

Dr. Zellmer  
Time: 7 PM Sun.  
40 min

Chemistry 1250  
Spring Semester 2022  
Quiz IX

T, R  
April 3, 2022

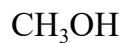
Name \_\_\_\_\_ Rec. TA/time \_\_\_\_\_

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Show **ALL** your work or **EXPLAIN** to receive full credit.

1. (2 pts) The solubility of a solid solute is 32.3 g solute/100 g H<sub>2</sub>O at 20 °C. What minimum mass (in grams) of solute would need to be added to 13.1 g H<sub>2</sub>O at 20 °C to make the solution saturated?

2. (4 pts) Which of the following are **soluble** in **water**, H<sub>2</sub>O, and **WHY** (give a brief explanation dealing w. IAF & type of compound; ionic, polar, nonpolar for both solute and solvent)? (Circle all that apply.)



3. (8 pts) When  $\text{CH}_3\text{OCH}_3$  dissolves in  $\text{H}_2\text{O}$  forces of attraction are being broken in the solute and in the solvent and attractive forces are formed between the solute and solvent. Answer the following questions concerning this process. (H, C, N and O are in groups 1A, 4A, 5A and 6A, respectively. H, C, N and O have 1, 6, 7 and 8 electrons, respectively.) **Explain your choices!**

a) What forces of attraction are broken between  $\text{CH}_3\text{OCH}_3$  molecules?

b) What forces of attraction are broken between  $\text{H}_2\text{O}$  molecules?

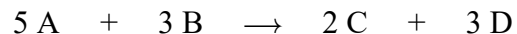
c) What forces of attraction are formed between  $\text{CH}_3\text{OCH}_3$  and  $\text{H}_2\text{O}$  in forming the solution?

4. (2 pts) What happens to the solubility of a gas in water as temperature increases?

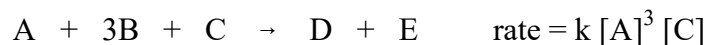
Not on Carmen quiz

5. (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.**
6. (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? ( $K_f = 7.10^\circ\text{C}/\text{m}$ )

7. (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.**

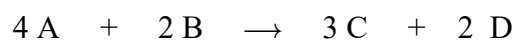


8. (3 pts) For the reaction and rate law given below, which of the statements is **CORRECT**?



- 1) the reaction is fourth order overall
  - 2) tripling [A] will increase the rate by a factor of 9
  - 3) doubling [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  $M^{-3} \cdot s^{-1}$
  - 5) tripling the rate constant, k, will increase the rate by a factor of 9
- a) 1, 2                      b) 1, 5                      c) 2, 3                      d) 1, 4                      e) 1, 4, 5

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)?

10. (6 pts) The rate law for the decomposition of  $AB_2$  ( $AB_2 \rightarrow AB + \frac{1}{2} B_2$ ) is

$$r = (0.630 \text{ M}^{-1}\cdot\text{s}^{-1}) [AB_2]^2.$$

- a) (4 pts) If the initial concentration of  $AB_2$  is 3.00 M what will the **concentration** of  $AB_2$  be (in M) after 1.00 minute?

- b) (2 pts) What is the rate after 1.00 minute?      Not asked for on the Carmen quiz.

11. (4 pts) The decomposition of  $AB$  ( $AB \rightarrow A + B$ ) is zero order in  $AB$  with a rate constant of  $1.10 \times 10^{-3} \text{ M}\cdot\text{s}^{-1}$ . If the initial concentration is 0.100 M at the very start of the reaction what is the second half-life (in minutes)?

## USEFUL INFORMATION

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

$$[A]_t = -kt + [A]_0 \quad \frac{1}{[A]_t} = kt + \frac{1}{[A]_0} \quad \ln[A]_t = -kt + \ln[A]_0$$

$$t_{1/2} = \frac{0.693}{k} \quad t_{1/2} = \frac{1}{k[A]_0} \quad t_{1/2} = \frac{[A]_0}{2k}$$

	IA	IIA	IIIB	IVB	VB	VIB	VIIIB	VIIIB	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 <b>110</b>	272 <b>111</b>	277 <b>112</b>						

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)