

Department of Chemistry
University of Missouri-St. Louis

Name _____
Chem 1052

Exam 2
Tuesday, March 9, 2010

1. (12pts) (a) Aspirin, acetosalicylic acid, has a molecular formula of $C_9H_8O_3$. What is the molecular weight of aspirin?

$$\begin{array}{r} 9 \times 12 = 108 \\ 8 \times 1 \\ 3 \times 16 \\ \hline 164 \end{array}$$

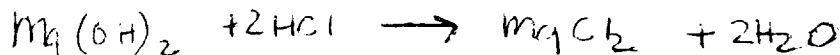
(b) A typical dose of aspirin is 200 mg (milligrams). How many moles of aspirin does this correspond to?

$$200 \text{ mg} / 1000 = 0.2 \text{ g} / 164 \text{ g/mol} = 0.0012 \text{ mol}$$

2. (8pts) Glucose, $C_6H_{12}O_6$ is oxidized by the body to carbon dioxide and water. Balance this equation.



3. (8pts) An antacid works by neutralizing HCl in the stomach. Balance the equation of Mylanta, $Mg(OH)_2$ reacting with excess stomach acid. The products are magnesium chloride and water.



4. (6pt) The concentration of a NaOH solution is 10^{-3} moles/L. What is the pH of this solution?

$$\begin{array}{l} pOH = 3 \\ pH = 11 \end{array}$$

5(6pts)(a). How does a strong electrolyte differ from a weak electrolyte and a non-electrolyte.

Strong electrolyte - completely dissociated
 weak electrolyte - partially dissociated
 non-electrolyte - non-dissociated

(b) Give an example of each

strong electrolyte NaCl salt

weak electrolyte HF , any weak acid NH_3

non-electrolyte Sugars H_2O

6.(12pts) Use the solubility table below to answer the following questions. The solubilities are given in g/100 mL of water

T °C	KBr	KI
20	65	145
40	80	160
60	90	175
80	100	190
100	110	210

a) On a gram basis, which salt, KBr or KI, is more soluble at 20 °C?

KI 145g/100mL

b) Is this true on a mol basis?

yes
 $\text{KI} = 39 + 127 = 166 \text{ g/mol}$
 $\text{KBr} = 39 + 79.9 = 118.9$

$\frac{145}{166} = 87 \text{ mol}$

$\frac{65}{118.9} = .547$

c) Will adding 40 g of solid KBr to 50 mL of water create a saturated solution at 80 °C?

~~yes~~ 40g/50mL as 80/100mL no

d) Suppose you took a solution containing 190 g of KI in 100 mL of water at 80 °C and you allowed it to cool to 20 °C. Describe as quantitatively as possible what would happen at equilibrium.

190 - 145 = 45g would crystallize out

7.(6pts) Until the development and widespread adoption of antibiotics, dilute solutions of AgNO_3 used to be dropped into newborn babies' eyes at birth to prevent contraction of gonorrhea from the mother. Eye infections and blindness of newborns was reduced by this method; incorrect dosage, however, could cause blindness in extreme cases. How many grams of silver nitrate would you need to prepare 500 mL of a 0.001 mole/L solution?

Ag	107.4	$0.001 \text{ mol} \times 169 \frac{\text{g}}{\text{mol}} = 169 \text{ g for 1 L}$ $0.0849 \text{ g for 500 mL}$
N	14	
O_3	<u>48</u>	
	169.9 g/mol	

8.(8pts) Match the terms *vapor pressure*, *atmospheric pressure*, *boiling point*, *critical temperature*, *critical pressure* appropriately to the following descriptions:

- a) the pressure exerted by a gas above the surface of its liquid vapor pressure
- b) the temperature at which the vapor pressure of the liquid becomes equal to the external pressure boiling pt
- c) the temperature at which bubbles of vapor appear within the liquid boiling pt
- d) the pressure exerted on the surface of Earth by gas particles atmospheric pressure

9.(8pts) a) A 2.0 L container is filled with methane gas (CH_4) at a pressure of 3040 mm Hg and a temperature of 25°C . How many moles of methane are in the container? (760 mm Hg = 1 atm, $R = 0.0821 \text{ L atm/(K mol)}$, $PV = nRT$)

$$3040 \text{ mm} / 760 = 4 \text{ atm}$$

$$25^\circ \text{C} = 298 \text{ K}$$

$$4(2) = n(0.0821)(298) \quad + (2) = n(0.0821)(298)$$

$$n = \frac{8}{298(0.0821)} = 0.327 \text{ mol}$$

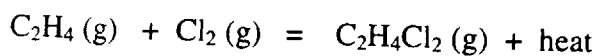
b) How many grams of methane are in the container?

$$0.327 \text{ mol} \times 16 = 5.23 \text{ g}$$

10.(6pts) Describe what is meant by an aqueous buffer solution

A solution resistant to change in pH

11.(8pts) Consider the following reaction at equilibrium:



A) Indicate how each of the following will shift the equilibrium (to product, to reactant or have no effect)

- a) increasing the pressure *to product*
- b) adding a catalyst *no effect*
- c) adding additional Cl_2 *to product*
- d) increasing the temperature *to reactant*

B) Indicate for the reaction above how each of the following will affect the initial rate of reaction (increase, decrease or no effect)

- a) adding a catalyst *increase*
- b) adding additional Cl_2 *increase*
- c) decreasing the volume of the reaction chamber but maintaining the same amount of reactants *increase*
- d) increasing the temperature *increase*

12.(12pts) A 0.1 M solution of sucrose and a 0.05 M solution of sucrose are separated by a semi-permeable membrane (answer questions a and b below).

- a) Toward what direction does the water flow faster initially? *toward the 0.1 M sol.*
- b) Once equilibrium is achieved, the rate of water flow is: (circle the correct answer)
 - 1) the same in both directions
 - 2) faster toward the 0.1 M solution
 - 3) faster toward the 0.05 M solution

13.(6 pts) A pure material (circle the correct answer)

- 1) melts over a range of temperatures but boils sharply
- 2) melts and boils over a range of different temperatures
- 3) melts sharply but boils over a range of temperatures
- 4) melts at a constant temperature and boils at a constant temperature