Chem 1711
Quiz 2

Name Key - yellow & beige
September 18, 2013

$N_A = 6.022 \times 10^{23} \text{ mol}^{-1}$

1. Consider the organic compound estriol, $C_{18}H_{26}O_3$.
   a. Determine the molecular mass (in amu) of estriol. $288.4 \text{ amu}$
   b. Determine the mass percent hydrogen in estriol. $\frac{44(1.008)}{288.4} \times 100 = 8.388 \% \text{ H}$

2. The ion $^{106}$Pd$^{4+}$ is composed of how many protons, neutrons, & electrons?
   $46 \text{ p, } 62 \text{ n, } 42 \text{ e}^-$

3. How many atoms – in total – are there in 25 XeF$_4$ molecules?
   125 atoms

4. Balance the following chemical equation:
   $4 \text{ KO}_2(\text{g}) + 2 \text{ CO}_2(\text{g}) \rightarrow 2 \text{ K}_2\text{CO}_3(\text{s}) + 3 \text{ O}_2(\text{g})$

5. Consider a compound formed between a metal cation ($M^{2+}$) and a nonmetal anion ($X^-$).
   a. Write the chemical formula for this compound. $M_3X_5$
   b. This compound can be described by which of the following? Circle all below that are appropriate.
      - binary
      - molecular
      - acid
      - monatomic
      - ionic
      - metalloid
      - cationic
      - oxoacid

6. Give the missing IUPAC name or chemical formula for each of the following:
   - CrPO$_4$ Chromium (III) phosphate
   - SO$_3$ Sulfur trioxide
   - ZnSe Zinc selenide
   - HIO$_3$ Iodic acid
   - Cs$_2$CO$_3$ Cesium carbonate
   - CCl$_4$ Carbon tetrachloride

7. Determine the mass (in g) of 1 BF$_3$ molecule.
   $1 \text{ mol BF}_3 \times \frac{1 \text{ mol BF}_3}{6.022 \times 10^{23} \text{ molecules}} \times \frac{67.81 \text{ g}}{1 \text{ mol BF}_3} = 1.126 \times 10^{-22} \text{ g}$

8. A sample of copper metal occupies a volume of 0.52 dm$^3$. Determine the quantity (in mol) of copper in this sample. For copper, $d = 8.96 \text{ g/cm}^3$.
   $0.52 \text{ dm}^3 \times \frac{1 \text{ cm}^3}{1 \text{ dm}^3} \times \frac{8.96 \text{ g}}{1 \text{ cm}^3} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g}} = 7.3 \text{ mol Cu}$

9. Consider ammonium sulfate, (NH$_4$)$_2$SO$_4$, to answer a – c below. molar mass = 132.13 g/mol
   a. Determine the mass (in g) of a 5.709 mol sample of (NH$_4$)$_2$SO$_4$.
      $5.709 \text{ mol (NH}_4)_2\text{SO}_4 \times \frac{132.13 \text{ g}}{1 \text{ mol (NH}_4)_2\text{SO}_4} = 754.2 \text{ g}$
   b. Determine the number of ammonium ions in a 5.709 mol sample of (NH$_4$)$_2$SO$_4$.
      $5.709 \text{ mol (NH}_4)_2\text{SO}_4 \times \frac{2 \text{ mol NH}_4^+}{1 \text{ mol (NH}_4)_2\text{SO}_4} \times \frac{6.022 \times 10^{24} \text{ ions}}{1 \text{ mol NH}_4^+} = 6.876 \times 10^{24} \text{ ions}$
   c. Determine the mass of nitrogen (in g) in 394.1 g (NH$_4$)$_2$SO$_4$.
      $394.1 \text{ g (NH}_4)_2\text{SO}_4 \times \frac{1 \text{ mol (NH}_4)_2\text{SO}_4}{132.13 \text{ g}} \times \frac{2 \text{ mol N}}{1 \text{ mol (NH}_4)_2\text{SO}_4} \times \frac{14.01 \text{ g}}{1 \text{ mol N}} = 83.59 \text{ g}$
1. Consider a compound formed between a metal cation \((M^{2+})\) and a nonmetal anion \((X^-)\).
   a. Write the chemical formula for this compound. \[M_3X_5\]
   b. This compound can be described by which of the following? Circle all below that are appropriate.
      - Binary
      - Molecular
      - Acid
      - Monatomic
      - Ionic
      - Metalloid
      - Cationic
      - Oxoacid

2. Give the missing IUPAC name or chemical formula for each of the following:
   - Iodous acid: \(\text{HIO}_2\)
   - Cesium acetate: \(\text{CsC}_2\text{H}_3\text{O}_2\)
   - Bromine pentachloride: \(\text{BrCl}_5\)
   - CrP: chromium (III) phosphide
   - SO\(_3\): sulfur trioxide
   - ZnCO\(_3\): zinc carbonate

3. How many atoms – in total – are there in 25 \(\text{XeF}_2\) molecules?
   - \(75\) atoms

4. The ion \(^{108}\text{Pd}^{2+}\) is composed of how many protons, neutrons, & electrons?
   - \(46\) p, \(62\) n, \(42\) e

5. Consider the organic compound estriol, \(\text{C}_{18}\text{H}_{22}\text{O}_3\).
   a. Determine the molecular mass (in amu) of estriol.
   - \(288.4\) amu
   b. Determine the mass percent carbon in estriol.
   - \(74.97\%\) C

6. Balance the following chemical equation:
   \[
   4 \text{ KO}_2 (g) + 2 \text{ CO}_3 (g) \rightarrow 2 \text{ K}_2\text{CO}_3 (s) + 3 \text{ O}_3 (g)
   \]

7. Consider ammonium sulfate, \((\text{NH}_4)_2\text{SO}_4\), to answer a – c below.
   a. Determine the mass (in g) of a 4.662 mol sample of \((\text{NH}_4)_2\text{SO}_4\).
   - \(615.9\) g
   b. Determine the number of ammonium ions in a 4.662 mol sample of \((\text{NH}_4)_2\text{SO}_4\).
   - \(5.615 \times 10^{24}\) ions
   c. Determine the mass of nitrogen (in g) in 129.8 g \((\text{NH}_4)_2\text{SO}_4\).
   - \(27.53\) g

8. Determine the mass (in g) of 1 \(\text{PF}_3\) molecule.
   \[
   1 \text{ mole \(\text{PF}_3\)} \times \frac{1 \\text{ mole \(\text{PF}_3\)}}{6.022 \times 10^{23} \text{ molecules}} \times \frac{87.979 \text{ g}}{1 \text{ mole \(\text{PF}_3\)}} = 1.461 \times 10^{-22} \text{ g}
   \]

9. A sample of a metal occupies a volume of 0.73 dm\(^3\). Determine the quantity (in mol) of cadmium in this sample. For cadmium, \(d = 8.65\) g/cm\(^3\).
   \[
   .73 \text{ dm}^3 \times \left(\frac{10 \text{ cm}}{1 \text{ dm}}\right)^3 \times \frac{8.65 \text{ g CD}}{1 \text{ cm}^3} \times \frac{1 \text{ mol CD}}{112.48 \text{ g}} = 56 \text{ mol CD}
   \]