

(3340)

Chemistry 14A Fall 2007: Quiz 13 Professor: Lavelle

Name: _____

Student ID Number: _____

TA: _____ Sid Kannan _____

Discussion Section: _____ 3K _____

Write in Pen.

Check your significant figures and units.

Good Luck.

Total points: 40

Total time: 40 minutes

2pt for sf

2pt for units

Planck's constant, $h = 6.62608 \times 10^{-34} \text{ J}\cdot\text{s}$

Avogadro's constant, $N_A = 6.02214 \times 10^{23} \text{ mol}^{-1}$

Rydberg constant, $R = 3.28984 \times 10^{15} \text{ Hz}$

Boltzmann's constant, $k = 1.38 \times 10^{-23} \text{ J}\cdot\text{K}^{-1}$

Faraday's constant, $F = 96,485 \text{ C}\cdot\text{mol}^{-1}$

Gas constant, $R = 8.314 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 8.206 \times 10^{-2} \text{ L}\cdot\text{atm}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} =$

$8.314 \times 10^{-2} \text{ L}\cdot\text{bar}\cdot\text{K}^{-1}\cdot\text{mol}^{-1} = 62.364 \text{ L}\cdot\text{Torr}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$

Mass of electron, $m_e = 9.1095 \times 10^{-31} \text{ kg}$

Speed of light, $c = 2.99792 \times 10^8 \text{ m}\cdot\text{s}^{-1}$

C_2 = Second radiation constant = 0.0144 K·m

$0^\circ\text{C} = 273.15 \text{ K}$

$1\text{L} = 1 \text{ dm}^3$

$1 \text{ atm} = 101.325 \text{ kPa}$

$\pi = 3.14$

Water Density = $1 \text{ g}\cdot\text{ml}^{-1}$

$\ln(X) = 2.303 \log_{10}(X)$

$1 \text{ kcal} = 4.18 \text{ kJ}$

$1 \text{ eV} = 1.602 \times 10^{-19} \text{ J}$

$c = \lambda v$

$E = h\nu$

$E = pc$

$p = mv$

$$E_n = -\frac{hR}{n^2}$$

$$E_n = \frac{h^2 n^2}{8mL^2}$$

$$\lambda = \frac{h}{p}$$

$$E = \frac{1}{2}mv^2$$

$$T \lambda_{MAX} = \frac{1}{5} C_2$$

$$\Delta p \times \Delta x \geq \frac{h}{4\pi}$$

$$E_{TOTAL} \psi(x) = E_K \psi(x) + V(x) \psi(x) = -\frac{\hbar^2}{8\pi^2 m} \frac{d^2\psi(x)}{dx^2} + V(x) \psi(x)$$

$$PV = nRT$$

1	H	1.007276
2	He	4.002601
3	Li	6.941277
4	Be	9.012141
5	Mg	24.305
6	Na	22.990
7	K	39.098
8	Ca	40.018
9	Sc	44.956
10	Ti	47.987
11	V	50.942
12	Cr	51.958
13	Mn	54.938
14	Fe	55.846
15	Co	58.923
16	Ni	58.935
17	Cu	63.545
18	Zn	65.456
19	Ga	69.723
20	Ge	72.641
21	In	73.95
22	Ga	74.922
23	Ge	75.946
24	In	76.955
25	Ge	77.965
26	In	78.975
27	Ge	79.985
28	In	80.995
29	Ge	81.996
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376	In	428.996
377	Ge	429.996
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380	In	432.996
381	Ge	433.996
382	In	434.996
383	Ge	435.9

1. Determine the oxidation state of chromium in $[\text{Cr}(\text{OH})_2(\text{NH}_3)_3(\text{H}_2\text{O})]^+$. (3pts)

Answer Chromium (II) 3+

X How many $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ ligands would be found in an square planar complex with Pt^{2+} as the central metal ion? (3pts)

Answer 8 (2)

3. What is the name of the complex $\text{Na}[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$? (3pts)

Answer Sodium triammine trichloro cobalt(III)

4. Which of the following is the formula of potassium hexacyanoferrate(II)? (3pts)

- A. $[\text{Fe}(\text{CN})_6]$
- B. $\text{K}[\text{Fe}(\text{CN})_6]$
- C. $\text{K}_2[\text{Fe}(\text{CN})_6]$
- D. $\text{K}_3[\text{Fe}(\text{CN})_6]$
- E. $\text{K}_4[\text{Fe}(\text{CN})_6]$

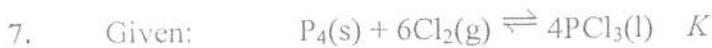
5. Which of the following are bidentate ligands? (3pts)

- I. SO_4^{2-}
- II. $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- III. $\text{C}_2\text{O}_4^{2-}$
- IV. NCS^-
- A. (I) and (II)
- B. (III) and (IV)
- C. (II) and (III)
- D. (II), (III) and (IV)

6. For each of the following equilibria, state whether reactants or products will be favored by an increase in the total pressure resulting from compression. (3pts)



- A. I – Reactants will be favored; II – products will be favored.
- B. I – products will be favored; II – Reactants will be favored.
- C. I, II – Reactants will be favored.
- D. I, II – products will be favored.



Calculate the equilibrium constant for the following reaction. (3pts)



- A. $-K^{1/2}$
- B. $1/K^{1/2}$
- C. $1/K^2$
- D. $1/K$
- E. $K^{1/2}$

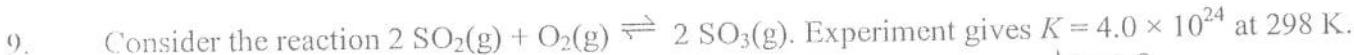
$$K_F = \frac{[P_4]^{\frac{1}{2}} [Cl_2]^3}{[PCl_3]^2}$$

X The effect of a volume decrease on the reaction



is (3pts)

- A. that K decreases.
- B. more CO(g) and H₂(g) are produced.
- C. no change.
- D. more H₂O(g) is produced.
- E. that K increases.



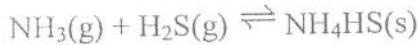
Which of the following can be concluded? (3pts)

large

- A. Very little reaction is expected to take place at the given temperature.
- B. This reaction essentially goes to completion at the given temperature.
- C. Neither reactants nor products are strongly favored at equilibrium.
- D. Very little reaction is expected to take place at any temperature.

$Q < K \rightarrow$ product favored

10. For the reaction



$K_c = 9.7$ at 900 K. If the initial concentrations of NH₃(g) and H₂S(g) are 2.0 M, what is the equilibrium concentration of NH₃(g)? (3pts)

- A. 1.9 M
- B. 1.7 M
- C. 0.20 M
- D. 0.10 M
- E. 0.32 M

$$K_C = 9.7, 900K$$

	NH ₃	H ₂ S	NH ₄ HS
I	2	2	—
C	$-x$	$-x$	—
E	$2-x$	$2-x$	—

$$K_C = 9.7 = \frac{1}{(2-x)(2-x)} \quad 2$$

$$9.7 = \frac{1}{4-4x+x^2} \quad 2$$

$$x = \frac{2.32}{1.67}$$

$$2 - 1.67 = .32$$

11. Consider the following reaction at a certain temperature:



At equilibrium, $[\text{PCl}_5] = 2.00 \text{ M}$ and $[\text{PCl}_3] = [\text{Cl}_2] = 1.00 \text{ M}$. If suddenly 1.00 M $\text{PCl}_5(\text{g})$, $\text{PCl}_3(\text{g})$, and $\text{Cl}_2(\text{g})$ is added, what is the equilibrium concentration of $\text{PCl}_5(\text{g})$? (10pts)

	PCl_5	PCl_3	Cl_2	at equilibrium
I	2	1	1	
C				
E	2	1	1	✓

$$K_C = \frac{[\text{PCl}_3][\text{Cl}_2]}{[\text{PCl}_5]} = \frac{[1][1]}{[2]} = 0.5 - K$$

	PCl_5	PCl_3	Cl_2	
I	3	2	2	
C	$-x$	$+x$	$+x$	$K = \frac{[\text{PCl}_3][\text{Cl}_2]}{[\text{PCl}_5]}$
E	$3-x$	$2+x$	$2+x$	good

$$0.5 = \frac{(2+x)(2+x)}{(3-x)} \rightarrow 1.5 - 0.5x = 2^2 + 4x + x^2$$

$$x^2 + 5.5x + 2.5 = 0$$

$$x = \frac{-4.5 \pm \sqrt{4.5^2 - 4(1)(2.5)}}{2(1)} = \frac{-4.5 \pm 3.8}{2} = -0.75 \text{ or } -3.8$$

$$x = \frac{5.2 - 0.649}{(2+0.649)} =$$

$$[\text{PCl}_5] = 3 - 0.649 = \boxed{3.649 \text{ M}}$$