

CHAPTER 8: CHEMICAL REACTIONS

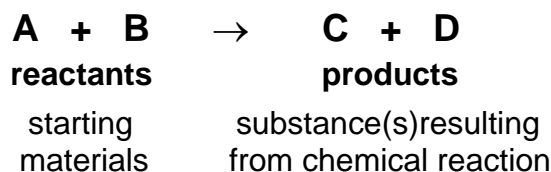
Problems: 1-16, 19-34, 39-44, 49-74, 77-86

8.1 EVIDENCE FOR CHEMICAL REACTIONS

1. A gas is produced—indicated by bubbles
2. A precipitate (solid) is formed when 2 solutions are combined
3. A permanent color change occurs
4. Heat energy change is noted
 - **exothermic reaction**: releases heat (reaction vessel feels hot)
 - **endothermic reaction**: absorbs heat (reaction vessel feels cold)

8.2 WRITING CHEMICAL EQUATIONS

chemical equation: Formulas and symbols describing a chemical reaction



Physical state of all reactants and products are indicated using subscripts:

- (s) = solid (g) = gas
(l) = liquid (aq) = aqueous (ions or compounds in solution)

Example:



Diatomic Molecules:

- Recognize those elements that exist as **diatomic molecules** (X_2):



I like to call these the “**lucky seven**” since there are seven of them, and six of them form a 7 on the periodic table.

8.3 BALANCING CHEMICAL EQUATIONS

coefficient: Whole #s *in front* of each reactant or product, indicating how many of each is present

subscript: Whole # *following* each element in a chemical formula, indicating the # of each element present in the compound

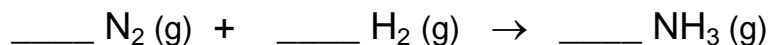
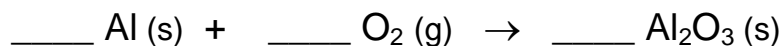
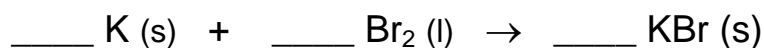
Balancing by Inspection GUIDELINES

1. Count the # of elements on both sides of the equation
2. Change the coefficients (NEVER the subscripts) to get the same # of elements on both sides of the equation

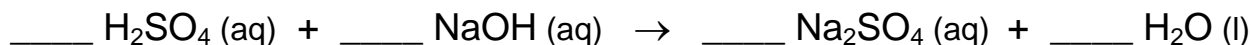
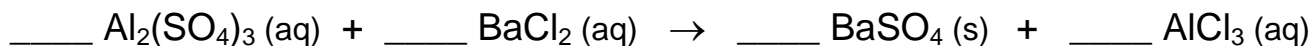
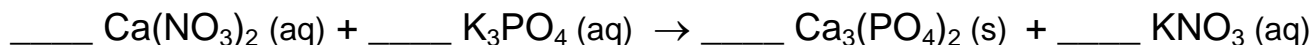
Balance in the following order:

- metals
- polyatomic ions —Balance as a whole, so don't break up!
- hydrogen (H)
- carbon (C)
- oxygen (O)
- all other elements

Examples:

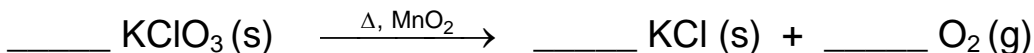


Treat polyatomic ions as ONE UNIT—Do not break them up into atoms!



8.6 Decomposition Reactions: $AZ \rightarrow A + Z$

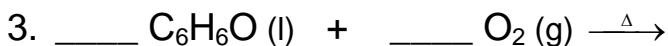
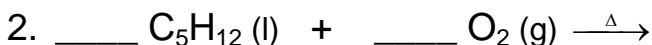
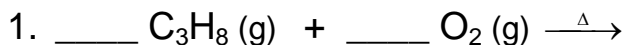
- One reactant breaks down into two or more products
- Given a reaction to balance, be able to balance it and identify it as a decomposition reaction



COMBUSTION REACTIONS: $\text{C}_x\text{H}_y + \text{O}_2(\text{g}) \xrightarrow{\Delta} \text{H}_2\text{O}(\text{g}) + \text{CO}_2(\text{g})$
(COMPLETE OXIDATION/BURNING) $\text{C}_x\text{H}_y\text{O}_z + \text{O}_2(\text{g}) \xrightarrow{\Delta} \text{H}_2\text{O}(\text{g}) + \text{CO}_2(\text{g})$

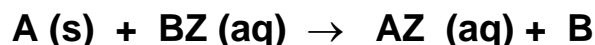
Hydrocarbons (compounds with only C and H) and hydrocarbon derivatives (compounds with only C, H and O) burn in O_2 to produce steam and CO_2 gas.

Write the formulas for the products then balance C, then H, then finally O:

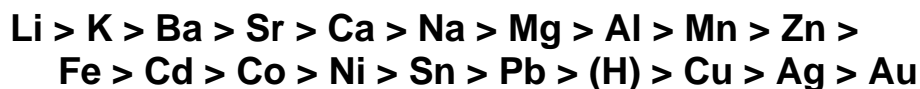


Note: Given any hydrocarbon or hydrocarbon derivative with oxygen as reactants in a chemical equation, indicate the products for the reaction are steam and CO_2 gas, balance the equation, and classify it as a combustion reaction.

8.8 SINGLE-REPLACEMENT REACTIONS:



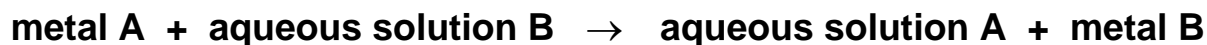
ACTIVITY SERIES: Relative order of elements arranged by their ability to undergo reaction



Note: The Activity Series will be given to you on quizzes and exams.

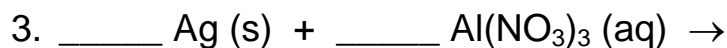
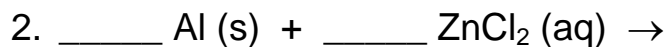
SOLID METAL IN A METAL SOLUTION

– The *more active* metal will prefer to be *in solution*=(aq).



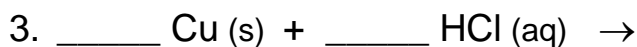
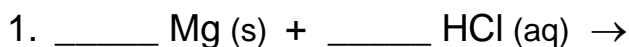
For each of the following,

1. Check the **Activity Series** to see if the ***solid metal is more active***.
 - If it is, the reaction occurs, so write the formulas for the products
 - If it's not, write NR for "no reaction"
2. Balance the equation if the reaction occurs



For each of the following,

1. Check the **Activity Series** to see if the ***solid metal is more active than H.***
 - If it is, the reaction occurs, so write the formulas for the products
 - If it's not, write NR for "no reaction"
2. Balance the equation if the reaction occurs

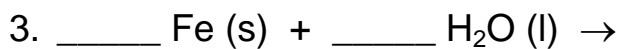
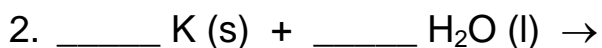
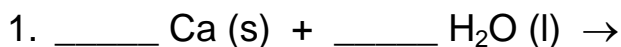


ACTIVE METALS: Li > K > Ba > Sr > Ca > Na

— Only active metals react with water

For each of the following,

1. Check to see if the ***solid metal is an active metal.***
 - If it is, the reaction occurs, so write the formulas for the products
 - If it's not, write NR for "no reaction"
2. Balance the equation if the reaction occurs



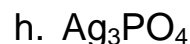
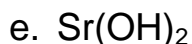
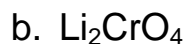
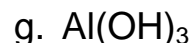
8.9 SOLUBILITY RULES: Indicate which ions combine to form an insoluble solid (precipitate)

soluble = ions stay in solution (no precipitate) → (aq)
insoluble = precipitate forms → (s)

Note: The Solubility Rules will be given on quizzes and exams

Example: Use your Solubility Rules to determine the physical state when each ionic compound below is placed in water:

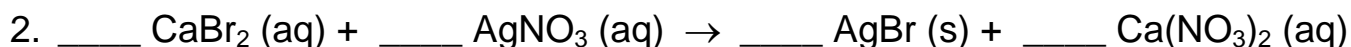
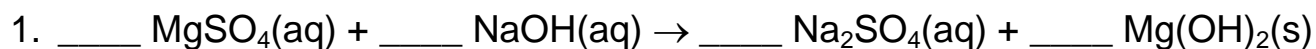
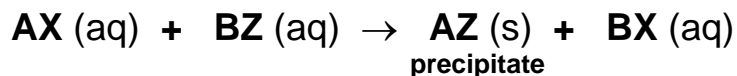
- If the compound is **soluble**, indicate the physical state as **(aq)**.
- If the compound is **insoluble**, indicate the physical state as **(s)**.



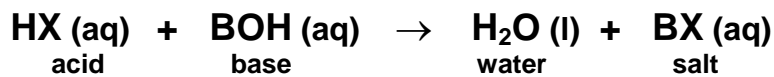
8.9 DOUBLE-REPLACEMENT/PRECIPIATION REACTIONS:

- Two cations (A & B) exchange anions (X & Z)
- Given a reaction to balance, be able to balance it and identify it as a double-replacement/precipitation reaction
- Be able to identify the precipitate in a double-replacement/precipitation reaction

Two solutions react to form a precipitate (a solid):



8.10 DOUBLE-REPLACEMENT (ACID-BASE) NEUTRALIZATION REACTIONS:



There is ALWAYS a reaction because water is always formed!
(i.e. it doesn't matter whether the salt is soluble or insoluble)

Example: Write the formulas for the products then balance the equation.
– Be sure to balance metals, then polyatomic ions, H, O, then everything else.

