

APPLICATIONS AND PROBLEMS

- Copy the following equations into your notebook, then balance them.
 - $C_4H_{10} + O_2 \rightarrow CO_2 + H_2O$
 - $Al_4C_3 + H_2O \rightarrow CH_4 + Al(OH)_3$
 - $Ca_3(PO_4)_2 + SiO_2 + C \rightarrow P_4 + CaSiO_3 + CO_2$
 - $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + H_2O$
 - $FeS_2 + O_2 \rightarrow Fe_2O_3 + SO_2$
 - $NH_4NO_3 \rightarrow N_2O + H_2O$
 - $Bi_2O_3 + H_2 \rightarrow Bi + H_2O$
 - $FeCl_3 + (NH_4)_2S \rightarrow Fe_2S_3 + NH_4Cl$
 - $C_{10}H_{16} + Cl_2 \rightarrow HCl + C$
 - $NaI + MnO_2 + H_2SO_4 \rightarrow Na_2SO_4 + MnSO_4 + H_2O + I_2$
- The following reactions are examples of synthesis reactions. Complete the equations by writing the formulas of the products, then balance the equations.
 - $Ca + N_2 \rightarrow$
 - $CaO + CO_2 \rightarrow$
 - $Al + Br_2 \rightarrow$
 - $Li + O_2 \rightarrow$
 - $P_4 + I_2 \rightarrow$
 - $BaO + H_2O \rightarrow$
- Complete the following equations for decomposition reactions, then balance the equations.
 - $HgO \rightarrow$
 - $MgCO_3 \rightarrow$
 - $HCl \rightarrow$
 - $H_2O \rightarrow$
- Predict whether a reaction will take place for each of the following. Write a balanced equation for any reaction that does occur.
 - $Mg + Pb(NO_3)_2 \rightarrow$
 - $Cu + ZnCl_2 \rightarrow$
 - $Cl_2 + LiI \rightarrow$
 - $Sn + AgNO_3 \rightarrow$
- In each of the following reactions, a precipitate forms. Noting that all compounds of group I metals are soluble, write a balanced equation for each reaction. Identify the precipitate in each case.
 - $AgNO_3 + K_2S \rightarrow$
 - $BaCl_2 + Na_2CO_3 \rightarrow$
 - $Ca(NO_3)_2 + Li_2SO_4 \rightarrow$
 - $CoCl_2 + NaOH \rightarrow$
- Identify each of the following reactions as a synthesis, decomposition, single replacement, or double replacement reaction.
 - $Mg(OH)_2 + 2HNO_3 \rightarrow Mg(NO_3)_2 + 2H_2O$
 - $H_2O + SO_3 \rightarrow H_2SO_4$
 - $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$
 - $Cl_2 + ZnI_2 \rightarrow ZnCl_2 + I_2$
 - $H_2SO_4 + Mg \rightarrow MgSO_4 + H_2$
 - $K_2O + H_2O \rightarrow 2KOH$
 - $2NaClO_3 \rightarrow 2NaCl + 3O_2$
 - $2AsCl_3 + 3H_2S \rightarrow As_2S_3 + 6HCl$
 - $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$
 - $3NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3H_2O$
- The presence of small amounts of calcium chloride dissolved in water is responsible for one type of water hardness. Hard water does not form a lather with soap, but forms a scum instead. The calcium ions can be removed from the water by the addition of sodium carbonate. A precipitate of calcium carbonate forms, and this can be removed by filtration. Write a balanced equation for the reaction between calcium chloride and sodium carbonate.

- Each of the following is a neutralization reaction. Complete and balance each equation.
 - $KOH + HBr \rightarrow$
 - $Ba(OH)_2 + HCl \rightarrow$
 - $Mg(OH)_2 + H_2SO_4 \rightarrow$
 - $Al(OH)_3 + HNO_3 \rightarrow$
 - $Ca(OH)_2 + HClO_4 \rightarrow$

- Write balanced equations for the following reactions, including the heat term in the equation.
 - Hydrogen and chlorine react to form hydrogen chloride, releasing energy in the process.
 - When sodium chlorate is heated, it decomposes into sodium chloride and oxygen.
 - Calcium reacts with water, releasing hydrogen gas and forming a solution of calcium hydroxide. The temperature of the water increases during the reaction.
- Write balanced equations for the following reactions. Include the heat term with the equation.
 - When calcium oxide is added to water, calcium hydroxide is formed. The temperature of the water increases during the reaction.
 - The process of photosynthesis in plants produces glucose, $C_6H_{12}O_6$, and oxygen, from the raw materials carbon dioxide and water. Energy, usually from the sun, is absorbed during photosynthesis.
 - Magnesium reacts with sulphuric acid, forming magnesium sulphate and releasing hydrogen gas. The solution becomes warmer as the reaction proceeds.

- For each of the following reactions, write a balanced equation. Indicate to which of the four types of reaction studied in this chapter each reaction belongs.
 - Ammonia gas and hydrogen chloride gas react to form ammonium chloride, a white solid.
 - Sulphur dioxide, formed during the burning of sulphur-containing coal, may be removed from smokestack gases by passing the gases over solid calcium oxide. Calcium sulphite is formed by this reaction.
 - If a bottle of hydrogen peroxide solution, H_2O_2 , is left to stand at room temperature, oxygen gas is slowly released. After a period of time, the bottle contains only water.
 - In some water treatment treatment plants, solutions of aluminum sulphate and calcium hydroxide are added to the water. A "sticky" precipitate of aluminum hydroxide forms. This removes some of the small particles in the water as it settles to the bottom.
