

Department of Chemistry  
University of Missouri-St. Louis

Name \_\_\_\_\_  
Chem 5

October 15, 1999  
Exam II

1. (15 pts)

a. Acetic acid, the major constituent of vinegar other than water has a molecular formula of  $C_2H_4O_2$ . What is its molecular weight?

$$\begin{array}{r} C \ 12 \quad 24 \\ H \ 1 \quad 4 \\ O \ 16 \quad 32 \\ \hline 60 \end{array}$$

b. If vinegar is a 5% (weight/volume) solution, how many grams of acetic acid are there in a liter?

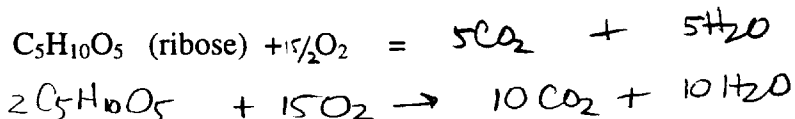
$$.05 \times 1000 = 50 \text{ g/l}$$

$$\frac{50 \text{ g}}{60 \text{ g/mol}} = 0.83 \text{ M}$$

c. How many moles of <sup>acetic acid</sup> vinegar does this correspond to? What is the molarity of acetic acid in vinegar?

$$\frac{50}{60} = .83 \text{ M}$$

2. (10pts) Balance the equation for the combustion of ribose, an important sugar in RNA.



3. (20pts) a. What is an isotonic solution? *a solution whose osmotic pressure = osmotic pressure of a red blood cell*

b. Describe the process of hemolysis. What cells are affected? Under what conditions does it occur?

*a red blood cell swells and bursts - when solution the blood cell is in has a lower osmotic pressure than the red blood cell*

c. Two solutions, a 0.1% (m/v) albumin solution and a 2% (m/v) albumen solution are separated by a semipermeable membrane (albumins are colloidal globular proteins).

1. In which direction will water flow, toward or away from the more concentrated (conc.) solution?

*toward*

2. In which compartment will the level initially rise (conc or dilute solution)?

*concentrated*

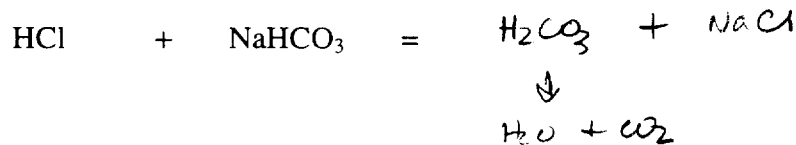
3. Which compartment has the higher osmotic pressure (conc or dilute solution)?

*concentrated*

4. (5pts) What is the difference between a strong and weak acid?

*a strong acid is completely dissociated in water, to form  $H_3O^+$   
a weak acid is not*

5. (8pts) Write a balanced equation for the neutralization of stomach acid (HCl) with sodium bicarbonate. What is it in this reaction that makes you burp?



6. (10pts) You have just eaten a quarter pound cheeseburger (no bacon), French fries and a chocolate shake. How long would a 70 kg person have to run to burn off the kcal in this meal?

Item	Protein (g)	Fat (g)	Carbohydrate (g)
cheeseburger	31	29	34
French fries	3	11	26
chocolate shake	11	9	60

Caloric Values: Protein: 4 kcal/g Fat: 9 kcal/g Carbohydrate: 4 kcal/g

Energy Expended (70 kg person): Sleeping: 60 kcal/hr; Walking: 200 kcal/hr; Running: 550 kcal/hr

$$\begin{aligned}
 45g \text{ protein} \times 4 \text{ kcal/g} &= 180 \text{ kcal} \\
 49g \text{ fat} \times 9 \text{ kcal/g} &= 441 \text{ kcal} \\
 120g \text{ carbs} \times 4 &= 480 \text{ kcal} \\
 \hline
 1101 / 550 &= 2 \text{ hr}
 \end{aligned}$$

7. (16pts)

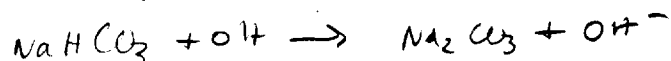
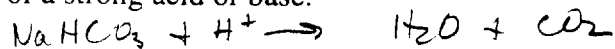
Give an explanation for the following:

a:

Water boils at 87 °C on top of Mount Whitney

pressure on top < 760mm

b. The pH of sodium bicarbonate ( $\text{NaHCO}_3$ ) doesn't change much after the addition of small amounts of a strong acid or base.



c. Odors migrate faster when the temperature is raised

molecular motion increases.

d. Table salt in water is a good conductor of electricity while glucose in water is not

salt is an electrolyte  
glucose is not

e. Most warm saturated solutions of salts crystallize out if they are allowed to cool.

solubility ↓ as temp ↓

8. (16pts)

a. How do catalysts speed up reactions?

lower the activation energy

b. Why does an increase in temperature speed up a reaction?

more molecules have enough energy to react

c. What does the vapor pressure of a liquid measure? Do solids have vapor pressures?

the tendency of molecules to escape

d. Describe what is meant by the terms: solute and solvent.

solute: substance in smallest amount  
solvent: " " largest "