NS G5 (pg 1 of 2) Decomposition Reactions

Name_____

During decomposition, <u>one reactant</u> compound splits apart into two (or more) substances. (Essentially this is the reverse of the synthesis reaction, which is on NS 8.4.) The product substances can be elements or compounds. Remember, the reaction will be a redox type if elements are involved. Generally heat is used to induce the decomposition.

Written using generic symbols, it is usually shown as:

$$AB \rightarrow A + B$$

Decomposition can split one compound into its elements.

Practice these examples: Write the skeleton equation, then balance. (answers on pg 2)

These are some examples of compounds decomposing into their elements. Practice writing the skeleton equations, then take the time to practice balancing and then label as redox or not. Answers are page 2.

a. solid mercury(I) oxide decomposes into its elements (a gas and a liquid)

b. liquid water decomposes into its gaseous elements

c. magnesium chloride decomposes into its elements (a gas and a solid)

d. iron(II) sulfide decomposes into its solid elements (you can write elemental sulfur as just S)

Decomposition can also split one compound into two simpler compounds (or a compound and an element)

Practice these examples:

These are some examples of compounds decomposing simpler compounds (or a compound and an element). Practice writing the skeleton equations, then take the time to practice balancing and then label as redox or not. Answers are on page 2.

e. liquid hydrogen peroxide (H_2O_2) decomposes into liquid water and oxygen gas

f. solid calcium carbonate decomposes into solid calcium oxide and gaseous carbon dioxide

g. solid sodium carbonate decomposes into solid sodium oxide and gaseous carbon dioxide

h. solid potassium chlorate decomposes into solid potassium chloride and oxygen gas

i. solid barium chlorate decomposes into solid barium chloride and oxygen gas

j. magnesium hydroxide decomposes into magnesium oxide and water

Decomposition Reactions

Important Points to Remember (i.e. *memorize*)

- Remember to always write the diatomic gases as X_2 (ie H_2 N_2 O_2 F_2 Cl_2 Br_2 I_2)
  All other elements will be written as Y (no subscript) unless you are told otherwise.
- Notice how, in every case so far, there is only <u>one</u> substance on the reactant (left-hand) side.
  This is always the case in a decomposition reaction.
- The reaction is always redox if at least one element is formed.
- You may notice some patterns above − the first three are the reverse of the three synthesis reactions that you should memorize The following decompositions occur upon heating.
  - Chlorate salts decompose into chloride salts and oxygen gas. (redox)
  - Carbonate salts decompose into oxide salts and carbon dioxide. (not redox)
  - Hydroxide salts decompose into oxide salts and water. (not redox)
  - Hydrogen peroxide decomposes into water and oxygen gas. (redox)
- As required by the decomposition of hydrogen peroxide in class, some reactions require a catalyst, which is a substance that changes the speed of a chemical reaction without itself undergoing a permanent chemical change in the process.

ANSWERS from page 1

a. skeleton: $Hg_2O \rightarrow Hg + O_2$ balanced: $2\ Hg_2O \rightarrow 4\ Hg + O_2$ (redox)

b. skeleton: $H_2O \rightarrow H_2 + O_2$ balanced: $2\ H_2O \rightarrow 2\ H_2 + O_2$ (redox)

c. skeleton: $MgCl_2 \rightarrow Mg + Cl_2$ already balanced (redox)

d. skeleton: $FeS \rightarrow Fe + S$ already balanced (redox)

e. skeleton: $H_2O_2 \rightarrow H_2O + O_2$ balanced: $2\ H_2O_2 \rightarrow 2\ H_2O + O_2$ (redox)

f. skeleton: $CaCO_3 \rightarrow CaO + CO_2$ already balanced (not redox)

g. skeleton: $Na_2CO_3 \rightarrow Na_2O + CO_2$ already balanced (not redox)

h. skeleton: $KClO_3 \rightarrow KCl + O_2$ $2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$ (redox)

i. skeleton: $Ba(ClO_3)_2 \rightarrow BaCl_2 + O_2$ balanced: $Ba(ClO_3)_2 \rightarrow BaCl_2 + 3\ O_2$ (redox)

j. skeleton: $Mg(OH)_2 \rightarrow MgO + H_2O$ already balanced (not redox)