

## CH 104 Seminar Practice Problems (Revised 9/19/02)

**COMPLETE ALL PRACTICE PROBLEMS BEFORE THE SEMINAR CLASS**

Practice problems for CH 104 seminar, week #1

1. Classify as chemical(C) or physical(P):

- |                            |  |
|----------------------------|--|
| a) color                   | i) exists as a solid at room temperature                           |
| b) odor                    | j) a waxy solid dissolves in gasoline                              |
| c) melting point           | k) a shiny solid turns black upon heating in air                   |
| d) boiling point           | l) a colorless liquid produces a gas when treated with electricity |
| e) combustible             | m) a snowball disappears in a freezer after several days           |
| f) magnetic                | n) sand is separated from water by filtration                      |
| g) salt dissolves in water | o) gasoline is removed from crude oil by distillation              |
| h) an abandoned car rusts  | p) a stick of dynamite explodes                                    |

2. Classify as a mixture or a pure substance:

- |                           |                               |
|---------------------------|-------------------------------|
| a) oxygen                 | d) $\text{NH}_3$              |
| b) 100 % pure apple juice | e) household ammonia solution |
| c) water                  | f) unpolluted air             |

3. Classify as an element or a compound:

- |                 |                    |
|-----------------|--------------------|
| a) oxygen       | d) CO              |
| b) water        | e) Co              |
| c) $\text{N}_2$ | f) $\text{CoCl}_3$ |

4. Indicate the number of significant figures in each measurement given below in (a) and (b); complete the two calculations to the correct number of significant figures and correct units.

$$(a) \frac{\overset{\text{s.f.}}{2.1250 \text{ g}}}{\underset{\text{s.f.}}{(12.000 \text{ cm})} \underset{\text{s.f.}}{(2,002 \text{ cm})} \underset{\text{s.f.}}{(0.0020 \text{ cm})}} =$$

$$(b) \underset{\text{s.f.}}{1.200 \text{ g}} + \underset{\text{s.f.}}{725.10 \text{ g}} + \underset{\text{s.f.}}{1,125.000 \text{ g}} =$$

5. Write your answers in 4(a) and 4(b) in scientific notation.

6. In each of the following, solve for Q using the correct number of significant digits.

a)  $450.0 \times Q = 3.00$

b)  $\frac{Q}{5.1256} = 1.703$

c)  $Q - 0.111 = 9.25$

## Practice problems for CH 104 seminar, week #2

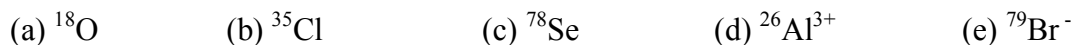
Complete the following calculations using the factor label method. Remember significant digits and units.

- 1) How many mg are in a 5.0 grain aspirin tablet? (1.00 grain = 64.8 mg)
  
- 2) How many centimeters are in 6.15 feet?
  
- 3) Convert  $6.7 \times 10^{15} \text{ um}^3$  into  $\text{m}^3$ .
  
- 4) How many grams in 0.850 tons? (2,000 lb. = 1 ton; 1 lb. = 454 grams)
  
- 5) The price of gasoline in France is 5.91 French francs/liter. What is the cost in \$/gal.?  
( $\$1 = 5.25$  French francs;  $1.06 \text{ qt.} = 1.00$  liters)
  
- 6) What is the volume in pints of 2.75 lb. of gold? (density of gold:  $19.3 \text{ g/cm}^3$ )
  
- 7) The density of mercury is  $13.7 \text{ g/ml}$ . What is the density of mercury in  $\text{lb./gal.}$ ?
  
- 8) In a normal person the level of blood sugar is  $85 \text{ mg}/100.0 \text{ mL}$ . If the average body contains about 11 pints of blood, how many pounds of blood sugar are present in the blood?
  
- 9) A pediatric dosage of a certain antibiotic is  $32 \text{ mg/kg}$  of body weight per day. How much antibiotic, in milligrams per day, should be administered to a child who weighs 38 pounds?
  
- 10) How many grams of Al can be heated from  $25.0^\circ\text{C}$  to  $125^\circ\text{C}$  by 975 calories?  
(specific heat of Al:  $0.221 \text{ cal/g}^\circ\text{C}$ .)
  
- 11) It was found that 60.9 calories of heat must be absorbed to raise the temperature of a 50.5 g sample of an unknown metal from  $20.0^\circ\text{C}$  to  $31.4^\circ\text{C}$ . What is the specific heat capacity of the metal?

## Practice problems for CH 104 seminar, week #3

1. Classify as a metal, a nonmetal, or a metalloid : Cs; Os; Ge; He; I; Al

2. Determine the number of protons, electrons, and neutrons for the following:



3. Show both  $nl^x$  and "box & arrow" electron configurations for each of the following:

Phosphorous

Iron

Technetium (Tc)

4. For each of the following, give (a) the electron configuration using  $nl^x$  notation, (b) the number of unpaired electrons, and (c) the orbital from which the first electron would be lost.

Sulfur

Zinc

Niobium (Nb)

Tellurium (Te)

5. Give the family name and the number of valence electrons in an atom of each of the following elements:

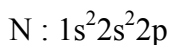
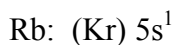
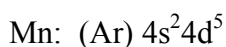
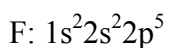
Cs

Ge

At

Xe

6. Circle the incorrect configurations below and then correct them.



## CH 104: Practice problems for seminar quiz #4.

1. Circle the element with the highest first ionization energy and underline the one with the lowest first ionization energy.

S      Cl      Se      Br

2. Circle the largest atom and underline the smallest atom.

Na      Mg      K      Ca

3. Write formulas and give the names for the ionic compound formed between the following pairs of elements.

(a) Na & N

(b) Na & O

(c) Na & F

(d) Mg & N

(e) Mg & O

(f) Mg & F

(g) Al & N

(h) Al & O

(i) Al & F

4. Name or write formulas for the following:

(a) diphosphorus hexachloride

(k)  $\text{SeO}_2$

(b) sodium sulfide

(l)  $\text{AlN}$

(c) lithium chloride

(m)  $\text{K}_3\text{P}$

(d) barium phosphide

(n)  $\text{Pb}_3\text{N}_4$

(e) hypobromous acid

(o)  $\text{Mg}(\text{NO}_2)_2$

(f) nickel (II) hydroxide

(p)  $\text{Cu}_2\text{SO}_4$

(g) chromium (III) phosphite

(q)  $\text{Na}_2\text{CO}_3$

(h) copper (I) carbonate

(r)  $\text{Mn}_3(\text{PO}_4)_2$

(i) cobalt (III) nitrate

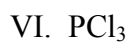
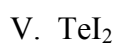
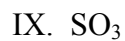
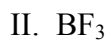
(s)  $\text{CH}_3\text{CO}_2\text{H}$

(j) iron (III) sulfate

(t)  $\text{Co}(\text{OH})_3$

## CH 104 : Seminar Practice Problems for Seminar #5

1. For each of the following (a) draw the Lewis structure; (b) give the electron pair geometry; (c) give the molecular shape; (d) indicate the value of the bond angle; (e) indicate polar or nonpolar :



## CH 104 : Practice Problems for seminar quiz, week #6

1. How many atoms of aluminum are in 6.75 mol of Al?
2. How many moles are in  $3.75 \times 10^3$  grams of iodine atoms?
3. How many moles are in  $3.75 \times 10^3$  grams of iodine molecules?
4. What is the mass in grams of one mole of silver?
5. What is the mass in grams of one atom of silver?
6. How many atoms of lithium are in 25.0g of lithium?
7. How many grams of gold are in  $3.98 \times 10^{19}$  atoms of gold?
8. How many molecules of  $N_2O_3$  are in 5.55 picograms of  $N_2O_3$ ?
9. How many nitrogen atoms are in 1.75 grams of  $Al(NO_3)_3$ ?
10. How many grams of  $Al(NO_3)_3$  are required to produce  $2.75 \times 10^{18}$  atoms of oxygen?
11. For each of the following (a) write a balanced chemical equation; (b) indicate the type of reaction (combination, decomposition, single replacement (displacement), or double replacement (partner exchange))
  - (i) ammonium phosphate + nickel(II) nitrate  $\rightarrow$
  - (ii) aluminum + sulfuric acid (hydrogen sulfate)  $\rightarrow$
  - (iii) aluminum + bromine  $\rightarrow$
  - (iv) potassium nitrate  $\rightarrow$  potassium nitrite + oxygen

## CH 104 : Seminar practice problems for week #7 quiz

1. Find the oxidation number of chromium in each of the following compounds:

- a)  $\text{CrO}_3$       b)  $\text{CrO}_4^{2-}$       c)  $\text{K}_2\text{Cr}_2\text{O}_7$

2. For each of the following equations (a) complete and balance the equation; (b) determine if the reaction is redox; (c) for those that are redox write the oxidation and reduction half reactions and (d) indicate the element that is reduced, the element oxidized, the reducing agent, and the oxidizing agent.

(i) sodium carbonate + iron(III) nitrate  $\rightarrow$

(ii) aluminum + nitric acid (hydrogen nitrate)  $\rightarrow$

(iii) aluminum + bromine  $\rightarrow$

2. Given the equation:  $4 \text{FeS}_2 + 11 \text{O}_2 \rightarrow 2 \text{Fe}_2\text{O}_3 + 8 \text{SO}_2$

(a) How many moles of  $\text{SO}_2$  are produced from 6.68 moles of  $\text{O}_2$ ?

(b) How many grams of  $\text{FeS}_2$  are required to act with 0.750 moles  $\text{O}_2$ ?

(c) How many grams of  $\text{SO}_2$  can be prepared from 25.0 grams of  $\text{O}_2$ ?

(d) If 31.8 grams of  $\text{SO}_2$  was isolated in problem 2(c) above, what is the percent yield of  $\text{SO}_2$ ?

3. Given the reaction:  $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$ .

(a) What is the theoretical yield when 15.0 grams of  $\text{N}_2$  is mixed with 5.00 grams of  $\text{H}_2$ ?

(b) What is the limiting reagent?

4. Given the reaction:  $3 \text{Mg} + \text{N}_2 \rightarrow \text{Mg}_3\text{N}_2$

(a) What is the theoretical yield when 20.0 grams of Mg are mixed with 10.0 grams of  $\text{N}_2$ ?

(b) What is the limiting reagent?

## CH 104: Practice problems for week #8 seminar quiz

1. What is the volume of a gas sample at 755 mm if it occupies 6.75 L at 875 mm? (Assume constant T & n)
2. What is the temperature in °C of 5.75 m<sup>3</sup> of a gas if 2.68 m<sup>3</sup> had a temperature of 27 °C? (Assume constant P & n)
3. What is the volume of a sample of gas at 25 °C if it occupies 24.4 L at 50. °C? (Assume constant P & n)
4. What is the temperature in °C of 5.78 L at 735 mm if it occupies 6.19 L at 18 °C and 925 mm? (Assume constant n)
5. How many moles of gas are present in a volume of 378 ml at 710mm and -22°C?
6. What is the pressure of 6.54 ml of a gas sample at 57 °C if it occupies 9.75ml at 21 °C and 1.64 atm? (Assume constant n)
7. What is the density of chlorine gas at STP ?
8. What is the volume of 216.8 g of oxygen at STP?
9. What is the molar mass of a gas whose density is 1.96 g/L at STP.
10. What is the pressure of 2.50 moles of oxygen if the sample occupied 40.0 L at 25 °C?



## CH 104 : Practice problems for seminar quiz # 9

1. For the following pairs, determine the compound with (i) the strongest intermolecular forces, (ii) the highest vapor pressure at  $-25^{\circ}\text{C}$ , (iii) the highest normal boiling point, (iv) the greatest surface tension, (v) the highest  $\Delta H_{\text{fus}}$ , (vi) the highest  $\Delta H_{\text{vap}}$ , (vii) the greatest viscosity, (viii) the greatest volatility.

(a)  $\text{CO}_2$  &  $\text{SO}_2$ (b)  $\text{CH}_3\text{NH}_2$  &  $\text{CH}_3\text{PH}_2$ 

(c) HF &amp; NaF

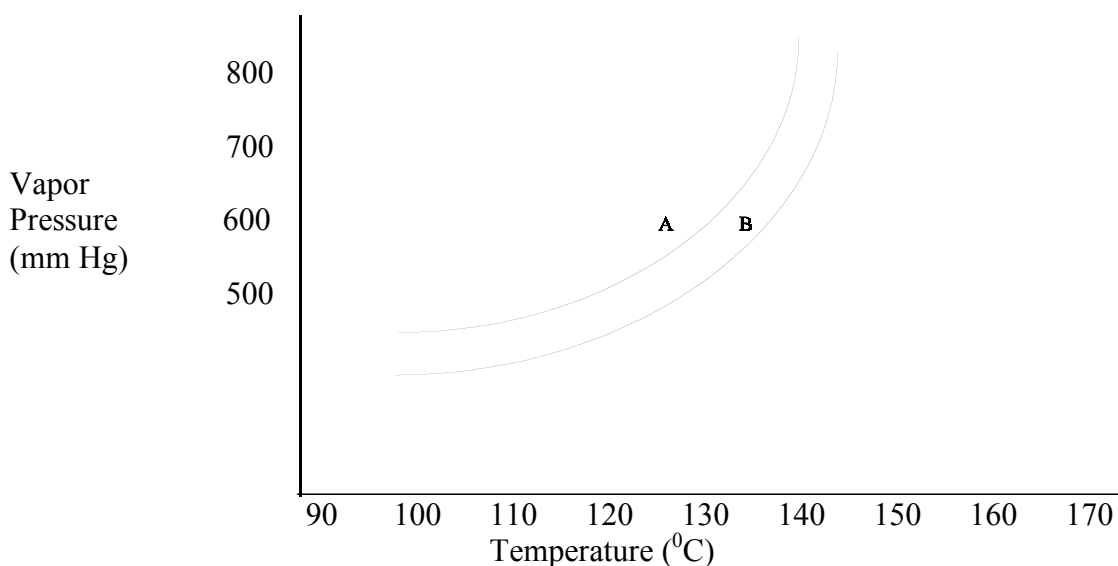
2. Indicate all types of interparticle forces in the compounds listed in (a), (b) & (c). What is the strongest interparticle force present in each?

3. Complete the following statement with the word increase or decrease:

If the strength of intermolecular forces decreases, the boiling point \_\_\_\_\_, the vapor pressure \_\_\_\_\_, the viscosity \_\_\_\_\_, the heat of vaporization \_\_\_\_\_, the rate of evaporation \_\_\_\_\_, the heat of fusion \_\_\_\_\_, and volatility \_\_\_\_\_.

4. Use two separate diagrams to show hydrogen bonding between (a) two molecules of  $\text{NH}_3$  and (b) one molecule of  $\text{H}_2\text{O}$  and one molecule of  $\text{NH}_3$ .

5. Given the following diagram (a) which compound (A or B) is more volatile? (b) Which compound has the stronger forces of attraction? (c) Which compound has the greater viscosity? (d) What is the normal boiling point of A? (e) What is the vapor pressure of B at  $120^{\circ}\text{C}$ ? (f) What is the boiling point of A at 650 mm(Hg)?



7. Dunhamonium, a rare and expensive gemstone, has the following physical constants:  $\Delta H_{\text{fus}} = 6.48 \text{ kcal/mol}$ ;  $\Delta H_{\text{vap}} = 28.5 \text{ kcal/mol}$ ; boiling point =  $975^{\circ}\text{C}$ ; melting point =  $438^{\circ}\text{C}$ ; specific heat specific heats: (solid) =  $0.168 \text{ cal/g}^{\circ}\text{C}$ ; (liquid) =  $0.275 \text{ cal/g}^{\circ}\text{C}$ ; (gas) =  $0.0975 \text{ cal/g}^{\circ}\text{C}$ ; molar mass =  $125 \text{ g/mol}$ . How many calories of heat are required to heat 50.0 grams of Dunhamonium from  $325^{\circ}\text{C}$  to  $1025^{\circ}\text{C}$ ?

## CH 104 : Practice problems for seminar quiz #10

1. Write balanced nuclear equations for the following:

(a)  $^{214}\text{Pb}$  undergoes beta decay.

(b)  $^{231}\text{Pa}$  undergoes alpha decay.

(c)  $^{14}\text{N} + ^4\text{He} \rightarrow ^1\text{H} + \underline{\hspace{2cm}}$

(d)  $^{40}\text{K} \rightarrow ^{40}\text{Ar} + \underline{\hspace{2cm}}$

(e)  $^{16}\text{O} + \underline{\hspace{2cm}} \rightarrow ^{28}\text{Si}$

(f)  $^{253}\text{Es} + ^4\text{He} \rightarrow ^{256}\text{Md} + \underline{\hspace{2cm}}$

(g)  $^{235}\text{U} + ^1_0\text{n} \rightarrow ^{137}\text{Te} + ^{97}\text{Zr} + \underline{\hspace{2cm}}$

3. Iodine-134 has a half-life of 52.0 minutes. If you begin with 1.28 g of the isotope, how much is left after 0.289 days?

4. A 64.0 mg sample of  $^{235}\text{Pu}$  decays to 2.00 mg in 130 minutes. What is the half life of this isotope?

5. How many weeks have passed if a 32.0 mg sample of a radioactive nuclide has decayed to 2.00 mg?  
( $t_{1/2} = 6.50$  days)