Chem 10113, Quiz 3 **Answer Key**

October 3, 2018

	IA (1)												IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	VIIIA (18)
1	1 **H** 1.0080	IIA (2)																2 **He** 4.0026
2	3 **Li** 6.9410	4 **Be** 9.0122											5 **B** 10.811	6 **C** 12.011	7 **N** 14.007	8 **O** 15.999	9 **F** 18.998	10 **Ne** 20.179
3	11 **Na** 22.990	12 **Mg** 24.305	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	(8)	VIIIB (9)	(10)	IB (11)	IIB (12)	13 **Al** 26.982	14 **Si** 28.086	15 **P** 30.974	16 **S** 32.066	17 **Cl** 35.453	18 **Ar** 39.948
4	19 **K** 39.098	20 **Ca** 40.078	21 **Sc** 44.956	22 **Ti** 47.880	23 **V** 50.942	24 **Cr** 51.996	25 **Mn** 54.938	26 **Fe** 55.847	27 **Co** 58.933	28 **Ni** 58.690	29 **Cu** 63.546	30 **Zn** 65.380	31 **Ga** 69.723	32 **Ge** 72.610	33 **As** 74.922	34 **Se** 78.960	35 **Br** 79.904	36 **Kr** 83.800
5	37 **Rb** 85.468	38 **Sr** 87.620	39 **Y** 88.906	40 **Zr** 91.224	41 **Nb** 92.906	42 **Mo** 95.940	43 **Tc** 98.907	44 **Ru** 101.07	45 **Rh** 102.91	46 **Pd** 106.42	47 **Ag** 107.87	48 **Cd** 112.41	49 **In** 114.82	50 **Sn** 118.71	51 **Sb** 121.75	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.29
6	55 **Cs** 132.91	56 **Ba** 137.33	57 **La** 138.91	72 **Hf** 178.49	73 **Ta** 180.95	74 **W** 183.85	75 **Re** 186.21	76 **Os** 190.20	77 **Ir** 192.22	78 **Pt** 195.09	79 **Au** 196.97	80 **Hg** 200.59	81 **Tl** 204.38	82 **Pb** 207.20	83 **Bi** 208.98	84 **Po** 208.98	85 **At** 209.99	86 **Rn** 222.02
7	87 **Fr** 223.02	88 **Ra** 226.03	89 **Ac** 227.03	104 Unq 261.11	105 Unp 262.11	106 Unh 263.12	107 Uns 262.12											

1. (2 points) I_2O_3 is the anhydride of HIO_2. The anhydride of $Sr(OH)_2$ is SrO.

2. (9 points) For each of the following reactions, write ***balanced chemical equations*** for both the ***molecular*** and the ***net ionic*** equations. If no reaction occurs, write No Reaction. Use subscripts [(s), (aq), (g), etc.] to indicate the phase of each compound or ion.

   (a) $(NH_4)_2SO_{3(aq)} + HBr_{(aq)} \longrightarrow$

   molecular:

   $(NH_4)_2SO_{3(aq)} + 2\ HBr_{(aq)} \longrightarrow 2\ NH_4Br_{(aq)} + H_2O + SO_{2(g)}$

   net ionic:

   $SO_3^{2-}{}_{(aq)} + 2\ H^+_{(aq)} \longrightarrow H_2O + SO_{2(g)}$ (gas formation)

   (b) $LiOH_{(aq)} + HBrO_{2(aq)} \longrightarrow$

   molecular:

   $LiOH_{(aq)} + HBrO_{2(aq)} \longrightarrow LiBrO_{2(aq)} + H_2O$

   net ionic:

   $OH^-_{(aq)} + HBrO_{2(aq)} \longrightarrow BrO_2^-{}_{(aq)} + H_2O$ (weak electrolyte formation)

   (c) $Ba(OH)_{2(aq)} + Fe(NO_3)_{3(aq)} \longrightarrow$

   molecular:

   $3\ Ba(OH)_{2(aq)} + 2\ Fe(NO_3)_{3(aq)} \longrightarrow 3\ Ba(NO_3)_{2(aq)} + 2\ Fe(OH)_{3(s)}$

   net ionic:

   $Fe^{3+}_{(aq)} + 3\ OH^-_{(aq)} \longrightarrow Fe(OH)_{3(s)}$ (precipitation)

3. (4 points) **SHOW ALL WORK.** Helium passes through a certain gas-separation membrane at the rate of 2.50 L per minute. Determine the volume (in Liters) of uranium hexafluoride (UF_6) gas that should pass through the same membrane in 12.0 hours. (molar mass: $UF_6 = 352$)

Graham's Law of Effusion

$ER_{He} / ER_{UF_6} = \sqrt{(FM_{UF_6} / FM_{He})}$

$(2.50 \text{ L/min}) / ER_{UF_6} = \sqrt{(352 / 4.00)} = 9.381$

$ER_{UF_6} = 0.2665 \text{ L/min}$

$(12.0 \text{ hr}) (60 \text{ min/hr}) (0.2665 \text{ L/min}) = 192 \text{ L}$

4. (2 points) Write a complete, ***balanced chemical equation*** to show how aziridine, $(CH_2)_2NH$, behaves when dissolved in water. (Use the proper type of arrow in your equation!)

$(CH_2)_2NH_{(aq)} + H_2O \rightleftharpoons (CH_2)_2NH_2^+{}_{(aq)} + OH^-{}_{(aq)}$

(weak base)

5. (3 points) In the following balanced redox equation, write the oxidation number of *each* underlined *atom* in the blanks below the formulas. Also, ***circle*** the substance that is the ***oxidizing agent***.

$26\ H^+_{(aq)} + 3\ H_2\underline{S}_{(g)} + 4\ \underline{Cr}_2O_7^{2-}{}_{(aq)} \longrightarrow 3\ \underline{S}O_4^{2-}{}_{(aq)} + 8\ \underline{Cr}^{3+}_{(aq)} + 16\ H_2O$

-2 +6 +6 +3

6. (5 points) **SHOW ALL WORK.** Refer to the balanced chemical equation in question 5 above. Determine the volume (in mL) of H_2S gas, measured at 22.0 °C and 735 torr, that is required to react completely with 150.0 mL of 0.0725 M $K_2Cr_2O_7$ solution.

$(0.150 \text{ L}) (0.0725 \text{ mole } Cr_2O_7^{2-} / \text{L}) (3 \text{ mole } H_2S / 4\ Cr_2O_7^{2-}) = 0.008156 \text{ mole } H_2S$

$P = (735 \text{ torr}) (1 \text{ atm} / 760 \text{ torr}) = 0.967 \text{ atm}$

$V = nRT/P = (0.008156 \text{ mole}) (0.0821 \text{ L·atm/mole·K}) (295 \text{ K}) / (0.967 \text{ atm})$

$V = 0.204 \text{ L} = 204 \text{ mL}$