

Types of Chemical Reactions (Section 2.4)

Name: __ Date: _

Block: __

SYNTHESIS AND DECOMPOSITION

Synthesis reactions are chemical reactions in which two or more substances react to form a new product. The general form of a synthesis reaction is written as: $A + B \rightarrow AB$

Decomposition reactions are chemical reactions in which a reactant breaks down into two or more products. The general form of a decomposition reaction is written as: $AB \rightarrow A + B$

Balance the following reactions and identify whether the reactions are synthesis or decomposition reactions.

	Balance the Reactions	Synthesis or Decomposition?
1.	$H_2SO_4 \rightarrow H_2O + SO_3$	Decomposition
2.	$16Cu + S_8 \rightarrow 8Cu_2S$	Synthesis
3.	$Zn(OH)_2 \rightarrow ZnO + H_2O$	Decomposition
4.	$2H_2O_2 \rightarrow 2H_2O + O_2$	Decomposition

Identify the following reaction types and predict the products. Then, balance the equations.

	Predict and Balance the Reactions	Synthesis or Decomposition?
5.	$2Na + I_2 \rightarrow 2NaI$	Synthesis
6.	hydrogen + chlorine \rightarrow ? $H_2 + Cl_2 \rightarrow 2HCl$	Synthesis
7.	$2Ag_2O \rightarrow 4Ag + O_2$	Decomposition
8.	$2P_3O_5 \rightarrow 6P + 5O_2$	Decomposition

SINGLE AND DOUBLE REPLACEMENT

Single replacement reactions are chemical reactions in which a metal or non-metal element replaces the corresponding metal or non-metal in an ionic compound. The general form of a single replacement reaction is written as $A + BC \rightarrow AC + B$ (A is a metal) or $A + BC \rightarrow C + BA$ (A is a non-metal).

Double replacement reactions are chemical reactions in which the positive ions in two ionic compounds 'switch places' to form two new ionic compounds. The general form of a double replacement reaction is written as $AB + CD \rightarrow AD + CB$.

Balance the following reactions and identify whether they are single replacement or double replacement.

	Balance the Reactions	Single or Double Replacement?
9.	$2KI + Br_2 \rightarrow 2KBr + I_2$	Single
10.	$3BaCl_2 + Al_2(SO_4)_3 \rightarrow 3BaSO_4 + 2AlCl_3$	Double
11.	$2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$	Single
12.	$2FeCl_3 + 3Ca(OH)_2 \rightarrow 2Fe(OH)_3 + 3CaCl_2$	Double

Identify the following reaction types and predict the products. Then, balance the equations.

	Predict and Balance the Reactions	Single or Double Replacement?
13.	$CuCl_2 + F_2 \rightarrow CuF_2 + Cl_2$	Single
14.	$K_2CO_3 + BaCl_2 \rightarrow 2KCl + BaCO_3$	Double
15.	calcium + aluminum nitride \rightarrow ? $3Ca + 2Al(NO_2)_3 \rightarrow 2Al + 3Ca(NO_2)_2$	Single
16.	ammonium chloride + lead(III) nitrate \rightarrow ? $3NH_4Cl + Pb(NO_3)_3 \rightarrow 3NH_4NO_3 + PbCl_3$	Double

NEUTRALISATION (SEE “ALL ABOUT THAT BASE” NOTES)

Neutralisation is a special example of a double replacement reaction where an acid and base react to form water and a salt. The general form of a neutralisation is $\text{HA} + \text{BOH} \rightarrow \text{H}_2\text{O} + \text{BA}$.

Extra Practice: Identify acids, bases, and salts using green workbook pg 91.

Write balanced chemical equations for each reaction below. Then, colour-code the acid (red), base (blue), and salt (green).

	Predict and Balance the Reactions
17.	$2\text{HCl} + \text{Ba}(\text{OH})_2 \rightarrow \text{BaCl}_2 + \text{H}_2\text{O}$
18.	$\text{NaOH} + \text{CH}_3\text{COOH} \rightarrow \text{NaCH}_3\text{COO} + \text{H}_2\text{O}$
19.	$3\text{Ca}(\text{OH})_2 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6\text{H}_2\text{O}$
20.	$\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$
21.	$2\text{HNO}_3 + \text{Sr}(\text{OH})_2 \rightarrow \text{Sr}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
22.	hydrogen fluoride + iron(III) hydroxide $\rightarrow ?$ $3\text{HF} + \text{Fe}(\text{OH})_3 \rightarrow \text{FeF}_3 + 3\text{H}_2\text{O}$
23.	hydrogen bromide + tin(IV) hydroxide $\rightarrow ?$ $4\text{HBr} + \text{Sn}(\text{OH})_4 \rightarrow \text{SnBr}_4 + 4\text{H}_2\text{O}$
24.	hydrogen phosphate + barium hydroxide $\rightarrow ?$ $2\text{H}_3\text{PO}_4 + 3\text{Ba}(\text{OH})_2 \rightarrow \text{Ba}_3(\text{PO}_4)_2 + 6\text{H}_2\text{O}$

COMBUSTION

Combustion is a reaction of an element or compound (often a hydrocarbon or alcohol) with oxygen to produce carbon dioxide and water. The general form of a hydrocarbon combustion reaction is $\text{C}_x\text{H}_y\text{O}_z + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$. Alcohol combustion leads to the same products (carbon dioxide and water).

Predict the products of the following combustion reactions. Then, balance the equations.

	Predict and Balance the Reactions
25.	$2\text{C}_2\text{H}_6 + 5\text{O}_2 \rightarrow 2\text{CO}_2 + 6\text{H}_2\text{O}$
26.	$2\text{C}_8\text{H}_{18} + 25\text{O}_2 \rightarrow 16\text{CO}_2 + 18\text{H}_2\text{O}$
27.	$2\text{C}_3\text{H}_8\text{O} + 9\text{O}_2 \rightarrow 6\text{CO}_2 + 8\text{H}_2\text{O}$
28.	$2\text{C}_{12}\text{H}_{22}\text{O}_{12} + 23\text{O}_2 \rightarrow 24\text{CO}_2 + 22\text{H}_2\text{O}$

6.1 Important Vocabulary

Combustion: the rapid reaction of an element or compound (usually a hydrocarbon or alcohol) with oxygen to form an oxide and to produce heat

Decomposition: the breaking down of a compound into smaller compounds or separate elements

Double Replacement: when two ionic solutions react to produce two other ionic compounds, one of which can be a precipitate

Neutralisation: an example of a double replacement reaction where an acid and base react to form water and a salt

Precipitate: an insoluble (does not dissolve) solid ionic compound that often forms in double replacement reactions

Single Replacement: when a reactive element (metal or non-metal) and compound react to produce another element and another compound

Synthesis (Combination): where two or more reactants combine to produce a single product

It may help you to review:

- Ionic bonding (Ch. 4.1)
- Diatomic molecules (Ch. 4.1)
- Naming Compounds (Ch. 4.2)
- Balancing Equations (Ch. 4.3)
- Acid-Base Neutralization (Pg. 236 in textbook)