Chemistry II Worksheet
Stoichiometry Review

1. Complete and balance the following reactions. Also give the type of reaction from the list: acid-base (broad definition of Lewis) or redox. In all cases, a reaction occurs. Identify, as appropriate, the acid, the base, or what is being oxidized and reduced.
   a. $Al + S_8 \rightarrow$
   b. $C_4H_{10} + O_2 \rightarrow$
   c. $Mg + Cl_2 \rightarrow$
   d. $NaBr + Cl_2 \rightarrow$
   e. $Li + N_2 \rightarrow$
   f. $Al + HCl \rightarrow$
   g. $Mg + SnCl_4 \rightarrow$
   h. $Mg(OH)_2 + HNO_3 \rightarrow$
   i. $Cu_2S \rightarrow$
   j. $CH_4 + O_2 \rightarrow$
   k. $HgO \rightarrow$
   l. $Na + Cl_2 \rightarrow$
   m. $KCl + Pb(NO_3)_2 \rightarrow$
   n. $Mg + ZnCl_2 \rightarrow$
   o. $C_6H_{12}O_6 + O_2 \rightarrow$
2. The acid secreted by the cells of the stomach lining is hydrochloric acid solution that typically contains 0.00774 mol of HCl per 0.0500 L of solution. What is the concentration of the acid?
3. How many moles of sulfuric acid, H_2SO_4, are contained in 0.80 L of 0.050 M solution of sulfuric acid?
4. How many grams of CaO are required for reaction with the HCl in 275 mL of a 0.523 M HCl solution? The equation for the reaction is:
   $CaO + 2\ HCl \rightarrow CaCl_2 + H_2O$
5. Automotive air bags inflate when a sample of sodium azide, NaN_3, is very rapidly decomposed.
   $2\ NaN_3(s) \rightarrow Na(s) + 3\ N_2(g)$
   What mass of sodium azide is needed to produce 368 L of nitrogen gas at STP?
6. A mixture of 5.0 g of H_2 and 10.0 g of O_2 is ignited to produce water. Water forms according to the equation
   $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$
   What reactant is limiting? How much water will be produced by the reaction? How much of the excess reactant remains?
7. What is the limiting reactant when 25.00 mL or a 0.2338 M lead (II) nitrate solution is added to 25.00 mL of a 0.0971 M aluminum sulfate solution?
   $3\ Pb(NO_3)_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 3\ PbSO_4(s) + 2\ Al(NO_3)_3(aq)$
8. Which is the limiting reactant when 1.00 g of Si and 1.00 g of C combine as in the following equation? What mass of SiC forms? What amount of the excess reactant remains?
   $Si + C \rightarrow SiC$
9. A chemistry student, preparing copper metal by the reaction of 1.274 g of copper (II) sulfate with zinc metal, isolated 0.392 g of copper. What was the percent yield?
   $CuSO_4(aq) + Zn(s) \rightarrow Cu(s) + ZnSO_4(aq)$
10. Calculate the mass of sodium nitrate required to produce 5.00 L of oxygen at STP according to the reaction
    $2\ NaNO_3 \rightarrow 2\ NaNO_2 + O_2$
    if the percent yield is 78.4%.

Answers

1. .
   a. $16\ Al + 3\ S_8 \rightarrow 8\ Al_2S_3$, redox, Al oxidized, S reduced
   b. $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$, redox, C and H oxidized, O reduced
   c. $Mg + Cl_2 \rightarrow MgCl_2$, redox, Mg oxidized, Cl reduced
   d. $2\ NaBr + Cl_2 \rightarrow 2\ NaCl + Br_2$, redox, Br oxidized, Cl reduced
   e. $6\ Li + N_2 \rightarrow 2\ Li_3N$, redox, Li oxidized, N reduced
   f. $2\ Al + 6\ HCl \rightarrow 2\ AlCl_3 + 3\ H_2$, redox, Al oxidized, H reduced
   g. $2\ Mg + SnCl_4 \rightarrow 2\ MgCl_2 + Sn$, single replacement
   h. $Mg(OH)_2 + 2\ HNO_3 \rightarrow Mg(NO_3)_2 + 2\ H_2O$, acid-base, HNO_3 (H^+) acid, $Mg(OH)_2$ (OH^-) base
   i. $8\ Cu_2S \rightarrow 16\ Cu + S_8$, redox, Cu reduced, S oxidized
   j. $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$, redox, C and H oxidized, O reduced
   k. $2\ HgO \rightarrow 2\ Hg + O_2$, redox, Hg reduced, O oxidized
   l. $2\ Na + Cl_2 \rightarrow 2\ NaCl$, redox, Na oxidized, Cl reduced
   m. $2\ KCl + Pb(NO_3)_2 \rightarrow 2\ KNO_3 + PbCl_2$, acid-base, Cl^- base, Pb^{2+} acid
   n. $Mg + ZnCl_2 \rightarrow MgCl_2 + Zn$, redox, Mg oxidized, Zn reduced
   o. $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$, redox, C and H oxidized, O reduced
2. 0.155 M HCl
3. 0.040 mol H_2SO_4
4. 4.03 g CaO
5. 712 g NaN_3
6. O_2, 11.3 g H_2O, 3.74 g H_2
7. $Pb(NO_3)_2$
8. Si, 1.43 g SiC, 0.573 g C
9. 0.5072 g Cu, 77.3%
10. 48.4 g $NaNO_3$