Name:_____

Chem. 4 – Fall 2009
Exam #3

1) Give the **NAME** and **FORMULA** for all of the **STRONG ACIDS**. **(no partial credit)**

$HCl_{(aq)}$	**hydrochloric acid**	**$HBr_{(aq)}$**	**hydrobromic acid**
$HI_{(aq)}$	**hydroiodic acid**	**$HClO_{4(aq)}$**	**perchloric acid**
$HNO_{3(aq)}$	**nitric acid**	**$H_2SO_{4(aq)}$**	**sulfuric acid**

2) What is the term for a digit in front of a chemical formula that helps to balance a chemical equation?

a) coefficient b) exponent c) subscript d) superscript e) none of these

3) Which of the following elements occurs naturally as diatomic molecules?

a) argon gas b) helium gas c) neon gas d) all of the above **e) none of these**

4) What is the coefficient of NaCl after balancing the following equation?

$$\_\_CrCl_3 + \_\_Na_2CO_3 \rightarrow \_\_Cr_2(CO_3)_3 + \_\_NaCl$$

a) 0
b) 1
c) 2
d) 3
e) 6
f) none of the above

5) What is the coefficient of $AlCl_3$ after balancing the following equation?

$$\_\_AlCl_3 + \_\_AgNO_3 \rightarrow \_\_Al(NO_3)_3 + \_\_AgCl$$

a) 0
b) 1
c) 2
d) 3
e) 6
f) none of the above

6) What is the coefficient of O_2 after balancing the following equation?

$$\_\_C_9H_{20\,(l)} + \_\_O_{2\,(g)} \rightarrow \_\_H_2O_{\,(l)} + \_\_CO_{2\,(g)}$$

a) 7
b) 14
c) 21
d) 28
e) 35
f) none of the above

7) Which of the following symbolizes a precipitate in a chemical equation?

a) (s) b) (l) c) (g) d) (aq) e) none of the above

8) In a chemical equation, which of the following symbolizes that a chemical is insoluble in water?

a) (s) b) (l) c) (g) d) (aq) e) none of the above

9) How many moles of aluminum acetate contain 7.52×10^{24} oxygen atoms?

a) 12.5 mol
b) 2.08 mol
c) 2.08×10^{46} mol
d) 1.25×10^{47} mol
e) 6.24 mol
f) none of the above

$$7.52 \times 10^{24}\ \textbf{molecules O} \times \frac{1\ \textbf{mol O}}{6.022 \times 10^{23}\ \textbf{molecules O}} = 12.5\ \textbf{mol O}$$

10) What is the molar mass of titanium (IV) sulfate?

a) 112.02 $\frac{g}{mol}$ b) 127.95 $\frac{g}{mol}$ c) 143.95 $\frac{g}{mol}$ d) 208.02 $\frac{g}{mol}$ **e) 240.02 $\frac{g}{mol}$**

11) What is the percent composition of oxygen in $Fe(OH)_3$?

a) 14.97% b) 16.00% **c) 44.91%** d) none of the above e) not enough information

$$\frac{48.00\ g\ \textbf{O}}{106.88\ g\ \textbf{Fe(OH)}_3} \times 100 = 44.91\%\ \textbf{O}$$

12) What is the mass of 1.20×10^{24} molecules of sulfur dioxide, SO_2 ($64.07 \frac{g}{mol}$)?

a) 0.0310 g b) 1.99 g c) 32.2 g d) 64.1 g **e) 128 g** f) none of the above

$$1.20 \times 10^{24}\ \textbf{molecules SO}_2 \times \frac{1\ \textbf{mol SO}_2}{6.022 \times 10^{23}\ \textbf{molecules SO}_2} \times \frac{64.07\ g\ \textbf{SO}_2}{1\ \textbf{mol SO}_2} = 128\ g\ \textbf{SO}_2$$

13) What is the mass of silver bromide ($187.77 \frac{g}{mol}$) can be made from 2.96 g of iron(III) bromide ($295.55 \frac{g}{mol}$)?

$$\_\_\textbf{FeBr}_{3(s)} + 3\ \textbf{AgNO}_{3(aq)} \rightarrow 3\ \textbf{AgBr}_{(s)} + \_\_\textbf{Fe(NO}_3\textbf{)}_{3(aq)}$$

a) 0.940 g
b) 0.627 g
c) 1.88 g
d) 5.64 g
e) 3.76 g
f) none of the above

$$2.96\ g\ \textbf{FeBr}_3 \times \frac{1\ \textbf{mol FeBr}_3}{295.55\ g\ \textbf{FeBr}_3} \times \frac{3\ \textbf{mol AgBr}}{1\ \textbf{FeBr}_3} \times \frac{197.77\ g\ \textbf{AgBr}}{1\ \textbf{mol AgBr}} = 5.64\ \textbf{AgBr}$$

14) What is the mass of solid silver metal produced from 6.35 g of solid copper?

$$\_\_\textbf{Cu}_{(s)} + 2\ \textbf{AgNO}_{3(aq)} \rightarrow \_\_\textbf{Cu(NO}_3\textbf{)}_{2(aq)} + 2\ \textbf{Ag}_{(s)}$$

a) 0.187 g
b) 0.540 g
c) 0.747 g
d) 1.08 g
e) 21.6 g
f) none of the above

$$6.35\ g\ \textbf{Cu} \times \frac{1\ \textbf{mol Cu}}{63.55\ g\ \textbf{Cu}} \times \frac{2\ \textbf{mol Ag}}{1\ \textbf{mol Cu}} \times \frac{107.97\ g\ \textbf{Ag}}{1\ \textbf{mol Ag}} = 21.6\ g\ \textbf{Ag}$$

15) Circle the **one** state of matter and **one** type of electrolyte for each of the following compounds. (Assume that all are in water)

a)	$CaCO_3$	**(s)**	(l)	(g)	(aq)	SE	**WE**	NE
b)	PbI_2	**(s)**	(l)	(g)	(aq)	SE	**WE**	NE
c)	HCN	(s)	(l)	(g)	**(aq)**	SE	**WE**	NE
d)	Li_2S	(s)	(l)	(g)	**(aq)**	**SE**	WE	NE
e)	$BaSO_4$	**(s)**	(l)	(g)	(aq)	SE	**WE**	NE
f)	HNO_3	(s)	(l)	(g)	**(aq)**	**SE**	WE	NE
g)	H_2O	(s)	**(l)**	(g)	(aq)	SE	WE	**NE**
h)	$(NH_4)_2C_2O_4$	(s)	(l)	(g)	**(aq)**	**SE**	WE	NE
i)	$Sr(OH)_2$	(s)	(l)	(g)	**(aq)**	**SE**	WE	NE
j)	CO_2	(s)	(l)	**(g)**	(aq)	SE	WE	**NE**

16) There is a pile of a compound in front of you that is 74.01% carbon, 5.23% hydrogen, 20.76% oxygen, what is the empirical formula of the compound?

a) $C_{25}H_{21}O_5$ **b) $C_{19}H_{16}O_4$** c) $C_9H_{12}O_2$ d) C_6H_5O e) C_5H_4O

$$74.01\%\,\mathbf{C} \Rightarrow 74.01\,\boldsymbol{g}\,\mathbf{C} \times \frac{1\,\boldsymbol{mol}\,\mathbf{C}}{12.01\,\boldsymbol{g}\,\mathbf{C}} = 6.1624 \qquad 5.23\%\,\mathbf{H} \Rightarrow 5.23\,\boldsymbol{g}\,\mathbf{H} \times \frac{1\,\boldsymbol{mol}\,\mathbf{H}}{1.01\,\boldsymbol{g}\,\mathbf{H}} = 5.1782$$

$$20.76\%\,\mathbf{O} \Rightarrow 20.76\,\boldsymbol{g}\,\mathbf{O} \times \frac{1\,\boldsymbol{mol}\,\mathbf{O}}{16.00\,\boldsymbol{g}\,\mathbf{O}} = 1.2975$$

$$\mathbf{C} = \frac{6.1624}{1.2975} = 4.7494 \approx 4.75 \times 4 = \mathbf{19} \qquad \mathbf{H} = \frac{5.1782}{1.2975} = 3.9909 \approx 4 \times 4 = \mathbf{16}$$

$$\mathbf{O} = \frac{1.2975}{1.2975} = 1 \times 4 = \mathbf{4}$$

Empirical Formula = $\boxed{C_{19}H_{16}O_4}$

17) A compound is found to have the empirical formula of C_2HCl and a molar mass of 181.44 $\frac{g}{mol}$. What is the molecular formula for the compound?

a) $C_8H_4Cl_4$ b) $C_3H_4Cl_4$ **c) $C_6H_3Cl_3$** d) C_2HCl e) $C_4H_2Cl_2$ f) $C_9H_3Cl_2$

C_2HCl = 60.48 g/mol

$$\frac{\textbf{Molecular Mass}}{\textbf{Empirical Mass}} = \frac{181.44\ g/mol}{60.48\ g/mol} = 3$$

Molecular Formula = 3 × (C_2HCl) = $\boxed{C_6H_3Cl_3}$

18) Complete and give the net ionic equation for each of the following:

a) lithium hydroxide is used to neutralize sulfuric acid

M.E. $2\ LiOH_{(aq)} + H_2SO_{4(aq)} \rightarrow Li_2SO_{4(aq)} + 2\ H_2O_{(l)}$

I.E. $2\ Li^+_{(aq)} + 2\ OH^-_{(aq)} + 2\ H^+_{(aq)} + SO_4^{2-}{}_{(aq)} \rightarrow 2\ Li^+_{(aq)} + SO_4^{2-}{}_{(aq)} + 2\ H_2O_{(l)}$

N.I.E. $OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(l)}$

b) cadmium nitrate is added to ammonium phosphate

M.E. $3\ Cd(NO_3)_{2(aq)} + 2\ (NH_4)_3PO_{4(aq)} \rightarrow 6\ NH_4NO_{3(aq)} + Cd_3(PO_4)_{2(s)}$

I.E. $3Cd^{2+}_{(aq)} + 6NO_3^-{}_{(aq)} + 6NH_4^+{}_{(aq)} + 2PO_4^{3-}{}_{(aq)} \rightarrow 6NH_4^+{}_{(aq)} + 6NO_3^-{}_{(aq)} + Cd_3(PO_4)_{2(s)}$

N.I.E. $3Cd^{2+}_{(aq)} + 2PO_4^{3-}{}_{(aq)} \rightarrow Cd_3(PO_4)_{2(s)}$