.