Chemistry 102 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Exam 3a Spring 2017

 Page 2 (36 points)

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Page 6 (10 points)

 Total (104 points)

Multiple Choice

1. London dispersion forces attractions between molecules depends on what two factors?

|  |  |
| --- | --- |
| 1. **Molar mass and shape**
 | 1. Vapor pressure and size
 |
| 1. Molar mass and volatility
 | 1. Volatility and shape
 |

1. Which of the following statements about intermolecular forces is true?
2. London dispersions forces are the strongest of the three types.
3. They occur within molecules rather than between the molecules.
4. Hydrogen bonding occurs between any two molecules that contain hydrogen atoms.
5. **Dipole-dipole interactions occurs between two polar molecules**
6. Which pair of solute and solvent would be miscible?

|  |  |  |
| --- | --- | --- |
| 1. H2O and Hg
 | 1. C3H8 and C2H5OH
 | 1. Br2 and PF3
 |
| 1. **NH3 and CH3OH**
 | 1. none of the above
 |  |

1. As the temperature of a gas sample increases, the number of molecules and volume remaining constant, the pressure exerted by the gas

|  |  |
| --- | --- |
| * 1. Decreases
 | * 1. **Increases**
 |
| * 1. Remains the same
 | * 1. Unable to determine
 |

1. The compound formed from the condensation reaction between a glycerol molecule and 3 fatty acid molecules contains the following functional group.

|  |  |  |
| --- | --- | --- |
| 1. Alcohol
 | 1. Ether
 | 1. carboxylic acid
 |
| 1. aldehyde
 | 1. **Ester**
 |  |

1. Which of the following is considered a colloid

|  |  |  |
| --- | --- | --- |
| 1. 0.9% NaCl
 | 1. 5% glucose
 | 1. **mayonnaise**
 |
| 1. vinegar (5% acetic acid)
 | 1. muddy water
 |  |

1. Given that the solubility of sodium acetate is 76 grams per 100 grams of water. What is unsaturated?

|  |  |
| --- | --- |
| 1. 90 g of sodium acetate dissolved in 100 g of water
 | 1. 450 g of sodium acetate dissolved in 500 g of water
 |
| 1. 240 g of sodium acetate dissolved in 300 g of water
 | 1. **100 g of sodium acetate dissolved in 200 g of water**
 |
| 1. all of them
 |  |

1. A water solution of acetic acid, vinegar, 'barely lights a light bulb (low conductivity). This means that vinegar is a(n):

|  |  |
| --- | --- |
| 1. **weak electrolyte**
 | 1. strong electrolyte
 |
| 1. non-electrolyte
 | 1. semi-electrolyte
 |

1. The rubbing alcohol sold in drug stores often is composed of 70% isopropyl alcohol and 30% water. In this solution (based on the percentages)

|  |  |
| --- | --- |
| 1. **Isopropyl alcohol is the solvent**
 | 1. Water is the solvent
 |
| 1. Both water and isopropyl alcohol are solvents.
 | 1. Neither water nor isopropyl alcohol is a solvent.
 |

1. What kind of taste do carboxylic acids have?

|  |  |  |
| --- | --- | --- |
| 1. sweet
 | 1. **sour**
 | 1. fruity
 |
| 1. slippery
 | 1. salty
 |  |

1. If the pH of an aqueous solution increases the molar concentration of \_\_\_\_\_

|  |  |
| --- | --- |
| 1. Hydronium decreases
 | 1. Hydroxide ion decreases
 |
| 1. **Hydronium increases**
 | 1. There is no change in the hydronium hydroxide concentration
 |

1. How does soap clean dirt away from clothes?
2. The nonpolar head group interacts with water
3. The polar head group interacts with water
4. The polar tails form a micelle and the dirt sticks to the outside nonpolar heads
5. The nonpolar tails form a micelle that interacts with dirt

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. I and III
 | 1. IV only
 | 1. I, II and III
 | 1. **II and IV**
 | 1. none of these
 |

1. Why corn oil is a liquid and lard is a solid?
2. The oil has no double bonds and thus has more intermolecular forces
3. **The oil has cis double bonds that make kinks and thus there are less intermolecular forces**
4. The oil has trans double bonds and they are toxic
5. The fats are colder and thus have more intermolecular forces
6. None of these
7. Which of the following statements is correct?
8. As pressure increases, the amount of gas dissolved in a liquid increases
9. As temperature increases, the amount of gas dissolved in a liquid increases
10. As temperature decreases, the amount of gas dissolved in a liquid increases
11. As pressure decreases, the amount of gas dissolved in a liquid increases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. **I and III**
 | 1. II and IV
 | 1. I, II and III
 | 1. IV only
 | 1. none of these
 |

1. Which of the following combinations make a buffer solution?

|  |  |
| --- | --- |
| 1. HCl and KCl
 | 1. H2CO3 and Na2CO3
 |
| 1. H3PO4 and NaCl
 | 1. **HC2H3O2 and KC2H3O2**
 |

1. Which of the following acids, if in solutions of equal concentration, is the least acidic?

 a) Phenol, Ka = 1.3 x 10-10 b) Lactic acid, Ka = 1.4 x 10-4

 c) **Saccharin, Ka = 2.1 x 10-12**d) Boric acid, Ka = 5.8 x 10-10

 e) All of these acids are equally acidic because they are all of equal concentration.

1. The movement of substances from an area of high concentration to an area of low concentration by interacting with a carrier molecule is an example of

|  |  |  |
| --- | --- | --- |
| 1. Osmosis.
 | 1. Active transport.
 | 1. **Facilitated diffusion.**
 |
| 1. Diffusion
 | 1. Filtration.
 |  |

1. Which of the following is a strong acid?

|  |  |  |
| --- | --- | --- |
| 1. **HClO4**
 | 1. H3PO4
 | 1. HF
 |
| 1. H2CO3
 | 1. All are weak acids
 |  |

Short Answer

1. (6 points) Given the following compounds CH4 or CH3F at 20oC
	1. Determine all intermolecular forces in each

CH3F:\_\_dipole-dipole, London dispersion\_\_\_\_\_\_\_\_\_

CH4:\_\_ London dispersion \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Which has the higher vapor pressure at a given temperature. Explain your prediction

The weaker the **intermolecular forces**, the weaker the interactions that hold the substance together, the higher the **vapor pressure** of a liquid at the given temperature, and the easier it is to vaporize a substance. Since CH4 has the weakest intermolecular forces it will have the highest vapor pressure

1. (6 points) Rank the following from highest to lowest boiling point (1 is highest 5 is lowest)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CH3OCH2CH3 | CH3CH(OH)CH3 | (CH3)2CHCH3  | CH3CH2CH2CH3 | CH3CH2CH2CH2CH3 |
| 2 | 1 | 5 | 4 | 3 |

b) If any can hydrogen bond to themselves draw two molecules and illustrate the Hydrogen bonding



1. (6 points) **Label** each beaker solution as isotonic, hypertonic, or hypotonic and **draw** an arrow to show the direction of water movement by osmosis.



 \_\_ hypotonic \_\_ \_\_\_ hypertonic \_\_\_ \_\_\_\_\_ isotonic \_\_\_\_\_\_\_

1. (10 points) For each reaction below: (1) identify each reaction below as an Arrhenius acid-base reaction, a Brønsted-Lowry acid-base reaction, or both; (2) indicate the acid and conjugate acid if present and the base and conjugate base if present in each reaction.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. C5H5N (aq)
 | + H2O (l) | ⮀ C5H5NH+ (aq) | + OH- (aq) | (circle) Arrhenius, **Brønsted-Lowry**, or both |
| Base | Acid | Conjugate acid | Conjugate base |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 2 KOH(aq)
 | + H2SO4 (aq) | 🡪 2 H2O (l) | + K2SO4 (aq) | (circle) Arrhenius, Brønsted-Lowry, or **both** |
| Base | Acid | Conjugate acid | Conjugate base |  |

1. (8 points) A solution is prepared by dissolving 8.975 grams of KNO3 to make 550.0 mL of solution
2. Calculate the molarity of the solution.

$$?M C\_{9}H\_{8}O=\frac{mol KNO\_{3} }{L soln}=\frac{8.975 g KNO\_{3}×\frac{1 mol KNO\_{3}}{101.10 g KNO\_{3}}}{550.0 mL×\frac{1 L}{1000 mL}}=\frac{0.08877 mol C\_{9}H\_{8}O}{0.5500L}=0.1614 M KNO\_{3}$$

1. If 25.00 mL of the above solution was diluted to 45.00 mL, what is the molarity of the new solution?

M1 = 0.1614 M V1 = 25.00 mL V2 = 45.00 mL M2 = ?

$$M\_{1}V\_{1}=M\_{2}V\_{2}⟹M\_{2}=\frac{M\_{1}V\_{1}}{V\_{2}}=\frac{\left(0.1614 M\right)\left(25.00 mL\right)}{\left(45.00 mL\right)}=0.08967 M KNO\_{3}$$

1. (4 points) An intravenous replacement solution contains 4.0 mEq/L of Ca2+ ions .How many moles of Ca2+ are in 3.0 L of the solution?

$$ 3.0 L×\frac{4.0 mEq Ca^{2+} }{L} × \frac{1 Eq}{1000 mEq} × \frac{1 mol Ca^{2+} }{2 Eq}=0.0060 mol Ca^{2+}$$

1. (8 points) A **urine pH** level test is a test that analyzes the acidity or alkalinity of a **urine** sample. A patient has a urine sample with a 4.5 x 10-6 M H+ (show work)

|  |  |
| --- | --- |
| What is the pH?pH= -log(4.5 x 10-6 M H+) =5.35 | What is the pOH?pOH = 14 – 5.35 =8.65 |
| What is the hydroxide ion, OH-, concentration? $$\left[OH^{-}\right]=10^{-pOH}=10^{-8.65}=2.2 ×10^{-9} M$$ | Is the urine acidic, basic, or neutral? \_\_Acidic\_\_ |

1. (10 points) Use Le Chatelier's Principle to predict how the changes listed will affect the following equilibrium reaction:

2 HI (g) + 9.4 kJ  H2 (g) + I2 (g)

|  |  |
| --- | --- |
|  | What is the effect on the concentration of HI(increase, decrease or no change) |
| I2 is removed from the system  | decrease |
| Temperature of the system is decreased? | increase |
| H2 is added | increase |

 b) Write the equilibrium constant expression for this reaction.



 c) At 435°C the equilibrium constant for this reaction is 1.88 × 10-2. Does equilibrium favor the reactants or products? **Reactants**

1. (6 points) Label the pieces of the lipid bilayer



carbohydrate

Nonpolar hydrophobic tail

Lipid bilayer

Polar hydrophilic head

Integral protein

Phospholipid

10. (3 points) A patient receives an IV containing 2.5% (m/v) glucose solution at the rate of 35 mL in 1 hour. How many grams of glucose does this patient receive after 12 hours?

$$12 hours × \frac{35 mL}{1 hour} × \frac{2.5 g Glucose}{100 mL}=10.5 g glucose$$

