

Practice Problems

13. Write a balanced equation for the synthesis of sodium oxide from sodium and oxygen.
14. The first two containers in Figure 3-26 represent sodium and oxygen before reaction. Draw a representation of the product, solid sodium oxide.

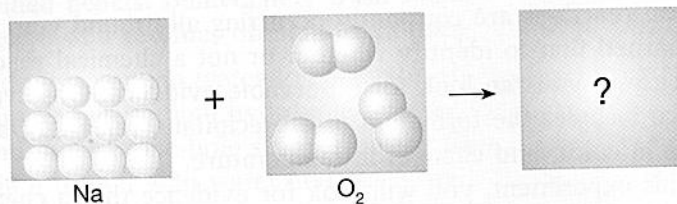


Figure 3-26 Models are shown for the reactants in the synthesis of sodium oxide. Complete the equation by drawing a model of the product.

PART 2 REVIEW

15. Predict the products and write the balanced equation for each of these reactions.

Combustion

- a. $C_2H_4(g) + O_2(g) \rightarrow$ c. $C_2H_5OH(l) + O_2(g) \rightarrow$
 b. $C_6H_{12}O_6(s) + O_2(g) \rightarrow$ d. $C_5H_{12}(l) + O_2(g) \rightarrow$

Synthesis

- e. $Sr(s) + O_2(g) \rightarrow$ g. $K(s) + Cl_2(g) \rightarrow$
 f. $Na(s) + O_2(g) \rightarrow$ h. $Ca(s) + F_2(g) \rightarrow$

Decomposition

- i. $MgBr_2(l) \rightarrow$ k. $H_2O(l) \rightarrow$
 j. $AlCl_3(l) \rightarrow$ l. $KI(l) \rightarrow$

Single replacement

- m. $Zn(s) + CuSO_4(aq) \rightarrow$ o. $Ni(s) + MgSO_4(aq) \rightarrow$
 n. $Cl_2(g) + KI(aq) \rightarrow$ p. $Br_2(aq) + CaCl_2(aq) \rightarrow$

Double replacement

- q. $FeCl_2(aq) + K_2S(aq) \rightarrow$ s. $AlCl_3(aq) + Na_2CO_3(aq) \rightarrow$
 r. $ZnSO_4(aq) + SrCl_2(aq) \rightarrow$ t. $(NH_4)_2SO_4(aq) + BaCl_2(aq) \rightarrow$

16. Predict the product and write a balanced equation for each of the following. Write N.R. if no reaction occurs.

- a. $MgCl_2(l) \xrightarrow{(elec)}$ c. $Zn(s) + Ni(NO_3)_2(aq) \rightarrow$
 b. $Zn(s) + MgSO_4(aq) \rightarrow$ d. $KCl(aq) + AgNO_3(aq) \rightarrow$

17. Complete the equation for these dissociation reactions.

- a. $NaCl(s) \rightarrow$ c. $Hg(NO_3)_2(s) \rightarrow$
 b. $K_2SO_4(s) \rightarrow$ d. $ZnCl_2(s) \rightarrow$

18. Predict whether the following reactions will occur.

- a. $3Mg(s) + 2AlCl_3(aq) \rightarrow 3MgCl_2(aq) + 2Al(s)$
 b. $Cl_2(g) + 2KBr(aq) \rightarrow 2KCl(aq) + Br_2(aq)$

CHAPTER Review

E. Objective: Explain the difference between exothermic and endothermic reactions and recognize equations that represent them.

20. a. Define an exothermic reaction.
b. How does an exothermic reaction differ from an endothermic reaction?
21. Is the reaction in Figure 3-15 endothermic or exothermic? Explain your answer.
22. Classify each of these reactions as exothermic or endothermic.
 - a. $\text{energy} + \text{SO}_2(\text{g}) \rightarrow \text{S}(\text{g}) + \text{O}_2(\text{g})$
 - b. $2\text{C}_8\text{H}_{18}(\text{g}) + 25\text{O}_2(\text{g}) \rightarrow 16\text{CO}_2(\text{g}) + 18\text{H}_2\text{O}(\text{g}) + \text{energy}$
 - c. $\text{energy} + \text{P}_4\text{O}_{10}(\text{s}) \rightarrow \text{P}_4(\text{s}) + 5\text{O}_2(\text{g})$
 - d. $\text{Mg}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{MgSO}_4(\text{aq}) + \text{H}_2(\text{g}) + \text{energy}$
23. Classify each of the reactions in question 26 as exothermic or endothermic.

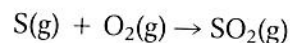
REGULARITIES IN CHEMICAL REACTIONS

F. Objective: Classify reactions as belonging to one of five general types of chemical reactions.

24. Name five general types of reactions.
25. For each of the following equations, state the general type of reaction that identifies the equation.
 - a. $\text{Cu} + \text{Cl}_2 \rightarrow \text{CuCl}_2$
 - b. $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
 - c. $\text{KBr} + \text{AgNO}_3 \rightarrow \text{KNO}_3 + \text{AgBr}$
 - d. $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 - e. $\text{Zn} + \text{CuBr}_2 \rightarrow \text{ZnBr}_2 + \text{Cu}$
26. Classify each of these reactions as one of the five general types of reactions.
 - a. $2\text{Ba}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{BaO}(\text{s}) + \text{energy}$
 - b. $\text{PCl}_3(\text{l}) + \text{Cl}_2(\text{g}) \rightarrow \text{PCl}_5(\text{s}) + \text{energy}$
 - c. $2\text{Sb}(\text{s}) + 3\text{I}_2(\text{g}) + \text{energy} \rightarrow 2\text{SbI}_3(\text{s})$
 - d. $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g}) + \text{energy}$
 - e. $\text{Fe}(\text{s}) + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s}) + \text{energy}$

- f. $\text{CS}_2(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{SO}_2(\text{g}) + \text{energy}$
- g. $\text{NH}_3(\text{g}) + \text{HCl}(\text{g}) \rightarrow \text{NH}_4\text{Cl}(\text{s}) + \text{energy}$
- h. $3\text{Mg}(\text{s}) + 2\text{CrCl}_3(\text{aq}) \rightarrow 3\text{MgCl}_2(\text{aq}) + 2\text{Cr}(\text{s}) + \text{energy}$
- i. $2\text{KNO}_3(\text{s}) + \text{energy} \rightarrow 2\text{KNO}_2(\text{s}) + \text{O}_2(\text{g})$
- j. $\text{Pb}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{PbSO}_4(\text{s}) + 2\text{NaNO}_3(\text{aq}) + \text{energy}$
- k. $\text{KBr}(\text{aq}) + \text{AgNO}_3(\text{aq}) \rightarrow \text{AgBr}(\text{s}) + \text{KNO}_3(\text{aq}) + \text{energy}$

27. Note this reaction.



- a. It can be classified as one of two different reaction types. What are they?
- b. Explain how the reaction fits both classifications.

G. Objective: Predict the products of a reaction from the reactants.

28. For each of the following reactions, predict the products and balance the equation.
 - a. $\text{C}_6\text{H}_6(\text{l}) + \text{O}_2(\text{g}) \rightarrow$
 - b. $\text{Cu}(\text{s}) + \text{AgNO}_3(\text{aq}) \rightarrow$
 - c. $\text{Pb}(\text{ClO}_3)_2(\text{aq}) + \text{KI}(\text{aq}) \rightarrow$
 - d. $\text{CoBr}_2(\text{s}) \xrightarrow{\text{elec}}$
 - e. $\text{Br}_2(\text{aq}) + \text{FeI}_3(\text{aq}) \rightarrow$
 - f. $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow$
 - g. $\text{C}_4\text{H}_{10}(\text{g}) + \text{O}_2(\text{g}) \rightarrow$
 - h. $\text{Ca}(\text{s}) + \text{O}_2(\text{g}) \rightarrow$
 - i. $\text{HgO}(\text{s}) \xrightarrow{\Delta}$
 - j. $\text{Li}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow$
 - k. $\text{F}_2(\text{g}) + \text{KCl}(\text{aq}) \rightarrow$
 - l. $\text{NH}_4\text{Cl}(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow$
29. Complete and balance each equation.
 - a. $\text{Ni}(\text{s}) + \text{FeSO}_4(\text{aq}) \rightarrow$
 - b. $\text{Sr}(\text{s}) + \text{N}_2(\text{g}) \rightarrow$
 - c. $\text{C}_4\text{H}_8(\text{g}) + \text{O}_2(\text{g}) \rightarrow$
 - d. $\text{BaCO}_3(\text{s}) \xrightarrow{\Delta}$
 - e. $\text{Na}_2\text{S}(\text{aq}) + \text{Ni}(\text{NO}_3)_2(\text{aq}) \rightarrow$
 - f. $\text{Pb}(\text{NO}_3)_2(\text{aq}) + \text{NaCl}(\text{aq}) \rightarrow$
 - g. $\text{Zn}(\text{s}) + \text{CuCl}_2(\text{aq}) \rightarrow$
 - h. $\text{AlCl}_3(\text{aq}) + \text{Pb}(\text{NO}_3)_2(\text{aq}) \rightarrow$