
Reactions
Topic#9
AMSAT Chem 1H

Student Edition

Reactions
Topic#9

Chemical Reactions

OOPS! SOMEHOW WE FIND OURSELVES MAROONED ON A DESERT ISLAND. HOW ARE WE GOING TO SURVIVE? MAYBE WE CAN MAKE SOMETHING USEFUL OUT OF THE MATERIALS AT HAND...



Intro to Reactions

**Reactions
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Handouts: SW#1, SW#2, Acid Nomenclature, Activity series

Characteristics

Common Symbols Used in Reactions

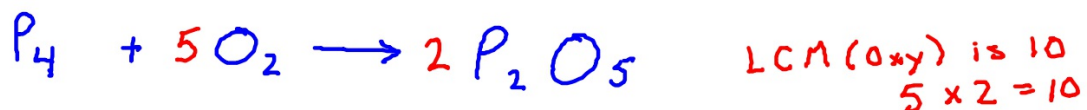
- yields
- ↔ reversible (equilibrium)
- (s) solid
- (l) liquid
- (aq) aqueous (solution with water as the solvent)
- (g) gas
- ↓ precipitate is formed (ppt)
- ↑ gas is evolved
- Δ heat
- or → heat is added to the reaction
- _{2atm} → reactants are under 2 atm pressure
- _{pressure} → reactants are under pressure
- 0°C → temperature at which reaction occurred
- _{MnO₂} → reaction is catalyzed (MnO₂ is the catalyst)

Characteristics

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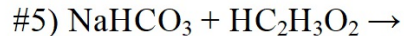
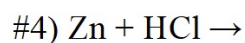
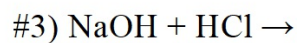
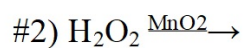
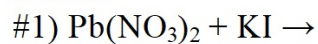
Elemental reactants with subscripts and conservation of mass:

Phosphorus reacts with oxygen to produce diphosphorus₂pentoxide₅



P	O	
4(30.97)	5(2(16))	2(141.94)
123.88g	160g	?

$$283.88g = 283.88g \quad \checkmark$$

Characteristics**Demo:**

*Universal Indicator, matches, splint, dish soap, MnO_2 ,

What are the indicators of a reaction?

- (1)
- (2)
- (3)
- (4)
- (5)

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Assign WS#1**Demo:**

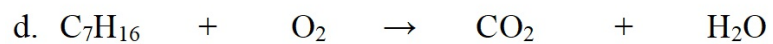
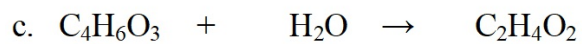
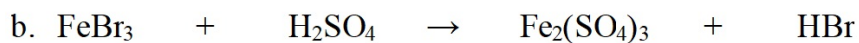
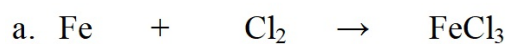
- glow stick
- screaming gummi bear (glucose + KClO_3)

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Balancing

Reactions Topic#9 Sample WS#1 - Balancing Chemical Equations

1. Balance the following chemical equations.



Balancing Combustion Reactions

1. Balance C
2. Balance H
3. Balance O
4. Remove denominator

** subscript of C becomes the coefficient of CO_2 , the subscript of H \div 2 is the coefficient of H_2O . The coefficient of O_2 is the sum total of O's \div 2

Balancing**Reactions
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Balancing Combustion Reactions

1. Balance C
2. Balance H
3. Balance O
4. Remove denominator

**subscript of C becomes the coefficient of CO₂, the subscript of H ÷ 2 is the coefficient of H₂O. The coefficient of O₂ is 1/2 sum total of O's ÷ 2



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Word/Formula Equations

- How to treat elements hydrogen, nitrogen, oxygen, fluorine, chlorine, bromine, iodine, phosphorus, and sulfur when they are a reactant or product.
- When writing the formula equation from a word equation, certain elements (above) need a subscript in their formula.
 - hydrogen or **hydrogen gas** is written as **H₂**
 - nitrogen or **nitrogen gas** is written as **N₂**
 - oxygen or **oxygen gas** is written as **O₂**
 - fluorine or **fluorine gas** is written as **F₂**
 - chlorine or **chlorine gas** is written as **Cl₂**
 - bromine or **liquid bromine** is written as **Br₂**
 - iodine or **solid iodine** is written as **I₂**
 - phosphorus or **solid phosphorus** is written as **P₄**
 - sulfur or **solid sulfur** is written as **S₈**

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Word/Formula Equations

Word Equation - describes a reaction using sentence(s)

Formula equation - uses the formulas of the reactants and products to describe a reaction

Reactions Topic#9 Sample WS#1 - Word/Formula Equation:

2. Write the word and formula equations for the chemical reaction that occurs when solid sodium oxide is added to water at room temperature and forms sodium hydroxide (dissolves in the water). Include symbols for physical states in the formula equation. Then balance the formula equation to give a balanced equation.

charges:

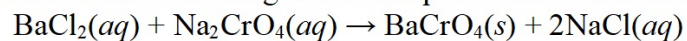
word equation:

balanced formula equation:

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Word/Formula Equations

3. Translate the following chemical equation into a sentence:



Process for Writing Word/Formula Equations:

- (1) Write word equation. (3) Balance
(2) Write formula equation. (4) Count atoms to check for correct balancing.

Word/Formula Equations Practice

4. Aluminum (III) sulfate and calcium hydroxide are used in a water-purification process. When added to water, they dissolve and react to produce two insoluble products, aluminum (III) hydroxide and calcium sulfate. These products settle out, taking suspended impurities with them. (flocculation of organic material)

charges:

word equation:

balanced formula equation:

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Word/Formula Equations

Process for Writing Word/Formula Equations:

- (1) Write word equation. (3) Balance
(2) Write formula equation. (4) Count atoms to check for correct balancing.

5. The reaction of zinc with aqueous hydrochloric acid produces a solution of zinc (II) chloride and hydrogen gas.

charges:

word equation:

balanced formula equation:

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Word/Formula Equations

Assign WS#2

6. (OYO) Solid aluminum (III) carbide, Al_4C_3 , reacts with water to produce methane gas (CH_4) and solid aluminum (III) hydroxide. Write a balanced equation.

Per EB/1 start here 01/14/20

charges:

word equation:

balanced formula equation:

7. (OYO) Butane gas (C_4H_{10}) is ignited in the presence of oxygen gas producing carbon dioxide and water.

charges:

word equation:

balanced formula equation:

Balancing Combustion Reaction

1. Balance C
2. Balance H
3. Balance O
4. Remove denominator

**subscript of C becomes the coefficient of CO_2 , the subscript of H \div 2 is the coefficient of H_2O . The coefficient of O_2 is the sum total of O's \div 2

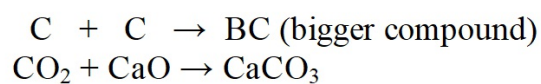
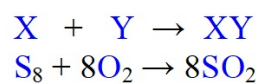
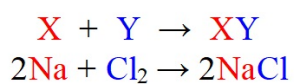
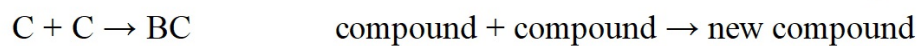
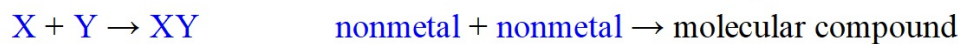
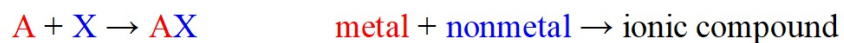
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Types of Reactions

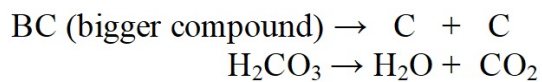
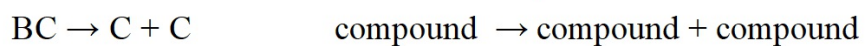
Intro

- o 5 basic types of general reactions
- o Synthesis (composition), decomposition, single-replacement (single displacement), double-replacement (double-displacement), and combustion

Synthesis (2 become 1)



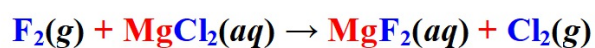
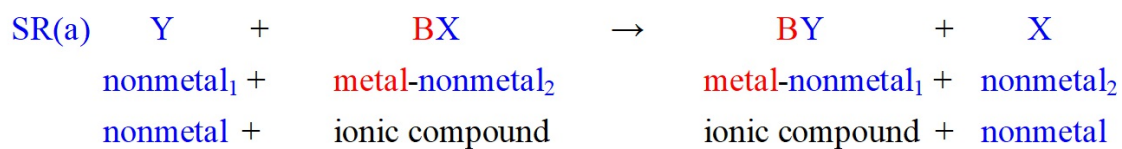
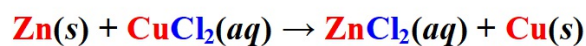
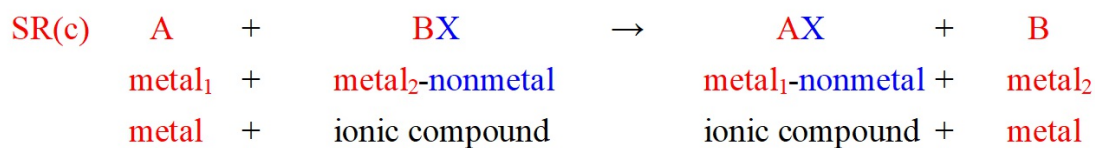
Types of Reactions**Reactions
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Decomposition (1 becomes 2 or more)

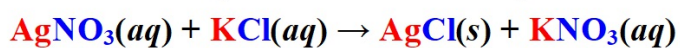
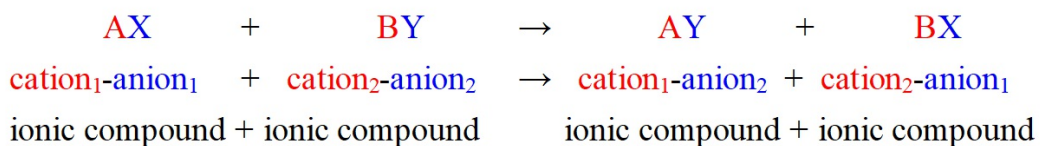
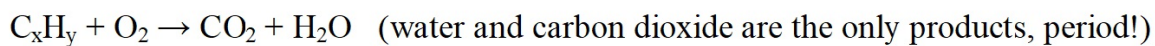
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Types of Reactions

Single-Replacement Reactions (Single-Displacement)



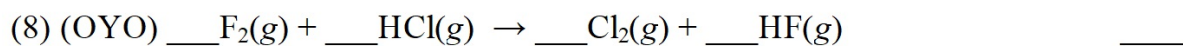
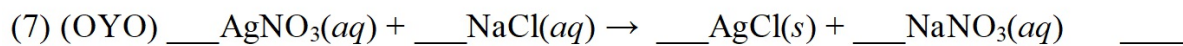
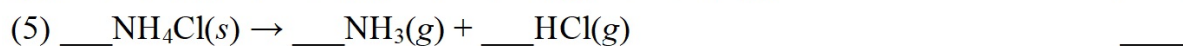
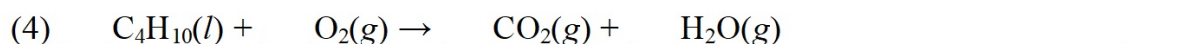
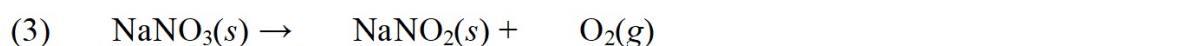
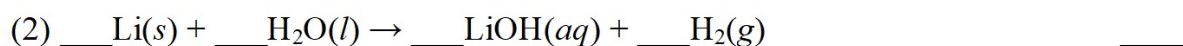
Types of Reactions**Reactions
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Double-replacement reactions (DR)**Combustion (C)**

Reactions Sample WS#2 - Balancing/Types of Chemical Equation Practice Problems

Balance/Classify the following equations.

Type (C, S, D, SR(a), SR(c), or DR)



Reactions

Single Replacement Reactions - Activity Series **Topic#9**

Assign WS#5

Metal Activity Series

Handout: Activity Series Student sheet

Li>Rb>K>Ba>Ca>Na > Mg>Al>Mn>Zn>Cr>Fe > Ni>Sn>Pb > I₂>Cu>Hg > Ag>Pt>Au

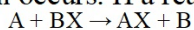
| cold H₂O, acids, oxygen | steam, acids, oxygen | acids, oxygen | oxygen | unreactive |

Nonmetal Activity Series

F₂>Cl₂>Br₂>I₂

Reactions Sample WS#2 - Activity Series Practice Problems

2. Using the activity series, predict whether a reaction occurs. If a reaction occurs, then predict the products and balance the equation.

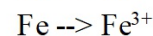
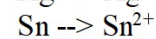
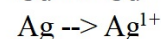
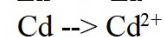
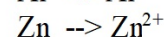
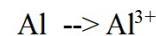


A vs B (If A > B, then a reaction occurs.)



h. Identify the element that replaces hydrogen from acids but cannot replace tin from its compounds. _____

i. According to the activity series, what is the most active transition metal? _____



Predicting Products.

1. Identify type of reaction (Use A, B, X, and Y)
 - a. two products for a decomposition
 - b. one product for a synthesis
 - c. two products for a single replacement
 - d. two products for a double replacement
2. Write the names of the products
3. Write the formula equation
4. Balance equation

Reactions Sample WS#3 - Predicting Products

Synthesis with one product

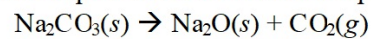
1. potassium plus fluorine →

Decomposition with two products

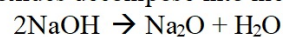
2. zinc (II) carbonate $\xrightarrow{\text{heated } \Delta}$

Reactions
Topic#9**Unique Reactions**

Carbonates decompose into the metal oxide plus carbon dioxide



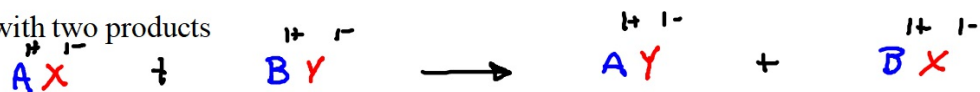
Metal hydroxides decompose into metal oxides and water



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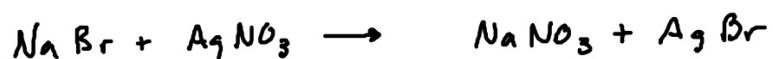
Predicting Products.

DR with two products

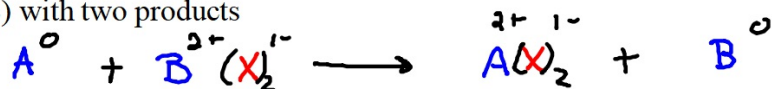


3. sodium bromide plus silver (I) nitrate →

sodium nitrate + silver(I) bromide



SR(c) with two products



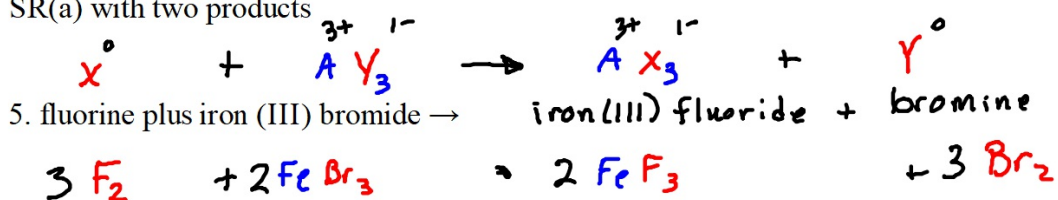
4. strontium plus lead (II) chlorate →



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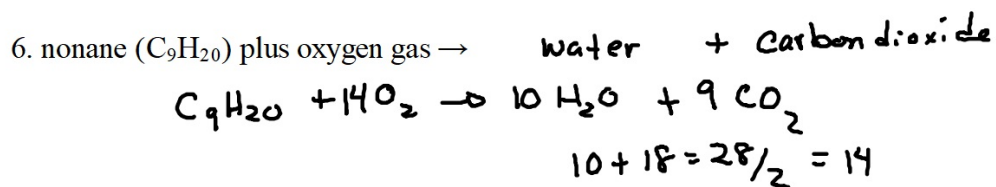
Predicting Products.

SR(a) with two products



LCM-6

Combustion with two products, CO₂ and H₂O



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END