CHEM 51. CHEMICAL REACTIONS WORKSHEET (Chapter 5)

Using your text book and these descriptions of chemical reactions, complete this worksheet Parts 1,2 and 3.

DESCRIPTIONS:

1. COMBINATION REACTION: Two reactants combine to form a single product.

2. DECOMPOSITION REACTION: One reactant decomposes into two or more products.

3. COMBUSTION REACTION: A reactant (a carbon compound made of C, H and sometimes O) combines with oxygen to give CO_2 and H_2O as the only products.

4. SINGLE DISPLACEMENT (REPLACEMENT) REACTION: Reactants are an element and a compound. Products are an element and compound. The reactant element replaces a similar element in the compound and the replaced element becomes the product element.

5. DOUBLE DISPLACEMENT (REPLACEMENT) REACTION. Two reactant compounds and two product compounds. One of the product compounds has to be a covalent compound, a gas, or a solid (precipitate).

Balancing Combustion Reactions

1. Balance carbon first
2. Balance hydrogen second
3. Sum the number of oxygens from water and CO_2 the right side.
   - 3a) Subtract any oxygens in the carbon compound on the left (reactant) side of the equation from the total number of oxygens on the right.
4. Put this number of oxygen atoms divided by 2 in front of O_2 as the coefficient.
5. If the coefficient is divisible by 2 then divide and place that number in front of the oxygen as the coefficient.
   - 5a) If the coefficient is not divisible by 2 then multiply the whole equation by 2 to clear the X/2 in the oxygen coefficient.
6. Write the balanced equation.

Example 1. Write a balanced equation for the combustion of C_4H_{10}

$C_4H_{10} + \frac{13}{2} O_2 \rightarrow 5H_2O + 4CO_2$

Step 4 | Step 2 | Step 1

Step 3 Total oxygen = 5 $_{(5H2O)}$ + 8 $_{(4CO2)}$ = 13 oxygen

Step 5a Multiply the whole equation by 2:

$2\,[C_4H_{10} + \frac{13}{2} O_2 \rightarrow 5H_2O + 4\,CO_2] = 2C_4H_{10} + 13\,O_2 \rightarrow 10H_2O + 8\,CO_2$

Step 6

Example 2. Write a balanced equation for the combustion of $C_4H_{10}O$

$C_4H_{10}O + 6\,O_2 \rightarrow 5H_2O + 4CO_2$ ← balanced

Steps 4 & 5 | Step 2 | Step 1 | Step 6

Step 3 Total oxygen = 5 $_{(5H2O)}$ + 8 $_{(4CO2)}$ = 13 oxygen – 1 oxygen = 12 oxygen

Step 3a

PART 1. Match the following reactions with the type reaction (draw a line from one to the other):

$CH_{4\,(g)} + O_{2\,(g)} \rightarrow CO_{2\,(g)} + H_2O_{\,(l)}$	combination reaction
$CuSO_{4\,(aq)} + Al_{\,(s)} \rightarrow Al_2(SO_4)_{3\,(aq)} + Cu_{\,(s)}$	decomposition reaction
$HgO_{\,(s)} \rightarrow Hg_{\,(l)} + O_{2\,(g)}$	combustion reaction
$Fe_{\,(s)} + O_{2\,(g)} \rightarrow Fe_2O_{3\,(s)}$	single replacement reaction
$NaOH_{\,(aq)} + HNO_{3\,(aq)} \rightarrow NaNO_{3(aq)} + H_2O_{\,(l)}$	double replacement reaction

PART 2. Rewrite each of the equations above so they are balanced.

PART 3. FOR EACH OF THE FOLLOWING WORD REACTIONS, WRITE A BALANCED EQUATION AND GIVE THE NAME OF TYPE REACTION

1. Solid carbon reacts with oxygen gas to produce carbon dioxide gas.

2. Water reacts with sodium metal to produce hydrogen gas and aqueous sodium hydroxide

3. Aqueous aluminum chloride reacts with aqueous sodium hydroxide to produce solid aluminum hydroxide and aqueous sodium chloride.

4. Propane (C_3H_8) reacts with oxygen gas to produce carbon dioxide gas and water.

5. Hydrogen peroxide produces water and oxygen gas.