

Balancing Chemical Equations



General
Chemistry
Mrs. Page
2015-2016

Daily Objectives:

- Describe the relationship between the law of conservation of matter and balancing chemical equations.
- Write a word equation and a formula equation for a given chemical equation.
- Balance chemical equations.
- Apply the use of state symbols (s), (l), (g) and (aq) in equations.
- List observations that would indicate that a chemical reaction has taken place.

REVIEW: Reading Chemical Formulas

Think back to early this year and answer the following question in your notebook:

- How is a subscript different from a coefficient?
- **Subscript**: lower and smaller, after element symbol, represents the number of atoms of that element in a compound, cannot be changed without changing the compound (N_2 , CO_2 , K_3PO_4)
- **Coefficient**: number in front of a chemical formula, shows the number of molecules/formula units (2NaCl , 4CO)

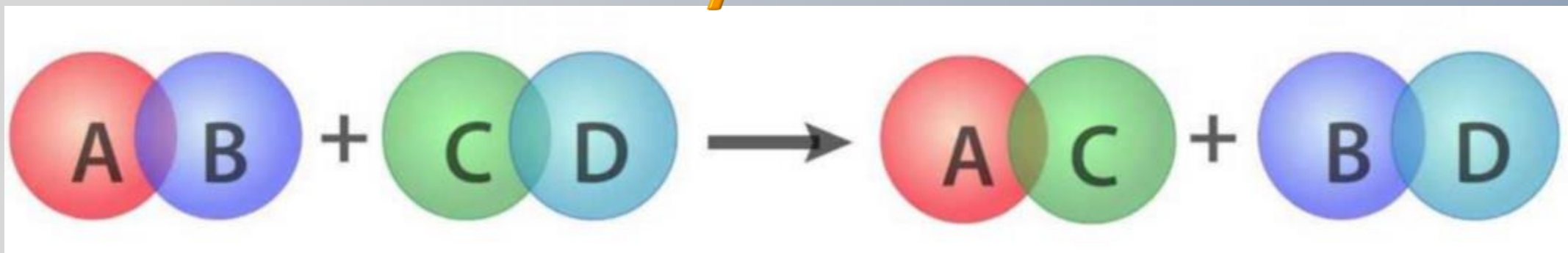
What is a Chemical Reaction?

- Chemical reactions occur when bonds are broken and new bonds form
- The two particles that you start with are called the **reactants**
- The results of the reaction are called the **products**
- The arrow symbol is read “**yields**”

Reactants

yield

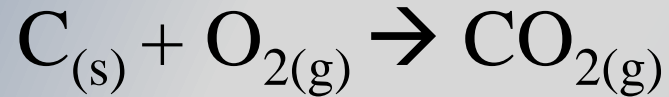
Products



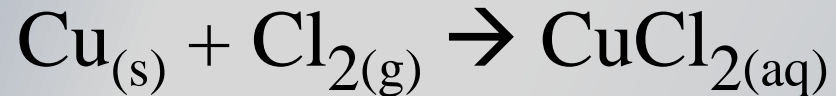
State Symbols

- In chemistry the state of an element or compound can effect how it reacts (think about energetics)
- The following symbols are used as a subscript at the end of each chemical formula:
 - Solid (*s*)
 - Liquid (*l*)
 - Gas (*g*)
 - Aqueous (*aq*) – for solutions

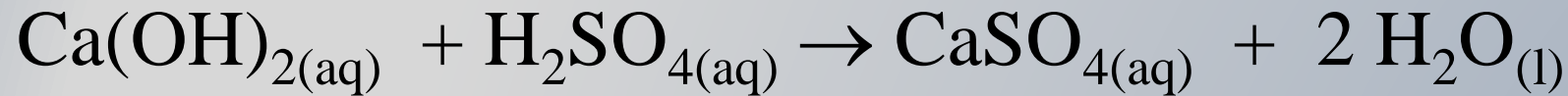
Reading Chemical Equations



- Carbon plus oxygen gas yields carbon dioxide



- Copper metal plus chlorine gas yields copper chloride



- Calcium hydroxide plus hydrogen sulfate yields calcium sulfate and 2 molecules of water



- 2 formula units of potassium iodide plus chlorine gas yields 2 formula units of potassium chloride and iodine gas

Reading Chemical Equations

- $\text{NH}_4\text{NO}_{3(\text{aq})} \rightarrow \text{N}_2\text{O}_{(\text{g})} + \text{H}_2\text{O}_{(\text{l})}$
- Ammonium nitrate yields dinitrogen oxide and 2 molecules of water
- $\text{C}_3\text{H}_{8(\text{l})} + 5\text{O}_{2(\text{g})} \rightarrow 3\text{CO}_{2(\text{g})} + 4\text{H}_2\text{O}_{(\text{l})}$
- Tricarbon octahydride plus 5 molecules of oxygen gas yields three molecules of carbon dioxide and 4 molecules of water
- $\text{PCl}_{5(\text{s})} + 4\text{H}_2\text{O}_{(\text{aq})} \rightarrow \text{H}_3\text{PO}_{4(\text{aq})} + 5\text{HCl}_{(\text{aq})}$
- Phosphorus pentachloride plus 4 molecules of water yields hydrogen phosphate and 5 formula units of hydrogen chloride

Writing Chemical Equations

Magnesium plus oxygen gas yields solid magnesium oxide



2 formula units of potassium nitrate breaks down into 2 formula units of potassium nitrate and oxygen gas



Carbon tetrahydride gas burns with 2 molecules of oxygen gas to yield carbon dioxide and 2 molecules of water

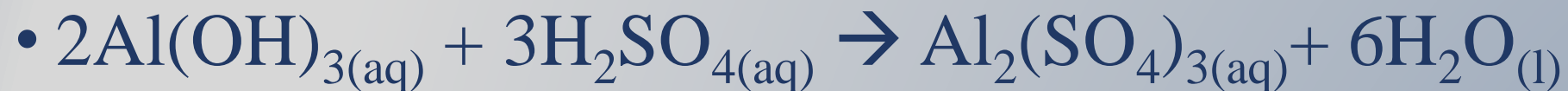


Writing Chemical Equations

Copper plus silver (I) nitrate yields copper (II) nitrate plus silver



2 formula units of aluminum hydroxide plus 3 formula units of hydrogen sulfate yields aluminum sulfate plus 6 molecules of water

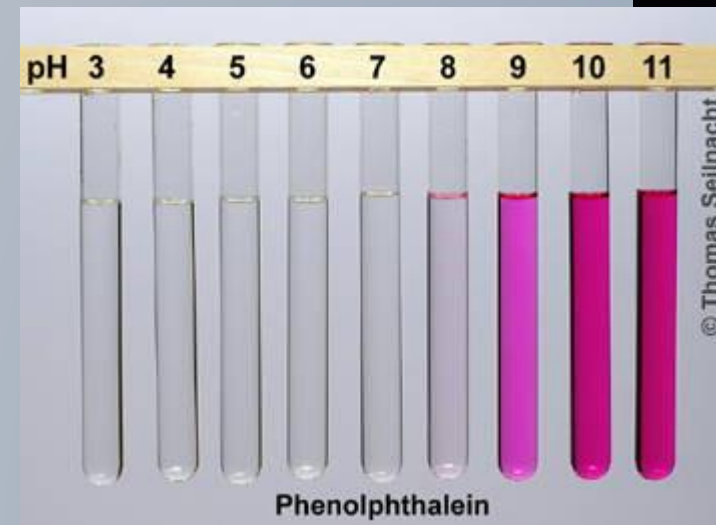
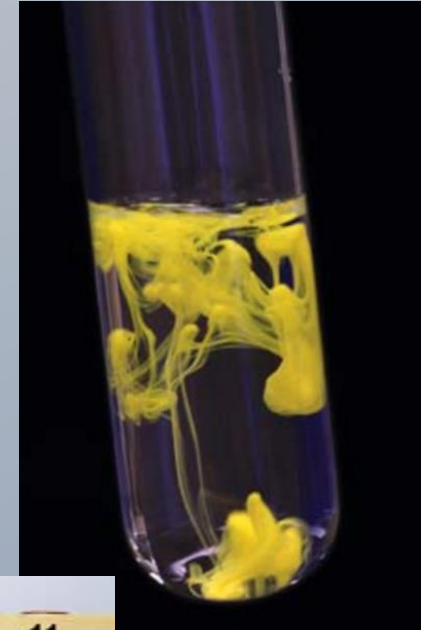


Aqueous magnesium nitride plus aqueous hydrogen chloride yields solid magnesium chloride plus aqueous ammonium chloride



Evidence of Chemical Reactions

- Emission of light
- Change in temperature
- Formation of a gas
- Formation of a precipitate
- Change in color (careful)
- Emission of smell



Law of Conservation of Matter

- Matter cannot be created or destroyed, it can only be transformed
- Therefore, during a chemical reaction, all of the atoms that are present at the start of the reaction also must be present at the end of the reaction
- In other words: the number of EACH type of atoms in your reactants **MUST EQUAL** the number of EACH type of atom in your products!

Balancing Chemical Equations



- STEP 1: Create a RAP table
- Step 2: Count the number of each atom in the reactants and products
- Step 3: Use coefficients to balance atoms
- Step 4: Check that ALL atoms are balanced

# Reactant		Atom	# Product	
1	4	Fe	2	4
2	6	O	3	6



Balancing Chemical Equations



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# Reactant		Atom	# Product	
1	1	C	1	1
4	4	H	2	4
2	4	O	3	4

Balancing Chemical Equations



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# Reactant		Atom	# Product	
1	1	P	1	1
5	5	Cl	1	5
2	8	H	4	8
1	4	O	4	4