ChemQuest 36

More Chemical Reactions

Name: _____

Date: _____

Hour: _____

Information: Double Replacement Reactions

In the previous ChemQuest, you learned about single replacement reactions in which a single atom replaces an ion from another reactant. Study what happens in the following reactions. They are called double replacement reactions.

$MgCl_2 + NaF \rightarrow NaCl + MgF_2$

$Al_2S_3 + Na_2O \rightarrow Al_2O_3 + Na_2S$

$Ca(NO_3)_2 + Na_3P \rightarrow NaNO_3 + Ca_3P_2$

Critical Thinking Questions

1. What is the difference between single replacement reactions and double replacement reactions?

2. Complete the following reactions by providing the formulas for the missing compound(s).

   a) $Cu(NO_3)_2$ + NaCl → $NaNO_3$ + $CuCl_2$

   b) ZnI_2 + $Al_2(SO_4)_3$ → $ZnSO_4$ + AlI_3

   c) $K_2O + MgBr_2 \rightarrow$ KBr + MgO

   d) Na_2SO_4 + $BaCl_2$ → $BaSO_4$ + NaCl

   e) $(NH_4)_2CO_3 + CaI_2 \rightarrow$ NH_4I + $CaCO_3$

3. Name the two products in the reaction between calcium phosphate and sodium iodide.

   $Ca_3(PO_4)_2 + NaI \longrightarrow Na_3PO_4 + CaI_2$

4. Explain why when you mix the following reactants, no reaction occurs:
   $Na_2SO_4 + NaCl \rightarrow$

   they both contain Sodium so the products wouldn't be any different.

Information: Combustion Reactions

Another type of reaction is a combustion reaction. During combustion, a hydrocarbon reacts with oxygen. The products for complete combustion are always the same—water and carbon dioxide and energy. The following equation is an example of the combustion of a hydrocarbon.

$$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$$

Critical Thinking Questions

5. Complete the following reactions by supplying the missing compound in each blank.

   a) C_4H_8 + ___O_2___ → CO_2 + H_2O

   b) C_6H_{14} + O_2 → ___CO_2___ + ___H_2O___

6. Write a combustion reaction for C_5H_{10}.

   $C_5H_{10} + O_2 \longrightarrow CO_2 + H_2O$

Information: Synthesis and Decomposition Reactions

Two other types of reactions are synthesis and decomposition. During a synthesis reaction, several reactants combine to make a single product. During a decomposition, one reactant *decomposes* into two or more products. The following table shows some examples of these types of reactions.

Synthesis	Decomposition
$H_2 + O_2 \rightarrow H_2O$	$H_2O \rightarrow H_2 + O_2$
$Na + Cl_2 \rightarrow NaCl$	$NaCl \rightarrow Na + Cl_2$

Critical Thinking Questions

7. Every synthesis reaction has ___1___ (how many?) product and every decomposition reaction has ___1___ (how many) reactant.

8. Write a synthesis reaction for sodium metal reacting with chlorine gas to form sodium chloride. (Remember that chlorine is diatomic.)

   $Na_{(s)} + Cl_{2(g)} \longrightarrow NaCl_{(s)}$

9. Categorize each of the following reactions as single replacement (SR), double replacement (DR), synthesis (S), decomposition (D) or combustion (C).

S a) $Ca + O_2 \rightarrow CaO$

SR b) $Mg(NO_3)_2 + Cu \rightarrow CuNO_3 + Mg$

C c) $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$

D d) $Al_2O_3 \rightarrow Al + O_2$

SR e) $SrCl_2 + F_2 \rightarrow SrF_2 + Cl_2$

DR f) $BaF_2 + Na_2O \rightarrow BaO + NaF$

10. Write an equation for the combustion of C_3H_6.

$C_3H_6 + O_2 \longrightarrow CO_2 + H_2O$

11. Write an equation for the decomposition of calcium oxide.

$CaO \longrightarrow Ca + O_2$

Practice Problems

1. Complete the following reactions.

a) $Na_2CO_3 + AlN \rightarrow$ $Na_3N + Al_2(CO_3)_3$

b) $BaCl_2 + F_2 \rightarrow$ $BaF_2 + Cl_2$

c) $CuNO_3 + Ag \rightarrow$ $AgNO_3 + Cu$

2. Fill in the blanks for the missing reactant or product and then in the blank to the left of each equation indicate whether the reaction is a single replacement (SR), double replacement (DR), synthesis (S), decomposition (D) or combustion (C).

DR a) $LiCl +$ $Zn(NO_3)_2$ $\rightarrow ZnCl_2 + LiNO_3$

SR b) Na $+ CaBr_2 \rightarrow NaBr + Ca$

S c) $K + Cl_2 \rightarrow$ KCl