33/40

Chemistry 14A Fall 2007: Quiz #3 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, $h = 6.62608 \times 10^{-34}$ J.s

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

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

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

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

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

8.314×10^{-2} L·bar·K^{-1}·mol^{-1} $= 62.364$ L·Torr·K^{-1}·mol^{-1}

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

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

C_2 = Second radiation constant = 0.0144 K·m

0°C = 273.15 K 1L = 1 dm^3 1 atm = 101.325 kPa $\pi = 3.14$

Water Density = 1g.ml^{-1} $\ln(X) = 2.303 \log_{10}(X)$ 1 kcal = 4.18 kJ

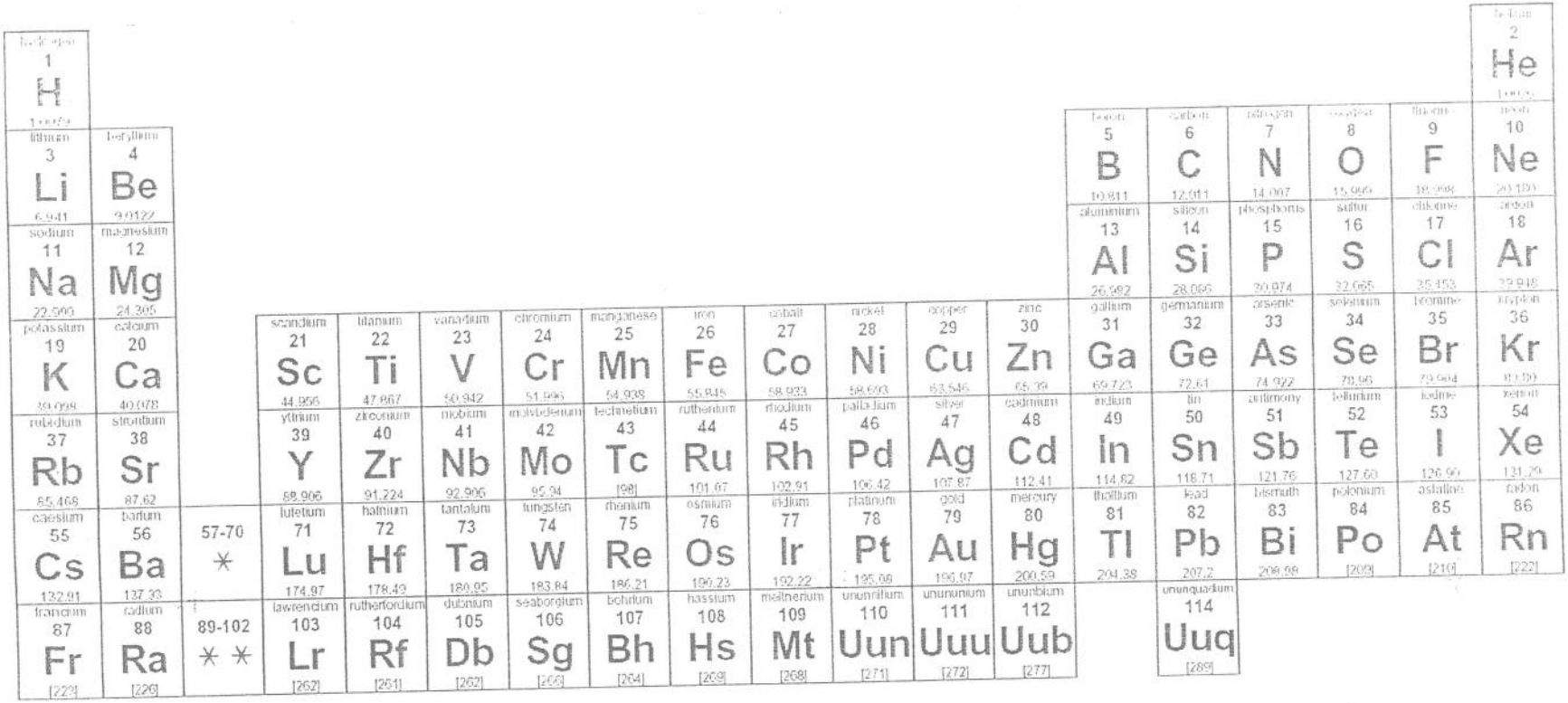
1 eV = 1.602×10^{-19} J

$c = \lambda \nu$ $E = h\nu$ $E = pc$ $p = mv$ $E_n = -\frac{h R}{n^2}$

$\lambda = \frac{h}{p}$ $E = \frac{1}{2} mv^2$ $T \lambda_{MAX} = \frac{1}{5} C_2$ $\Delta p \times \Delta x \geq \frac{h}{4\pi}$ $E_n = \frac{h^2 n^2}{8\, m\, L^2}$

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

PV=nRT



																	2 He
											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
1 H 1.008											13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948
3 Li 6.941	4 Be 9.0122										31 Ga 69.723	32 Ge 72.61	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80
11 Na 22.990	12 Mg 24.305										49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
19 K 39.098	20 Ca 40.078		21 Sc 44.956	22 Ti 47.867	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.693	29 Cu 63.546	30 Zn 65.39	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po [209]	85 At [210]	86 Rn [222]
37 Rb 85.468	38 Sr 87.62		39 Y 88.906	40 Zr 91.224	41 Nb 92.906	42 Mo 95.94	43 Tc [98]	44 Ru 101.07	45 Rh 102.91	46 Pd 106.42	47 Ag 107.87	48 Cd 112.41						
55 Cs 132.91	56 Ba 137.33	57-70 *	71 Lu 174.97	72 Hf 178.49	73 Ta 180.95	74 W 183.84	75 Re 186.21	76 Os 190.23	77 Ir 192.22	78 Pt 195.08	79 Au 196.97	80 Hg 200.59						
87 Fr [223]	88 Ra [226]	89-102 * *	103 Lr [262]	104 Rf [261]	105 Db [262]	106 Sg [266]	107 Bh [264]	108 Hs [269]	109 Mt [268]	110 Uun [271]	111 Uuu [272]	112 Uub [277]		114 Uuq [289]				

* Lanthanide series	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm [145]	62 Sm 150.36	63 Eu 151.96	64 Gd 157.25	65 Tb 158.93	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04
* * Actinide series	89 Ac [227]	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np [237]	94 Pu [244]	95 Am [243]	96 Cm [247]	97 Bk [247]	98 Cf [251]	99 Es [252]	100 Fm [257]	101 Md [258]	102 No [259]

http://www.bpc.edu/mathscience/chemistry/images/periodic_table_of_elements.jpg

11/29/2007

1. Determine the oxidation state of chromium in $[Cr(OH)_2(NH_3)_3(H_2O)]^+$. (3pts)

Answer Chromium (III) (3+)

2. How many $NH_2CH_2CH_2NH_2$ 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 $Na[Co(NH_3)_3Cl_3]$? (3pts)

Answer

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

A. $[Fe(CN)_6]$
B. $K[Fe(CN)_6]$
C. $K_2[Fe(CN)_6]$
D. $K_3[Fe(CN)_6]$
(E.) $K_4[Fe(CN)_6]$

$K_4[Fe^{+2}(CN)_6^{-1}]^{-4}$

$+2-6=-4$

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

I. SO_4^{2-}
II. $NH_2CH_2CH_2NH_2$
(III.) $C_2O_4^{2-}$
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)

I. $2\ CH_4(g) + S_8(s) \rightleftharpoons 2\ CS_2(l) + 4\ H_2S(g)$
II. $HgO(s) \rightleftharpoons Hg(l) + O_2(g)$

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.

7. Given: $P_4(s) + 6Cl_2(g) \rightleftharpoons 4PCl_3(l)$ K

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

$$2PCl_3(l) \rightleftharpoons 3Cl_2(g) + \tfrac{1}{2} P_4(s)$$

A. $-K^{1/2}$

B. $1/K^{1/2}$

C. $1/K^2$

D. $1/K$

E. $K^{1/2}$

$$K_1 = \frac{[PCl_3]^4}{[P_4][Cl_2]^6}$$

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

8. The effect of a volume decrease on the reaction

$C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$

is (3pts)

A. that K decreases.

B. more $CO(g)$ and $H_2(g)$ are produced.

C. no change.

D. more $H_2O(g)$ is produced.

E. that K increases.

9. Consider the reaction $2\ SO_2(g) + O_2(g) \rightleftharpoons 2\ SO_3(g)$. Experiment gives $K = 4.0 \times 10^{24}$ at 298 K. 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

$NH_3(g) + H_2S(g) \rightleftharpoons NH_4HS(s)$

$K_c = 9.7$ at 900 K. If the initial concentrations of $NH_3(g)$ and $H_2S(g)$ are 2.0 M, what is the equilibrium concentration of $NH_3(g)$? (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_2S	NH_4HS
I	2	2	—
C	$-x$	$-x$	—
E	$2-x$	$2-x$	—

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

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

$x = 2.32$, 1.67

$2 - 1.67 = .32$

11. Consider the following reaction at a certain temperature:

$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

At equilibrium, $[PCl_5] = 2.00\ M$ and $[PCl_3] = [Cl_2] = 1.00\ M$. If suddenly $1.00\ M$ $PCl_5(g)$, $PCl_3(g)$, and $Cl_2(g)$ is added, what is the equilibrium concentration of $PCl_5(g)$? (10pts)

	PCl_5	PCl_3	Cl_2
I	2	1	1
C			
E	2	1	1

at equilibrium

$$K_c = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{[1][1]}{[2]} = .5 - K$$

	PCl_5	PCl_3	Cl_2
I	3	2	2
C	$-x$	$+x$	$+x$
E	$3-x$	$2+x$	$2+x$

$$K = \frac{[PCl_3][Cl_2]}{[PCl_5]}$$

good !!

$$.5 = \frac{(2+x)(2+x)}{(3-x)} \rightarrow$$

$$x = \frac{-4.5 \pm \sqrt{4.5^2 - 4(1)(0.5)}}{2(1)} = -0.649 \text{ or } -2.85$$

$$[PCl_5] = 3 - (-.649) = 3.649\ M$$