General Chemistry II
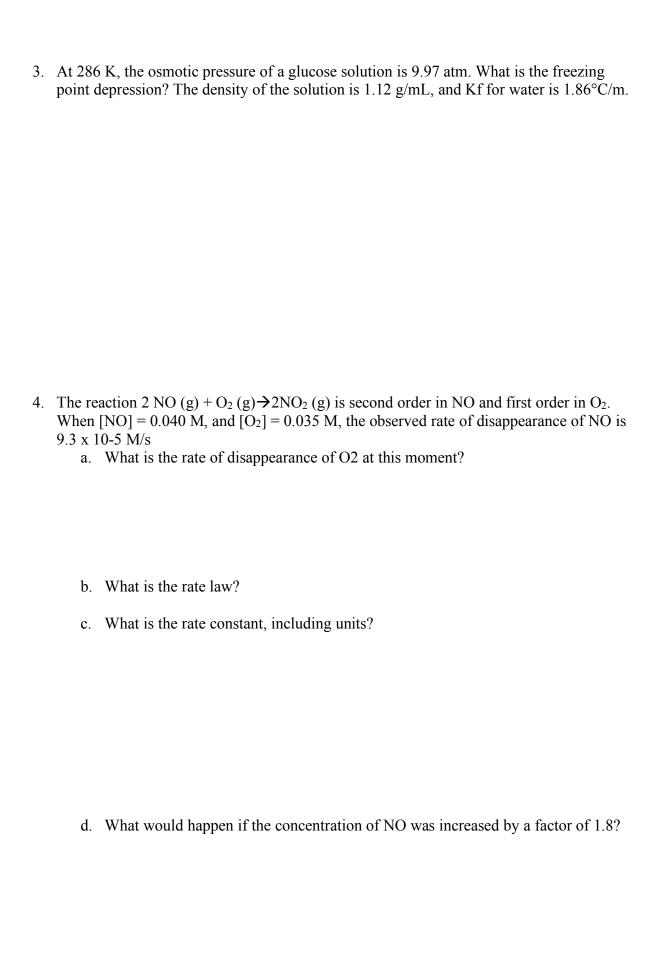RR Exam 1 Review
  Summer 2022

1. The solubility of nitrogen gas in water is 821 µm/L at 0˚C when N_2 pressure above the water is 0.790 atm.
   a. What is the Henry's Law constant for N_2 in units of mol/L*atm?

   b. What is the solubility of N_2 in water when the partial pressure of nitrogen above the water is 1.10 atm at 0˚C?

2. Hemoglobin is a large covalent molecule that carries oxygen in human blood. A water solution that contains 0.263 g of hemoglobin (Hb) in 10.0 mL of solution has an osmotic pressure of 7.51 Torr at 25°C. What is the molar mass of the hemoglobin?

3. At 286 K, the osmotic pressure of a glucose solution is 9.97 atm. What is the freezing point depression? The density of the solution is 1.12 g/mL, and Kf for water is 1.86°C/m.

4. The reaction 2 NO (g) + O_2 (g)→2NO_2 (g) is second order in NO and first order in O_2. When [NO] = 0.040 M, and [O_2] = 0.035 M, the observed rate of disappearance of NO is 9.3 x 10-5 M/s

   a. What is the rate of disappearance of O2 at this moment?

   b. What is the rate law?

   c. What is the rate constant, including units?

   d. What would happen if the concentration of NO was increased by a factor of 1.8?

5. Cyclopentadiene (C_5H_6) reacts with itself to form dicyclopentadiene ($C_{10}H_{12}$). A 0.0400 M solution of C_5H_6 was monitored as a function of time as the reaction $2\ C_5H_6 \rightarrow C_{10}H_{12}$ proceeded. The following data were collected:

Time (s)	[C_5H_6] (M)		
0.0	0.0400		
50.0	0.0300		
100.0	0.0240		
150.0	0.0201		
200.0	0.0174		

    a. What is the order of the reaction?

    b. What is the rate constant?

6. The decomposition of ethanol (C_2H_5OH) on an alumina surface was studied at 600 K: $C_2H_5OH \rightarrow C_2H_4 + H_2O$. Concentration vs. time data were collected, and a plot of [C_2H_5OH] vs. time resulted in a straight line slope of -4.00×10^{-5} M/s.

    a. Determine the rate law, the integrated rate law, and the value of the rate constant for this reaction

    b. If the initial concentration of ethanol is 1.25×10^{-2} M, calculate the half-life for the reaction

    c. How much time is required for all of the ethanol to decompose?

7. NOBr decomposes into NO and Br$_2$.

Time (s)	[NOBr] (M)		
10.	0.50		
20.	0.33		
30.	0.25		
40.	0.20		

    a. What is the order of the reaction?

    b. What is the rate constant?

8. Consider the following solutions (assume complete dissociation in water):

0.24 m K$_3$PO$_4$ 0.72 m CH$_3$OH   0.33 m CaI$_2$ 0.5 m C$_2$H$_6$O   0.45 m NaCl

    a. Which has the highest boiling point?

    b. Rank in order of freezing point, lowest to highest.

    c. What is the vapor pressure of the water in the solution of 0.72 m CH$_3$OH if P°$_{water}$ = 525.8 mmHg and the density of water is 1 g/mL?