Chem 10113, Quiz 3 **Answer Key**

October 9, 2019

	IA (1)	IIA (2)	IIIB (3)	IVB (4)	VB (5)	VIB (6)	VIIB (7)	(8)	VIIIB (9)	(10)	IB (11)	IIB (12)	IIIA (13)	IVA (14)	VA (15)	VIA (16)	VIIA (17)	VIIIA (18)
1	1 **H** 1.0080																	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											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) Write a complete, ***balanced chemical equation*** to show how hydroxylamine, $HONH_2$, behaves when dissolved in water. (Remember that chemists are precise in their use of arrows!)

$HONH_{2(aq)} + H_2O \rightleftharpoons HONH_3^+{}_{(aq)} + OH^-{}_{(aq)}$

(weak base)

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

molecular:

$(NH_4)_2SO_{3(aq)} + 2\ KOH_{(aq)} \longrightarrow K_2SO_{3(aq)} + 2\ H_2O + 2\ NH_{3(g)}$

net ionic: (gas formation)

$NH_4^+{}_{(aq)} + OH^-{}_{(aq)} \longrightarrow H_2O + NH_{3(g)}$

(b) $HC_2H_3O_{2(aq)} + Ca(OH)_{2(aq)} \longrightarrow$

molecular:

$2\ HC_2H_3O_{2(aq)} + Ca(OH)_{2(aq)} \longrightarrow Ca(C_2H_3O_2)_{2(aq)} + 2\ H_2O$

net ionic: (weak electrolyte formation)

$HC_2H_3O_{2(aq)} + OH^-{}_{(aq)} \longrightarrow H_2O + C_2H_3O_2^-{}_{(aq)}$

(c) $CrCl_{3(aq)} + Hg_2(NO_3)_{2(aq)} \longrightarrow$

molecular:

$2\ CrCl_{3(aq)} + 3\ Hg_2(NO_3)_{2(aq)} \longrightarrow 3\ Hg_2Cl_{2(s)} + 2\ Cr(NO_3)_{3(aq)}$

net ionic: (precipitate formation)

$2\ Cl^-{}_{(aq)} + Hg_2^{2+}{}_{(aq)} \longrightarrow Hg_2Cl_{2(s)}$

3. (5 points) **SHOW ALL WORK.** A sample of helium passes through a certain membrane in 75 sec. The same amount of an unknown noble gas requires 343 sec to pass through the same membrane. Identify the unknown gas by performing an appropriate calculation.
The major concept related to this problem is known as Graham's Law of Effusion.

Graham's Law of Effusion: $ER_{He} / ER_X = (FM_X / FM_{He})^{1/2}$

but time ~ 1/rate (i.e., larger particles take longer to pass through the membrane)

$\therefore$ $Time_X / Time_{He} = (FM_X / FM_{He})^{1/2}$

$343 \text{ sec} / 75 \text{ sec} = (FM_X / 4.0 \text{ g/mole})^{1/2}$

$FM_X = 83.7$ g/mole $\therefore$ the unknown noble gas is Kr

4. (2 points) Write the oxidation number of each atom in $(NH_4)_3SbO_3$.

N -3 H +1 Sb +3 O -2

5. (2 points) BaO is the anhydride of $Ba(OH)_2$. The anhydride of $HBrO_4$ is Br_2O_7.

6. (5 points) **SHOW ALL WORK.** Automobile air bags inflate when a serious impact triggers the following chemical reaction. If the air bag has a volume of 24.5 L, determine the mass (in grams) of sodium azide that is required to inflate the bag to a pressure of 1250 torr at 23 °C.
(molar masses: $NaN_3 = 65.0$, $N_2 = 28.0$, $Na = 23.0$)

$$2\ NaN_{3(s)} \longrightarrow 2\ Na_{(s)} + 3\ N_{2(g)}$$

n = moles $N_{2(g)} = PV/RT$

$n = (1250 \text{ torr})(1 \text{ atm} / 760 \text{ torr})(24.5 \text{ L}) / (0.0821 \text{ L·atm/mole·K})(296 \text{ K})$

$n = 1.66$ mole N_2

$(1.66 \text{ mole } N_2)(2 \text{ mole } NaN_3 / 3 \text{ mole } N_2)(65.0 \text{ g/mole}) = 71.9 \text{ g } NaN_3$