CH 151 Problem Set #4

Complete problem set on separate pieces of paper showing all work, circling final answers, etc.

Covering: **Chapter Three**
Important Tables and/or Constants: none

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1. What do the symbols in parentheses stand for in the following equations?
    a. $PCl_3(l) + Cl_2(g) \rightarrow PCl_5(s)$
    b. $NaCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + NaNO_3(aq)$
2. For each of the following balanced equations, indicate how many atoms of each element are present on the reactant and product sides of the chemical equation.
    a. $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$
    b. $2\ Na + 2\ H_2O \rightarrow 2\ NaOH + H_2$
    c. $2\ Co + 3\ HgCl_2 \rightarrow 2\ CoCl_3 + 3\ Hg$
    d. $H_2SO_4 + 2\ NH_3 \rightarrow (NH_4)_2SO_4$
3. Balance the following chemical equations.
    a. $Fe + O_2 \rightarrow Fe_2O_3$
    b. $NaClO_3 \rightarrow NaCl + O_2$
    c. $Au_2S_3 + H_2 \rightarrow H_2S + Au$
    d. $NH_3 + O_2 \rightarrow N_2O + H_2O$
4. Balance the following combustion equations.
    a. $C_2H_4 + O_2 \rightarrow CO_2 + H_2O$
    b. $C_6H_{12} + O_2 \rightarrow CO_2 + H_2O$
    c. $C_3H_6O + O_2 \rightarrow CO_2 + H_2O$
    d. $C_5H_{10}O_2 + O_2 \rightarrow CO_2 + H_2O$
5. Balance the following chemical equations.
    a. $Al + Sn(NO_3)_2 \rightarrow Al(NO_3)_3 + Sn$
    b. $Na_2CO_3 + Mg(NO_3)_2 \rightarrow MgCO_3 + NaNO_3$
    c. $Al(NO_3)_3 + H_2SO_4 \rightarrow Al_2(SO_4)_3 + HNO_3$
    d. $Ba(C_2H_3O_2)_2 + (NH_4)_3PO_4 \rightarrow Ba_3(PO_4)_2 + NH_4C_2H_3O_2$
6. Classify each of the following chemical reactions as precipitation, decomposition, single-replacement, combustion, acid-base or combination.
    a. $3\ CuSO_4 + 2\ Al \rightarrow Al_2(SO_4)_3 + 3\ Cu$
    b. $K_2CO_3 \rightarrow K_2O + CO_2$
    c. $2\ AgNO_3 + K_2SO_4 \rightarrow Ag_2SO_4(s) + 2\ KNO_3$
    d. $2\ SO_2 + O_2 \rightarrow 2\ SO_3$
    e. $H_2SO_4 + 2\ KOH \rightarrow 2\ H_2O + K_2SO_4$
    f. $CH_4 + 2\ O_2 \rightarrow CO_2 + 2\ H_2O$

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7. Identify the products of, and then write a balanced chemical equation for, each of the following chemical reactions.
    a. $AlCl_3 \rightarrow ? + ?$ (decomposition reaction into elements)
    b. $HNO_3 + NaOH \rightarrow ? + ?$ (acid-base reaction)
    c. $Al + Ni(NO_3)_2 \rightarrow ? + ?$ (single replacement reaction)
    d. $Be + N_2 \rightarrow ?$ (combination reaction)
8. Write a balanced chemical equation for the thermal decomposition of each of the following metal carbonates to its metal oxide and carbon dioxide.
    a. $BeCO_3$
    b. Li_2CO_3
    c. $ZnCO_3$
    d. Cs_2CO_3
9. Write a balanced chemical equation for the combustion of each of the following hydrocarbons in air.
    a. C_5H_{12}
    b. C_4H_6
    c. C_7H_8
    d. C_8H_{18}
10. Write a balanced chemical equation for the combustion of each of the following hydrocarbons in air.
    a. C_2H_4O
    b. $C_5H_{10}O$
    c. $C_2H_4O_2$
    d. $C_3H_6O_2$
11. Balance the following chemical equations.
    a. $NH_3 + O_2 + CH_4 \rightarrow HCN + H_2O$
    b. $KClO_3 + HCl \rightarrow KCl + Cl_2 + H_2O$