

I. Fill in the blanks with the most appropriate term:

Common names of substances like "milk of magnesia" or "lime" usually give no information about the chemical composition of a compound. Consequently, chemists rely on a chemical formula when representing a chemical compound. Ionic compounds are composed of a metal and a nonmetal while molecular compounds are formed between nonmetals. In formulas for binary ionic compounds, the positive ion (or cation) is always written first and named first. The negative ion (or anion) is then written and named, with the ending changed to "-ide". Subscripts are used to show the number of each ion in the formula. The stock system of nomenclature is used for compounds of metals that have more than one charge. Ions made up of more than one element are called polyatomic ions, and the ending is NOT changed when naming the compound! Prefixes are used to show the number of atoms of each element when naming a molecular compound. Carbon compounds are a special type of molecular compound with the prefix denoting the number of carbon atoms and the suffix denoting the type of bonds.

A chemical reaction can be represented by a chemical equation. The starting substances that undergo a chemical change are called the reactants. The new substances formed are called the products. Following the Law of Conservation of Mass /Matter, a chemical equation must be balanced. When balancing an equation, coefficients are placed in front of the reactants and products so that the same number of atoms of each element is on each side of the equation. An equation must never be balanced by changing the subscripts in the chemical formula of a substance.

Special abbreviations are used to show the physical state of a substance in a reaction. The symbol for a liquid is (l); for a solid, (s); for a gas, (g) or ↑; and for a precipitate (an insoluble solid), a (s) or ↓. A substance that is dissolved in water is designated (aq).

We recognize five general types of reactions. In a synthesis reaction, the reactants are two or more elements and/or compounds and a more complex product is formed. A decomposition reaction is just the opposite; a single compound is broken down into two or more simpler substances. In a single replacement reaction, the reactants and products take the general form of $A + BY \rightarrow AY + B$. An activity series must be used to determine if this type reaction will actually take place. An element in the activity series can replace any element below it on the list, but cannot replace any element above it on the list. A double replacement reaction involves the exchange of cations (positive ions) between two compounds generally in an aqueous solution. One of the reactants in a combustion reaction is atmospheric oxygen; the products of the complete combustion of a hydrocarbon are CO₂ and H₂O. If the combustion is incomplete (which means not enough oxygen is present), the poisonous, colorless, odorless gas carbon monoxide (CO) is also formed.

II. Writing and naming formulas

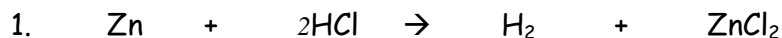
Write either the name or formula for the following compounds, whichever is appropriate.

1. phosphorus pentachloride PCl₅
2. CH₄ methane
3. zinc phosphate Zn₃(PO₄)₂

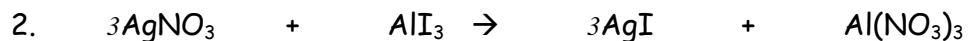
4. C_4H_8 butene
5. CCl_4 carbon tetrachloride
6. ammonium thiosulfate $(NH_4)_2S_2O_3$
7. aluminum citrate $AlC_6H_5O_7$
8. tin (II) oxide SnO
9. Fe_2O_3 iron (III) oxide
10. copper (II) iodate $Cu(IO_3)_2$

III. Balancing Equations

Balance the following equations. Tell which type of reaction each represents.



type: single replacement



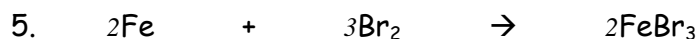
type: double replacement



type: decomposition



type: combustion



type: synthesis

IV. Activity Series

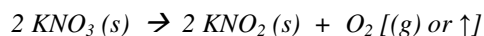
Use the activity series to write balanced chemical equations for each of these single replacement reactions. If no reaction will occur, write "NR".

1. $\text{Sn}(s) + \text{NaNO}_3(aq) \rightarrow \text{NR}$
2. $\text{Cl}_2(g) + 2\text{NaBr}(aq) \rightarrow 2\text{NaCl}(aq) + \text{Br}_2(l)$
3. $\text{Cu}(s) + \text{FeSO}_4(aq) \rightarrow \text{NR}$

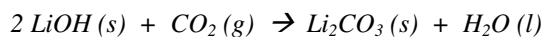
V. Word Equations

Substitute symbols and formulas for words and then balance the following equations. Be sure to use abbreviations to denote physical states.

1. When solid potassium nitrate is heated, it decomposes to solid potassium nitrite, and oxygen gas is evolved.

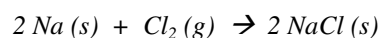


2. Solid lithium hydroxide reacts with carbon dioxide to form solid lithium carbonate and liquid water.



VI. Predicting Products

1. In a common synthesis reaction, sodium metal is lowered into a bottle of chlorine gas. Predict the product, substitute symbols and formulas for names, and then balance the equation. Be sure to use abbreviations to denote physical states.



2. Aluminum sulfate and calcium hydroxide are used in a water purification process. When each is dissolved in water, they react to produce two insoluble products. Predict the products, substitute symbols and formulas for names, and then balance the equation. Be sure to use abbreviations to denote physical states.

