Dr. Zellmer | Chemistry 1220 | All Sections
Time: 7 PM Sun. | Spring Semester 2023 | January 29, 2023
30 min | Quiz II

Name _____ Rec. TA/time _____

Show **ALL** your work or **EXPLAIN** to receive full credit. R = 0.08206 L•atm/mol•K = 8.314 J/mol•K

1. (6 pts) At 63.5°C the vapor pressure of water is 175.0 torr and that of ethanol (C_2H_6O) is 400.0 torr. Assume that water and ethanol form an ideal solution. A solution is made by mixing 0.555 moles of H_2O and 0.217 moles of C_2H_6O. (Mol. Wts. H_2O = 18.02, C_2H_6O = 46.07)

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

   b) What is the **mole fraction** of ethanol (C_2H_6O) **in** the **vapor** above the solution? (Not asked on quiz.)

2. (5 pts) You have a 0.0020 M aqueous $Fe(NO_3)_3$ solution? Assuming an "ideal" ionic solution (i.e. no ion-pairing), what would be the **osmotic pressure** at 30.0°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 $MgSO_4$ would be expected to exhibit more ion pairing than a 0.10 ***m*** solution of 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°C. A solution of 1.26 g of a sulfa drug in 10.0 g of p-dichlorobenzene freezes at 47.9 °C. What is the **molecular weight** of the sulfa drug? (K_f = 7.10 °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.**

$$5\,A + 3\,B \longrightarrow 2\,C + 3\,D$$

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 1.0×10^{-6} M/sec when the initial concentrations are, $[A]_o = 0.0100$ M, $[B]_o = 0.0200$ M and $[C]_o = 0.0100$ M. What is the **rate constant** (in $M^{-3}s^{-1}$)?

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

$$A + 3B + C \rightarrow D + E \qquad \text{rate} = k\,[A]^3\,[C]$$

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 $M^{-3} \bullet s^{-1}$
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

$$4\,A + 2\,B \longrightarrow 3\,C + 2\,D$$

Experiment	[A] (M)	[C] (M)	Initial rate (M/s)
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 L-atm/mol-K = 8.3145 J/mol-K

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

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

A PERIODIC CHART OF THE ELEMENTS
(Based on ^{12}C)