

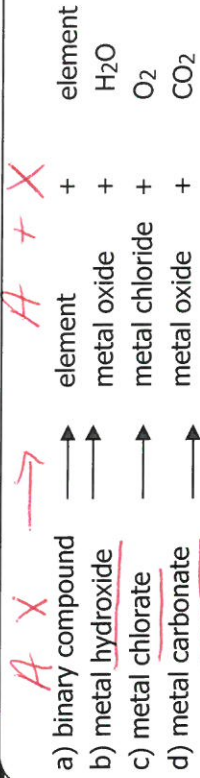
# Types of Reactions

Reactants  $\longrightarrow$  Products

TYPE 1



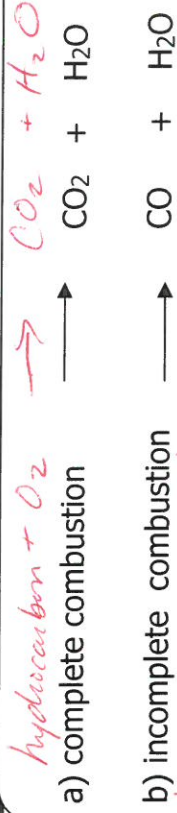
TYPE 2



TYPE 3

## COMBUSTION

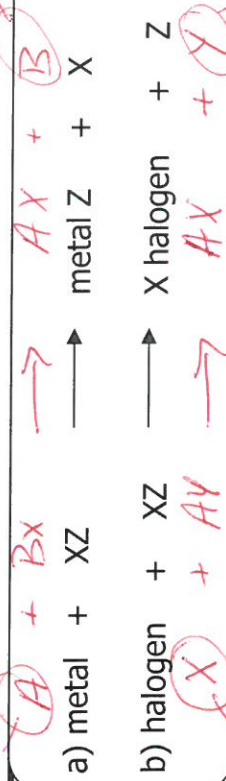
Hydrocarbon + O<sub>2</sub>



TYPE 4

## SINGLE REPLACEMENT

Element + Compound



TYPE 5

## DOUBLE REPLACEMENT

Compound + Compound



NOTES

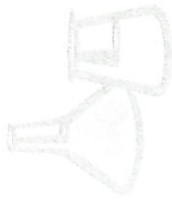
Honors Chemistry  
 Chapters 6 & 7

### Diatomic Molecules

- 7 Shape*
- H<sub>2</sub>
  - O<sub>2</sub>
  - N<sub>2</sub>  $\leftarrow$  #7
  - F<sub>2</sub>
  - Cl<sub>2</sub>
  - Br<sub>2</sub>
  - I<sub>2</sub>

*Necessary*

- s = solid
- l = liquid
- g = gas
- aq = aqueous (water solution)



Type of Reaction	Reactant Characteristic(s)	Product Characteristic(s)	Other Possible Types
Synthesis/Composition	2 or more	only 1	redox, combustion
Decomposition	only 1	2 or more	redox
Single Replacement/Displacement	1 element + 1 compound	new element + new compound	redox
Double Replacement/Displacement	2 compounds	switch, 2 new compounds	precipitation, acid-base
Combustion	fuel + O <sub>2</sub>	CO <sub>2</sub> + H <sub>2</sub> O	redox, synthesis
Redox/Oxidation-Reduction	O <sub>2</sub> possible, metal loses electrons, nonmetal gains electrons	O <sub>2</sub> possible, metal loses electrons, nonmetal gains electrons	synthesis, combustion, single replacement
Precipitation	2 aqueous compounds	1 solid and 1 aqueous compound	acid-base, double replacement
Acid-Base	H = acid, OH = base	salt + water	double replacement, precipitation

Type of Reaction	General Equation	Helpful Hints
Synthesis/Composition	$A + X \rightarrow AX$	check charges of ions
Decomposition	$AX \rightarrow A + X$	gas usually produced
Single Replacement/Displacement	$A + BX \rightarrow AX + B$	use the activity series
Double Replacement/Displacement	$AX + BY \rightarrow BX + AY$	positives bond with negatives
Combustion	Hydrocarbon + O <sub>2</sub> → CO <sub>2</sub> + H <sub>2</sub> O	no CO <sub>2</sub> for flammable gases or metals
Redox/Oxidation-Reduction	$\begin{aligned} &\text{metal} - e^- \rightarrow \text{metal}^{+\text{charge}} \\ &\text{metal}^{+\text{charge}} - e^- \rightarrow \text{metal}^{\text{more} + \text{charge}} \\ &\text{nonmetal} + e^- \rightarrow \text{nonmetal}^{-\text{charge}} \\ &\text{nonmetal}^{-\text{charge}} + e^- \rightarrow \text{nonmetal}^{\text{more} - \text{charge}} \end{aligned}$	OIL RIG: oxidation is the loss of electrons, reduction is the gain of electrons
Precipitation	2 aqueous compounds → solid compound + aqueous compound	use the solubility chart
Acid-Base	$HX + AOH \rightarrow AX + H_2O$	look for H and OH as reactants

**Table 8.1**

**General Rules for Solubility of Ionic Compounds (Salts) in Water at 25 °C**

1. Most nitrate ( $\text{NO}_3^-$ ) salts are soluble.
2. Most salts of  $\text{Na}^+$ ,  $\text{K}^+$ , and  $\text{NH}_4^+$  are soluble.
3. Most chloride salts are soluble. Notable exceptions are  $\text{AgCl}$ ,  $\text{PbCl}_2$ , and  $\text{Hg}_2\text{Cl}_2$ .
4. Most sulfate salts are soluble. Notable exceptions are  $\text{BaSO}_4$ ,  $\text{PbSO}_4$ , and  $\text{CaSO}_4$ .
5. Most hydroxide compounds are only slightly soluble.\* The important exceptions are  $\text{NaOH}$  and  $\text{KOH}$ .  $\text{Ba}(\text{OH})_2$  and  $\text{Ca}(\text{OH})_2$  are moderately soluble.
6. Most sulfide ( $\text{S}^{2-}$ ), carbonate ( $\text{CO}_3^{2-}$ ), and phosphate ( $\text{PO}_4^{3-}$ ) salts are only slightly soluble.\*

\*The terms *insoluble* and *slightly soluble* really mean the same thing: such a tiny amount dissolves that it is not possible to detect it with the naked eye.

**TABLE 8-3 Activity Series of the Elements**

Activity of metals	Activity of halogen nonmetals
Li Rb React with cold $\text{H}_2\text{O}$ and acids, replacing hydrogen. K Ba React with oxygen, forming oxides. Sr Ca Na	$\text{F}_2$ $\text{Cl}_2$ $\text{Br}_2$ $\text{I}_2$
Mg Al React with steam (but not cold water) and acids, replacing hydrogen. Mn Zn React with oxygen, forming oxides. Cr Fe Cd	
Co Do not react with water. Ni React with acids, replacing hydrogen. Sn Pb React with oxygen, forming oxides.	
$\text{H}_2$ Sb React with oxygen, forming oxides. Bi Cu Hg	
Ag Fairly unreactive, forming oxides only indirectly. Pt Au	

(a) Soluble compounds

$\text{NO}_3^-$  salts

$\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$  salts

$\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$  salts  
Except for those containing  $\text{Ag}^+$ ,  $\text{Hg}_2^{2+}$ ,  $\text{Pb}^{2+}$

$\text{SO}_4^{2-}$  salts  
Except for those containing  $\text{Ba}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Ca}^{2+}$

(b) Insoluble compounds

$\text{S}^{2-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{PO}_4^{3-}$  salts

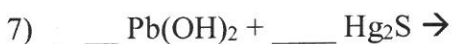
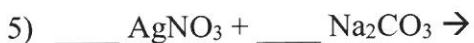
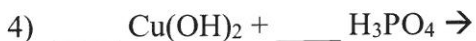
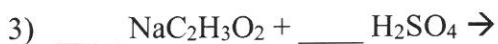
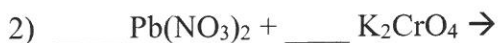
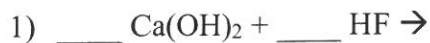
$\text{OH}^-$  salts  
Except for those containing  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$

**Figure 8.3**  
Solubilities of common compounds

## Reaction Products Worksheet

For each of the following reactions, determine what the products of each reaction will be. When you have predicted the products, balance the equation and use a table of solubility products to determine which of the products (if any) will precipitate. Assume all reactions take place in water.

THERE IS ONE REACTION THAT WILL NOT TAKE PLACE BECAUSE THE ORIGINAL REACTANTS ARE NOT SOLUBLE IN WATER. It is one of the last 3 equations.

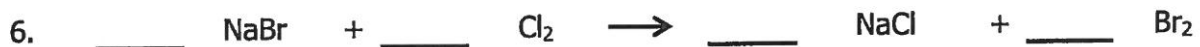
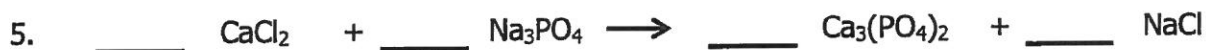
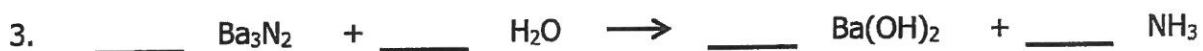


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### Balancing Equations

Balance the following chemical equations.

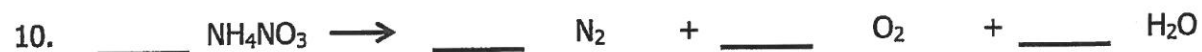
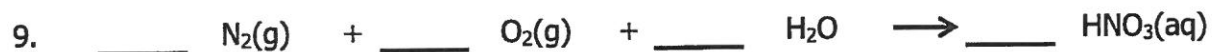
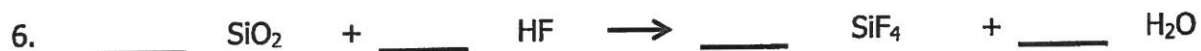
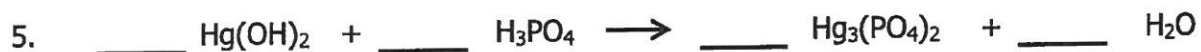
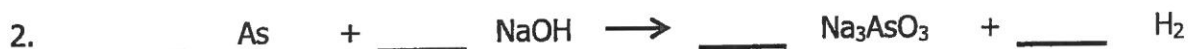


Name: \_\_\_\_\_

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### Balancing Equations

Balance the following chemical equations.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Balancing Equations

Balance the following chemical equations.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Balancing Equations

Balance the following chemical equations.

