Dr. Zellmer | Chemistry 1220 | All Sections
Time: 7 PM Sun. | Spring Semester 2023 | February 12, 2023
30 min | Quiz IV

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. The equilibrium constant for the following reaction is 70 at 350°C. A system at equilibrium has $[N_2] = 0.200$ M and $[NH_3] = 0.118$ M. What is the $[H_2]$?

$$N_2(g) + 3\ H_2(g) \rightleftarrows 2\ NH_3(g)$$

2. The properly written heterogeneous K_c expression for the following reaction as written is:

$$NiCO_3\ (s) + 2\ H^+\ (aq) \rightleftarrows Ni^{2+}\ (aq) + CO_2\ (g) + H_2O\ (l)$$

3. (3 pts) At equilibrium, which of the following is(are) **TRUE**?

a) All chemical processes have ceased.

b) The rate constant for the forward reaction equals that of the reverse.

c) The rate of the forward reaction equals that of the reverse.

d) Both the rate of the forward reaction equals that of the reverse and the rate constant for the forward reaction equals that of the reverse.

e) The concentrations of reactants and products are constant.

4. (3 pts) For the following reaction $K_P = 3.14 \times 10^{-10}$ at 727.0 °C .

$$5\ NO\ (g) + 5/2\ Br_2\ (g) \rightleftarrows 5\ NOBr\ (g) \qquad \textbf{Rxn 1}$$

What is the value of K_P for the following reaction, **Rxn 2**? **Show all work or explain.**

$$2\ NOBr\ (g) \rightleftarrows 2\ NO\ (g) + Br_2\ (g) \qquad \textbf{Rxn 2}$$

5. Given the following two equilibrium reactions,

(1) $2\ NO\ (g) + Br_2\ (g) \rightleftarrows 2\ NOBr\ (g) \qquad K_1 = 2.00$

(2) $NO\ (g) \rightleftarrows \frac{1}{2}\ N_2\ (g) + \frac{1}{2}\ O_2\ (g) \qquad K_2 = 1.45 \times 10^{15}$

What is the equilibrium constant, K_3, for the reaction below?

$$N_2\ (g) + O_2\ (g) + Br_2\ (g) \rightleftarrows 2\ NOBr\ (g) \qquad K_3$$

6. The equilibrium constant K_c for the following reaction at 1100°C is 6.80×10^{51}. What is K_p?

$$B(\mathbf{s}) + 3/2\ F_2(g) \rightleftarrows BF_3(g)$$

7. (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!**

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

8. (5 pts) The following reaction is started with 2.000 moles of SO_3 in a 2.000-L container. When equilibrium is reached there are 1.645 moles of SO_3 in the container. What is the value of the **equilibrium constant**, K_C? (**Show the ICE table. You can use numbers or variables in your ICE table.)**

$$2\ SO_3(g) \rightleftarrows 2\ SO_2(g) + O_2(g)$$

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

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

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.**)

10. (3 pts) A plot of ln(r) vs. ln[A] has a slope of -2.5 and an intercept of -10.55. Determine the **rate constant** and **order** of the reaction for the rate law, $r = k[A]^n$.

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)