

Dr. Zellmer  
Time: 7 PM Sun.  
30 min

Chemistry 1220  
Spring Semester 2023  
Quiz II

All Sections  
January 29, 2023

Name \_\_\_\_\_ Rec. TA/time \_\_\_\_\_

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Show **ALL** your work or **EXPLAIN** to receive full credit.  $R = 0.08206 \text{ L}\cdot\text{atm/mol}\cdot\text{K} = 8.314 \text{ J/mol}\cdot\text{K}$

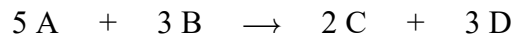
1. (6 pts) At  $63.5^\circ\text{C}$  the vapor pressure of water is 175.0 torr and that of ethanol ( $\text{C}_2\text{H}_6\text{O}$ ) is 400.0 torr. Assume that water and ethanol form an ideal solution. A solution is made by mixing 0.555 moles of  $\text{H}_2\text{O}$  and 0.217 moles of  $\text{C}_2\text{H}_6\text{O}$ . (Mol. Wts.  $\text{H}_2\text{O} = 18.02$ ,  $\text{C}_2\text{H}_6\text{O} = 46.07$ )

a) What is the **total** vapor pressure above the solution?

b) What is the **mole fraction** of ethanol ( $\text{C}_2\text{H}_6\text{O}$ ) **in** the **vapor** above the solution? (Not asked on quiz.)

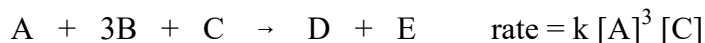
2. (5 pts) You have a 0.0020 M aqueous  $\text{Fe}(\text{NO}_3)_3$  solution? Assuming an “ideal” ionic solution (i.e. no ion-pairing), what would be the osmotic pressure at  $30.0^\circ\text{C}$ ? **Show work or explain your answers.**
3. (2 pts) Which of the following statements is FALSE?
- a) The vapor pressure of a solution with a nonvolatile solute is due just to the solvent.
  - b) A 0.10 *m* solution of  $\text{MgSO}_4$  would be expected to exhibit more ion pairing than a 0.10 *m* solution of  $\text{NaCl}$ .
  - c) Hydrophilic colloid particles tend to stay dispersed in water.
  - d) The vapor pressure of a solution increases with increasing temperature.
  - e) The vapor pressure of a solution of a nonvolatile solute is higher than that of the pure solvent.
4. (2 pts) Solution A is hypotonic with respect to solution B. What does this mean about the relative osmotic pressures of the two solutions and the relative concentrations of solute in the solutions? **Explain.**
5. (4 pts) The freezing point of p-dichlorobenzene is  $53.1^\circ\text{C}$ . A solution of 1.26 g of a sulfa drug in 10.0 g of p-dichlorobenzene freezes at  $47.9^\circ\text{C}$ . What is the molecular weight of the sulfa drug? ( $K_f = 7.10^\circ\text{C/m}$ )

6. (3 pts) For the reaction below, the rate of disappearance of reactant A ( $-\Delta[A]/\Delta t$ ) is 0.55 M/s. What is the rate of appearance of product C ( $\Delta[C]/\Delta t$ ) in M/s? **Show work or explain your answer.**



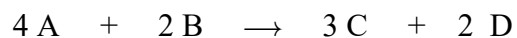
7. (3 pts) A reaction is **3/2 order** in **A**, **second order** in **B** and **1/2 order** in **C**. The initial rate of the reaction is  $1.0 \times 10^{-6}$  M/sec when the initial concentrations are,  $[A]_0 = 0.0100$  M,  $[B]_0 = 0.0200$  M and  $[C]_0 = 0.0100$  M. What is the **rate constant** (in  $\text{M}^{-3}\text{s}^{-1}$ )?

8. (3 pts) For the reaction and rate law given below, which of the statements is **CORRECT**?



- 1) the reaction is fourth order overall
- 2) tripling  $[\text{A}]$  will increase the rate by a factor of 9
- 3) doubling  $[\text{C}]$  will increase the rate by a factor of 4
- 4) assuming the units for rate are M/s, the units for  $k$  would be  $\text{M}^{-3}\cdot\text{s}^{-1}$
- 5) tripling the rate constant,  $k$ , will increase the rate by a factor of 9

9. (12 pts) The following data were measure for the reaction



<u>Experiment</u>	<u>[A] (M)</u>	<u>[C] (M)</u>	<u>Initial rate (M/s)</u>
1	0.200	0.200	0.2000
2	0.600	0.200	5.4000
3	0.600	0.400	1.3500
4	0.200	0.400	0.0500
5	0.400	0.600	0.1778

- a) What is the **rate law** for the reaction?

- b) What is the reaction **order** with respect to each **compound** AND what is the **overall** reaction **order**?

order with respect to A =

order with respect to C =

overall order of the reaction =

- c) What is the value of the **rate constant** (based on data from experiment 1)?

# USEFUL INFORMATION

$$R = 0.08206 \text{ L-atm/mol-K} = 8.3145 \text{ J/mol-K}$$

	IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII B					IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA	
1	1.008 <b>H</b> 1																			4.003 <b>He</b> 2	
2	6.941 <b>Li</b> 3	9.012 <b>Be</b> 4														10.811 <b>B</b> 5	12.011 <b>C</b> 6	14.007 <b>N</b> 7	15.999 <b>O</b> 8	18.998 <b>F</b> 9	20.179 <b>Ne</b> 10
3	22.990 <b>Na</b> 11	24.305 <b>Mg</b> 12														26.98 <b>Al</b> 13	28.09 <b>Si</b> 14	30.974 <b>P</b> 15	32.06 <b>S</b> 16	35.453 <b>Cl</b> 17	39.948 <b>Ar</b> 18
4	39.098 <b>K</b> 19	40.08 <b>Ca</b> 20	44.96 <b>Sc</b> 21	47.88 <b>Ti</b> 22	50.94 <b>V</b> 23	52.00 <b>Cr</b> 24	54.94 <b>Mn</b> 25	55.85 <b>Fe</b> 26	58.93 <b>Co</b> 27	58.69 <b>Ni</b> 28	63.546 <b>Cu</b> 29	65.38 <b>Zn</b> 30	69.72 <b>Ga</b> 31	72.59 <b>Ge</b> 32	74.92 <b>As</b> 33	78.96 <b>Se</b> 34	79.904 <b>Br</b> 35	83.80 <b>Kr</b> 36			
5	85.47 <b>Rb</b> 37	87.62 <b>Sr</b> 38	88.91 <b>Y</b> 39	91.22 <b>Zr</b> 40	92.91 <b>Nb</b> 41	95.94 <b>Mo</b> 42	98 <b>Tc</b> 43	101.07 <b>Ru</b> 44	102.91 <b>Rh</b> 45	106.42 <b>Pd</b> 46	107.87 <b>Ag</b> 47	112.41 <b>Cd</b> 48	114.82 <b>In</b> 49	118.69 <b>Sn</b> 50	121.75 <b>Sb</b> 51	127.60 <b>Te</b> 52	126.90 <b>I</b> 53	131.39 <b>Xe</b> 54			
6	132.91 <b>Cs</b> 55	137.33 <b>Ba</b> 56	138.91 <b>La</b> 57	178.39 <b>Hf</b> 72	180.95 <b>Ta</b> 73	183.85 <b>W</b> 74	186.21 <b>Re</b> 75	190.23 <b>Os</b> 76	192.22 <b>Ir</b> 77	195.08 <b>Pt</b> 78	196.97 <b>Au</b> 79	200.59 <b>Hg</b> 80	204.38 <b>Tl</b> 81	207.2 <b>Pb</b> 82	208.98 <b>Bi</b> 83	209 <b>Po</b> 84	210 <b>At</b> 85	222 <b>Rn</b> 86			
7	223 <b>Fr</b> 87	226.03 <b>Ra</b> 88	227.03 <b>Ac</b> 89	261 <b>Rf</b> 104	262 <b>Ha</b> 105	263 <b>Sg</b> 106	262 <b>Ns</b> 107	265 <b>Hs</b> 108	266 <b>Mt</b> 109	269 110	272 111	277 112									

Lanthanide Series	140.12 <b>Ce</b> 58	140.91 <b>Pr</b> 59	144.24 <b>Nd</b> 60	145 <b>Pm</b> 61	150.36 <b>Sm</b> 62	151.96 <b>Eu</b> 63	157.25 <b>Gd</b> 64	158.93 <b>Tb</b> 65	162.50 <b>Dy</b> 66	164.93 <b>Ho</b> 67	167.26 <b>Er</b> 68	168.93 <b>Tm</b> 69	173.04 <b>Yb</b> 70	173.04 <b>Lu</b> 71
Actinide Series	232.04 <b>Th</b> 90	231.04 <b>Pa</b> 91	238.03 <b>U</b> 92	237.05 <b>Np</b> 93	<b>Pu</b> 94	<b>Am</b> 95	<b>Cm</b> 96	<b>Bk</b> 97	<b>Cf</b> 98	<b>Es</b> 99	<b>Fm</b> 100	<b>Md</b> 101	<b>No</b> 102	<b>Lr</b> 103

A PERIODIC CHART OF THE ELEMENTS  
(Based on <sup>12</sup>C)