Dr. Zellmer | Chemistry 1250 | T, R
Time: 6 PM Mon. | Spring Semester 2022 | April 18, 2022
40 min | Quiz XI

Name _____ Rec. TA/time _____

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

1. (3 pts) For the following reaction $K_C = 25.8$. The reaction is started with 1.000 mole of AB_3, 2.000 moles of AB_2 and 1.000 mole of B_2 in a 2.000-L container. Determine if the reaction is at equilibrium or not? If not, which direction will it proceed to reach equilibrium? **Show work and explain!**

$$2\ AB_2(g) \quad + \quad B_2(g) \quad \rightleftarrows \quad 2\ AB_3(g)$$

2. (9 pts) For the following reaction K_C equals 7.10×10^{-4}, at 25 °C.

$$CaCrO_4\ (s) \quad \rightleftarrows \quad Ca^{2+}\ (aq) \quad + \quad CrO_4^{2-}\ (aq)$$

a) (4 pts) What are the **equilibrium** concentrations of Ca^{2+} and CrO_4^{2-} if solid $CaCrO_4$ is placed in water to form a saturated solution at 25°C? (**Show the ICE table. State any assumptions made and check your percent error.**)

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2. (Cont.)

b) (1 pts) For the system at equilibrium, what happens when $CaCl_2(s)$, a soluble compound, is added?? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) **EXPLAIN!**

c) (1 pts) For the system at equilibrium, what happens when **water** is **added** to the system? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) **EXPLAIN!**

d) (1 pts) For the system at equilibrium, what happens when part of the $CaCrO_4$ is **removed**? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) **EXPLAIN!**

e) (2 pts) Assuming the above reaction is endothermic, what happens when the temperature increases? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) Also, what happens to the value of K? **EXPLAIN!**

3. (9 pts) For the following reaction K_C equals 5.35×10^2 at 80 °C.

$$PH_3\,(g) \quad + \quad BCl_3\,(g) \quad \rightleftarrows \quad PH_3BCl_3\,(s)$$

a) (4pts) What are the **equilibrium** concentrations of PH_3 and BCl_3 if 1.000 mole of each is placed in a 0.500-L vessel and allowed to react until equilibrium is reached? (**Show the ICE table. When appropriate, state any assumptions made and check your percent error.**)

NOT on Carmen quiz - just for practice

b) (1 pt) For the system at equilibrium, what happens to the reaction when the **pressure** is **increased** by adding Ne (an inert gas) at **constant temperature** and **volume**? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) **EXPLAIN!**

c) (1 pt) For the system at equilibrium, what happens to the reaction when PH_3 is **added**? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) **EXPLAIN!**

d) (1 pt) For the system at equilibrium, what happens to the reaction when **all** the PH_3BCl_3 is **removed**? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) **EXPLAIN!**

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3. (Cont.)

e) (2 pts) Assuming the above reaction is exothermic, what happens when the temperature decreases? (i.e. does the equilibrium shift and if so in what direction? If no shift then why not.) Also, what happens to the value of K? **EXPLAIN!**

4. (2 pts) What is(are) the difference(s) between the **Arrhenius** and **Bronsted-Lowry** definitions of a **base**? **Not on quiz - just for practice.**

5. (3 pts) What is the **conjugate <u>acid</u>** of $H_2P_2O_7^{2-}$?

6. (2 pts) Which of the following are **strong** acids or **strong** bases? (Circle all that apply.)

HNO_3	$HClO_2$	$HClO_4$	RbOH	NH_3
$HBrO_3$	N^{3-}	HSO_4^-	HF	C_6H_5OH

7. (5 pts) A saturated solution of $Ca(OH)_2$ has a $[Ca^{2+}]$ of 0.15 M. What is the pH of the solution? (atomic weights: Ca = 40.08, O = 16.00, H = 1.008)

8. (6 pts) A 0.0100 M solution of an acid is 19.0% ionized at 25 °C. **Show all work or explain!**

a) What are the **$[H^+]$** and **pH** of this solution?

b) What is the **K_a** for the acid? **Show the ICE table.**

9. (11 pts) You have a solution of 0.0942 M aniline, $C_6H_5NH_2$, with $K_b = 4.3 \times 10^{-10}$, at 25°C. (**Show the ICE table, state any assumptions made and check your percent error**.) **Show all work or explain!**

a) What are $[H^+]$, $[OH^-]$, pH and pOH in this solution?

b) What is the **<u>percent</u> <u>ionization</u>** for $C_6H_5NH_2$ in this solution?

10. (3 pts) Given the following K_a values, determine which species is the **<u>strongest</u> base**. **Explain!**

HSO_3^- 6.3×10^{-8} HPO_4^{2-} 4.8×10^{-13} HCO_3^- 4.7×10^{-11}

USEFUL INFORMATION

R = 0.08206 L-atm/mol-K = 8.3145 J/mol-K

$$K_p = K_c\,(RT)^{\Delta n}$$

$$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14} \quad (at\ 25°C)$$

$$pH = -\log[H_3O^+]\ ; \quad pOH = -\log[OH^-]\ ; \quad pK_w = -\log[K_w]$$

$$for\ \ ax^2 + bx + c = 0, \qquad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

	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)