

Exam 1A: Chemistry 102 (Spring 2021)

Name: PRINT _____

Sign _____

1-2) An aqueous solution is 35.00% by mass methanol, CH₃OH (32.04 g/mol) has a density of 0.836 g/mL The **Molality** and **Molarity** of Methanol in the solution is? **(10 pts.)**

3) Based upon the assigned video, what is required WITHIN the cell for the cell to distinguish a virus from necessary proteins? (1-3 words)

Gases dissolved in H ₂ O @ 298K	Molar Mass(g/mol)	k _H (mol L ⁻¹ atm ⁻¹)
Oxygen (O ₂)	32.9978	0.001300
Nitrogen (N ₂)	28.0134	0.006101

4) Air at the top of Everest is approximately 18 % Oxygen and 82% Nitrogen gases by weight (largely because of N₂ being lighter than O₂), what would be the **total concentration** of air **in g/L** or air dissolved in water at the top of Mount Everest where total pressure is approximately 350 torr?

5) How does the virus finally get into the nucleus of the cell? (One sentence)

6) In a Second Order Reaction the Initial concentration of reactant is 550mM and decreases to 0.125 mM in 225 microseconds. What is the rate constant for this reaction **in units of Moles, Liters and seconds?**

7) Explain **WHY?** half-lives are much more practical and useful when dealing with a **1st order reaction** than when dealing with other rate order reactions such as 2nd or 3rd order?

8) In a research experiment, a new non-electrolytic compound was synthesized and it was found that when 23.25 grams was dissolved in cyclohexane up 420.0 mL of solution, the Osmotic Pressure generated was 420.5 torr at 37°C. Assuming the compound was nonvolatile (doesn't dissociate), what is the estimated **molecular weight** determined for this compound?

9) Explain using the Boltzmann Distribution why : *(be concise one or two sentences for each MAX)*
Evaporation is a cooling Process

10-11) The following initial rate data are for the **Oxidation of Ruminite ion by Molybdenum (IV) ion in aqueous solution**: $\text{PbO}_3^{3-} + 2 \text{Mo}^{4+} + \text{H}_2\text{O} \longrightarrow \text{PbO}_4^{3-} + 2 \text{Mo}^{3+} + 2 \text{H}^+$ (10 pts)

Experiment	$[\text{PbO}_3^{3-}]_0$, M	$[\text{Mo}^{4+}]_0$, M	Initial Rate, Ms^{-1}
EXPERIMENT 1	0.270	0.243	5.01E-06
EXPERIMENT 2	0.540	0.243	4.01E-05
EXPERIMENT 3	0.270	0.1215	1.25E-06
EXPERIMENT 4	0.540	0.486	1.60E-04

What is the **determined Rate Law** for the above reaction, including the value of the rate constant k?

12) The reaction of mercury (II) bromide with oxalate ion: $2 \text{HgBr}_2 + \text{C}_2\text{O}_4^{2-} \longrightarrow 2 \text{Br}^- + \text{Hg}_2\text{Br}_2 + 2 \text{CO}_2$ is found to be 1st order in HgBr_2 and 2nd order in oxalate. In an experiment to determine the rate law, the rate constant was determined to be $1.45 \times 10^{-2} \text{ M}^{-2}\text{s}^{-1}$. Using this information, the **RATE** of the reaction when $[\text{HgBr}_2] = 234 \text{ mM}$ and $[\text{C}_2\text{O}_4^{2-}] = 317 \text{ mM}$ would be? *Hint be careful with consistency of units.*

13) The half-life for the 1st order decay of a neurotoxin is found to be 2.5 hrs. If a patient reports to have ingested a quantity equivalent to 150 μM initially in the blood, how long would one need to wait before the level dropped to an acceptable level of 1.0 μM ? (*Hint" What is the rate constant, use equation that allows you to determine t for 1st order reaction*)

14) The **half-life** of radioactive ^{131}I is 8.02 days. What is the rate constant for this first order decay? How long would it take for 75% of 22.5 microgram/cc of $^{131}\text{I}_2$ to decay away?

15-16) The solvent for an organic reaction is prepared by mixing 250.0 ml of acetone ($\text{C}_3\text{H}_6\text{O}$) with 150.0ml of Cyclohexane (C_6H_{12}). This mixture is stored at 22.0 C. The vapor pressure and the densities for the two pure components at 22.0 C are given in the following table. What is the vapor pressure of the total stored mixture?

Compound	Molar Mass g mol^{-1}	Vapor pressure (torr)	Density g/ml
Cyclohexane	84.16	89.12	0.779
Acetone	58.08	201.57	0.791