

Describing Chemical Reactions

SECTION 1 REVIEW

- (1) Balance different types of atoms one at a time; (2) balance types of atoms that appear only once on each side of the equation first; (3) balance as single units any polyatomic ions that appear on both sides of the equation; and (4) balance H atoms and O atoms last.
- 6N
 - 4H, 2O
 - 4H, 4N, 12O
 - 2Ca, 4O, 4H
 - 3Ba, 6Cl, 18O
 - 5Fe, 10N, 30O
 - 12Mg, 8P, 32O
 - 4N, 16H, 2S, 8O
 - 12Al, 18Se, 72O
 - 12C, 32H
- $2\text{ZnS}(s) + 3\text{O}_2(g) \longrightarrow 2\text{ZnO}(s) + 2\text{SO}_2(g)$
 - $2\text{HCl}(aq) + \text{Ba}(\text{OH})_2(aq) \longrightarrow \text{BaCl}_2(aq) + 2\text{H}_2\text{O}(l)$
 - $2\text{HNO}_3(aq) + \text{Ca}(\text{OH})_2(aq) \longrightarrow \text{Ca}(\text{NO}_3)_2(aq) + 2\text{H}_2\text{O}(l)$
- Solid zinc sulfide reacts with oxygen gas to form solid zinc oxide and sulfur dioxide gas.
 - When solid calcium hydride is added to water, aqueous calcium hydroxide and hydrogen gas are formed.
 - Aqueous silver nitrate mixed with aqueous potassium iodide produces a precipitate of silver iodide and aqueous potassium nitrate.
- $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$
 - $2\text{Al} + \text{Fe}_2\text{O}_3 \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$
 - $\text{Pb}(\text{CH}_3\text{COO})_2 + \text{H}_2\text{S} \longrightarrow \text{PbS} + 2\text{CH}_3\text{COOH}$
- LiO_2 is an incorrect formula; $4\text{Li} + \text{O}_2 \longrightarrow 2\text{Li}_2\text{O}$
 - H_2Cl_2 is an incorrect formula; $\text{H}_2 + \text{Cl}_2 \longrightarrow 2\text{HCl}$
 - MgO_2 is an incorrect formula, and the equation as written is not balanced; $\text{MgCO}_3 \longrightarrow \text{MgO} + \text{CO}_2$
- List four observations that indicate that a chemical reaction may be taking place.
- List the three requirements for a correctly written chemical equation.
- What is meant by the term *coefficient* in relation to a chemical equation?
 - How does the presence of a coefficient affect the number of atoms of each type in the formula that the coefficient precedes?
- Give an example of a word equation, a formula equation, and a chemical equation.
- What quantitative information is revealed by a chemical equation?
- What limitations are associated with the use of both word and formula equations?
- Define each of the following terms:
 - aqueous solution
 - catalyst
 - reversible reaction
- Write formulas for each of the following compounds:
 - potassium hydroxide
 - calcium nitrate
 - sodium carbonate
 - carbon tetrachloride
 - magnesium bromide
- What four guidelines are useful in balancing an equation?
- How many atoms of each type are represented in each of the following?

| | |
|---------------------------------|-----------------------------------|
| a. 3N_2 | f. $5\text{Fe}(\text{NO}_3)_2$ |
| b. $2\text{H}_2\text{O}$ | g. $4\text{Mg}_3(\text{PO}_4)_2$ |
| c. 4HNO_3 | h. $2(\text{NH}_4)_2\text{SO}_4$ |
| d. $2\text{Ca}(\text{OH})_2$ | i. $6\text{Al}_2(\text{SeO}_4)_3$ |
| e. $3\text{Ba}(\text{ClO}_3)_2$ | j. $4\text{C}_3\text{H}_8$ |

PRACTICE PROBLEMS

- Write the chemical equation that relates to each of the following word equations. Include symbols for physical states in the equation.

- solid zinc sulfide + oxygen gas \longrightarrow solid zinc oxide + sulfur dioxide gas
 - aqueous hydrochloric acid + aqueous barium hydroxide \longrightarrow aqueous barium chloride + water
 - aqueous nitric acid + aqueous calcium hydroxide \longrightarrow aqueous calcium nitrate + water
- Translate each of the following chemical equations into a sentence.
 - $2\text{ZnS}(s) + 3\text{O}_2(g) \longrightarrow 2\text{ZnO}(s) + 2\text{SO}_2(g)$
 - $\text{CaH}_2(s) + 2\text{H}_2\text{O}(l) \longrightarrow \text{Ca}(\text{OH})_2(aq) + 2\text{H}_2(g)$
 - $\text{AgNO}_3(aq) + \text{KI}(aq) \longrightarrow \text{AgI}(s) + \text{KNO}_3(aq)$
 - Balance each of the following:
 - $\text{H}_2 + \text{Cl}_2 \longrightarrow \text{HCl}$
 - $\text{Al} + \text{Fe}_2\text{O}_3 \longrightarrow \text{Al}_2\text{O}_3 + \text{Fe}$
 - $\text{Pb}(\text{CH}_3\text{COO})_2 + \text{H}_2\text{S} \longrightarrow \text{PbS} + \text{CH}_3\text{COOH}$
 - Identify and correct each error in the following equations, and then balance each equation.
 - $\text{Li} + \text{O}_2 \longrightarrow \text{LiO}_2$
 - $\text{H}_2 + \text{Cl}_2 \longrightarrow \text{H}_2\text{Cl}_2$
 - $\text{MgCO}_3 \longrightarrow \text{MgO}_2 + \text{CO}_2$
 - $\text{NaI} + \text{Cl}_2 \longrightarrow \text{NaCl} + \text{I}$
 - Write chemical equations for each of the following sentences:
 - Aluminum reacts with oxygen to produce aluminum oxide.
 - Phosphoric acid, H_3PO_4 , is produced through the reaction between tetraphosphorus decoxide and water.
 - Iron(III) oxide reacts with carbon monoxide to produce iron and carbon dioxide.
 - Carbon tetrachloride is used as an intermediate chemical in the manufacture of other chemicals. It is prepared in liquid form by reacting chlorine gas with methane gas. Hydrogen chloride gas is also formed in this reaction. Write the balanced chemical equation for the production of carbon tetrachloride. (Hint: See Sample Problems C and D.)