QuickLAB

Wear safety goggles and an apron.

Balancing Equations Using Models

Question

How can molecular models and formula-unit ionic models be used to balance chemical equations and classify chemical reactions?

Procedure

Examine the partial equations in Groups A–E. Using different-colored gumdrops to represent atoms of different elements, make models of the reactions by connecting the appropriate "atoms" with toothpicks. Use your models to (1) balance equations (a) and (b) in each group, (2) determine the products for reaction (c) in each group, and (3) complete and balance each equation (c). Finally, (4) classify each group of reactions by type.

Group A
a. $H_2 + Cl_2 \longrightarrow HCl$
b. $Mg + O_2 \longrightarrow MgO$
c. $BaO + H_2O \longrightarrow$ _____

Group B
a. $H_2CO_3 \longrightarrow CO_2 + H_2O$
b. $KClO_3 \longrightarrow KCl + O_2$
c. $H_2O \xrightarrow{\text{electricity}}$ _____

Group C
a. $Ca + H_2O \longrightarrow Ca(OH)_2 + H_2$
b. $KI + Br_2 \longrightarrow KBr + I_2$
c. $Zn + HCl \longrightarrow$ _____

Group D
a. $AgNO_3 + NaCl \longrightarrow$
$\qquad\qquad\qquad AgCl + NaNO_3$
b. $FeS + HCl \longrightarrow FeCl_2 + H_2S$
c. $H_2SO_4 + KOH \longrightarrow$ _____

Group E
a. $CH_4 + O_2 \longrightarrow CO_2 + H_2O$
b. $CO + O_2 \longrightarrow CO_2$
c. $C_3H_8 + O_2 \longrightarrow$ _____

SECTION REVIEW

1. List five types of chemical reactions.

2. Classify each of the following reactions as a synthesis, decomposition, single-displacement, double-displacement, or combustion reaction:

   a. $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$

   b. $2Li(s) + 2H_2O(l) \longrightarrow 2LiOH(aq) + H_2(g)$

   c. $2NaNO_3(s) \longrightarrow 2NaNO_2(s) + O_2(g)$

   d. $2C_6H_{14}(l) + 19O_2(g) \longrightarrow 12CO_2(g) + 14H_2O(l)$

3. For each of the following reactions, identify the missing reactant(s) or products(s) and then balance the resulting equation. Note that each empty slot may require one or more substances.

   a. synthesis: _____ $\longrightarrow Li_2O$

   b. decomposition: $Mg(ClO_3)_2 \longrightarrow$ _____

   c. double displacement:
   $HNO_3 + Ca(OH)_2 \longrightarrow$ _____

   d. combustion: $C_5H_{12} + O_2 \longrightarrow$ _____

4. For each of the following reactions, write the missing product(s) and then balance the resulting equation. Identify each reaction by type.

   a. $Br_2 + KI \longrightarrow$ _____

   b. $NaClO_3 \xrightarrow{\Delta}$ _____

   c. $C_7H_{14} + O_2 \longrightarrow$ _____

   d. $CuCl_2 + Na_2S \longrightarrow$ _____

Critical Thinking

5. **INFERRING RELATIONSHIPS** In an experiment, an iron sample is oxidized to iron(III) oxide by oxygen, which is generated in the thermal decomposition of potassium chlorate. Write the two chemical reactions in the correct sequence.