Name_____   Date_____
AP Chemistry

Reaction Prediction – 3

For each of the following eight reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

a) A piece of aluminum metal is added to a solution of silver nitrate.
   i. $Al(s) + 3Ag^+(aq) \longrightarrow Al^{3+}(aq) + 3Ag(s)$

   ii. What is the balanced reduction half-reaction?
        $3Ag^+ + 3e^- \longrightarrow Ag$

b) A piece of solid bismuth is heated strongly in oxygen.
   i. $2\ Bi(s) + 3O_2(g) \longrightarrow Bi_2O_3(s)$

   ii. Explain the mass difference between the solid bismuth and the product.
        $2Bi \neq Bi_2O_3$ the additional mass is oxygen

c) Solid ammonium carbonate is heated.
   i. $(NH_4)_2CO_3(s) \longrightarrow 2NH_3(g) + CO_2(g) + H_2O(g)$

   ii. Name all products that are polar molecules.
        NH_3 = polar H_2O = polar

d) Propanol is burned completely in air.
   i. $2\ C_3H_7OH_{(l)} + 9\ O_2(g) \longrightarrow 6CO_2(g) + 8H_2O(g)$

   ii. What is the oxidation state of the carbon before and after the reaction?
        before C^{+2} after = C^{+4}

e) Equal volumes of 0.1M sulfuric acid and 0.1M potassium hydroxide are mixed.
   i. $H^+(aq) + OH^-(aq) \longrightarrow HOH_{(l)}$

   ii. Comparatively, how much 0.1M potassium hydroxide is needed to totally neutralize the acid? Explain.
                 twice as much

f) An excess of sodium hydroxide is added to a solution of magnesium nitrate.
   i. $2\ OH^-(aq) + Mg^{2+}(aq) \longrightarrow Mg(OH)_2(s)$
   ii. Besides heat, what observation indicates a reaction actually occurred?
        Precipitate forms – turns cloudy

g) Solid Lithium hydride is added to water.
   i. $LiH(s) + HOH(l) \longrightarrow Li^+(aq) + OH^-(aq) + H_2(g)$
   ii. Describe the changes it temperature and pressure if performed in a sealed container
             temperature and pressure rise

h) A concentrated solution of ammonia is added to a solution of zinc iodide. No precipitate is formed
   i. $Zn^{2+}(aq) + 4\ NH_3(aq) \longrightarrow \left[Zn(NH_3)_4\right]^{2+}(aq)$ or
        $Zn^{2+}(aq) + 2\ NH_3(aq) + 2H_2O(1) \longrightarrow Zn(OH)_2(s) + 2\ NH_4^+(aq)$
   ii. If dilute ammonia is used a precipitate is formed. What is the precipitate?
             Zinc Hydroxide

Reaction predictions from:
 Hague, G., & Smith, J. (2001). *The Ultimate Chemical Equations Handbook*. Batavia, IL: Flinn Scientific, Inc.
Correlating questions (ii) from:
Rodney Schmitz (2007) Moore County Schools, NC