AP Worksheet 4e (ACID-BASE and REDOX)

1. Identify the acid, base, conjugate acid, and conjugate base in:

    a. $HNO_3(aq) + H_2O(l) \leftrightarrow NO_3^-(aq) + H_3O^+(aq)$
    b. $CH_3COO^-(aq) + H_3O^+(aq) \leftrightarrow CH_3COOH(aq) + H_2O(l)$
    c. $CH_3COOH(aq) + HS^-(aq) \leftrightarrow CH_3COO^-(aq) + H_2S(g)$

2. Give the conjugate base of the following acids:

    a. HCOOH
    b. HPO_4^{2-}

3. Give the conjugate acid of the following bases:

    a. SO_4^{2-}
    b. CH_3NH_2

4. Calculate the concentration (molarity) of the ion indicated in each of the following solutions. The use of square brackets, [ ], denotes concentration in mol L^{-1}.

    a. $[K^+]$ in 0.238 M KNO_3
    b. $[Al^{3+}]$ and $[SO_4^{2-}]$ in 0.080 M $Al_2(SO_4)_3$

5. What is the oxidation number of each of the underline atoms in each of the following species? Think carefully about the rules that are being applied and write a brief, simple explanation of your answer in each case.

    a. $\underline{Ca}I_2$
    b. $\underline{Ge}O_2$
    c. $K\underline{O}_2$
    d. $\underline{N}H_3$

6. For each of the following reactions write two separate half-reactions, one showing the oxidation and one showing the reduction. Then use the half-reactions to write the balanced full REDOX equation.

    a. $Na + Cl_2 \rightarrow NaCl$
    b. $Mg + O_2 \rightarrow MgO$
    c. $BrO^- \rightarrow BrO_3^- + Br^-$
    d. $Zn + FeSO_4 \rightarrow ZnSO_4 + Fe$

7. Complete and balance this equation by the method of half-reactions. The reaction takes place in acidic solution.

$$I_2(s) + OCl^-(aq) \rightarrow IO_3^-(aq) + Cl^-(aq)$$

8. A 0.347 g sample of the hydrated “double salt”, ammonium iron(II) sulfate hexahydrate, $FeSO_4(NH_4)_2SO_4 \bullet 6H_2O$, was dissolved in water. The solution had some acid added to it and then it reacted completely with 12.6 mL of potassium permanganate, $KMnO_4$, solution. Calculate [$KMnO_4$] given the full REDOX equation below.

$$5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$$