

Chemical Equations and Reactions

Teacher Notes and Answers

SECTION 1

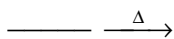
SHORT ANSWER

- d
 - a
 - b
 - f
 - e
 - c
- 8,4,9
- 12 atoms
 - 16 atoms
 - 51 atoms
 - 3×10^{24} atoms
- $2\text{Al}(s) + 3\text{CuF}_2(aq) \rightarrow 2\text{AlF}_3(aq) + 3\text{Cu}(s)$
- $\text{NaCl}(aq) + \text{AgNO}_3(aq) \rightarrow \text{AgCl}(s) + \text{NaNO}_3(aq)$
- $2\text{NaHCO}_3(s) \xrightarrow{\Delta} \text{Na}_2\text{CO}_3(s) + \text{H}_2\text{O}(g) + \text{CO}_2(g)$
b. When solid sodium hydrogen carbonate (bicarbonate) is heated, it decomposes into solid sodium carbonate while releasing carbon dioxide gas and water vapor.
- It is balanced but incorrect. In two of the formulas the subscripts were changed, which changed the compounds involved. Water is not H_3O , and sodium hydroxide is not Na_2OH . The correct balanced equation is $2\text{NaOH} + \text{H}_2\text{S} \rightarrow \text{Na}_2\text{S} + 2\text{H}_2\text{O}$.
- 30 mol
 - 40 mol

CHAPTER 8 REVIEW

Chemical Equations and Reactions**SECTION 1****SHORT ANSWER** Answer the following questions in the space provided.

1. Match the symbol on the left with its appropriate description on the right.



(a) A precipitate forms.



(b) A gas forms.



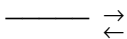
(c) A reversible reaction occurs.



(d) Heat is applied to the reactants.



(e) A chemical is dissolved in water.



(f) A chemical is in the liquid state.

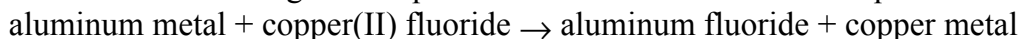
2. Finish balancing the following equation:



3. In each of the following formulas, write the total number of atoms present.



4. Convert the following word equation into a balanced chemical equation:



5. One way to test the salinity of a water sample is to add a few drops of silver nitrate solution with a known concentration. As the solutions of sodium chloride and silver nitrate mix, a precipitate of silver chloride forms, and sodium nitrate is left in solution. Translate these sentences into a balanced chemical equation.

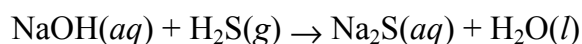
6. a. Balance the following equation:



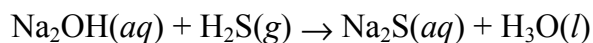
SECTION 1 *continued*

- b. Translate the chemical equation in part a into a sentence.

7. The poisonous gas hydrogen sulfide, H_2S , can be neutralized with a base such as sodium hydroxide, NaOH . The unbalanced equation for this reaction follows:



A student who was asked to balance this equation wrote the following:

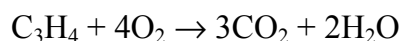


Is this equation balanced? Is it correct? Explain why or why not, and supply the correct balanced equation if necessary.

PROBLEM Write the answer on the line to the left. Show all your work in the space provided.

8. Recall that coefficients in a balanced chemical equation give relative amounts of moles as well as numbers of molecules.

- _____ a. Calculate the number of moles of CO_2 that form if 10 mol of C_3H_4 react according to the following balanced equation:



- _____ b. Calculate the number of moles of O_2 that are consumed.

Chemical Equations and Reactions

Teacher Notes and Answers

SECTION 2

SHORT ANSWER

- c
 - d
 - b
 - a
- c
- a
- b
- its separate elements
 - metal oxide + water
 - metal oxide + carbon dioxide
 - water + sulfur dioxide
- CO_2 , H_2O
- single-displacement; $\text{Cl}_2(\text{aq}) + 2\text{NaI}(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{NaCl}(\text{aq})$
 - synthesis; $3\text{Mg}(\text{s}) + \text{N}_2(\text{g}) \rightarrow \text{Mg}_3\text{N}_2(\text{s})$
 - double-displacement; $\text{Co}(\text{NO}_3)_2(\text{aq}) + \text{H}_2\text{S}(\text{aq}) + \text{CoS}(\text{s}) + 2\text{HNO}_3(\text{aq})$
 - combustion; $\text{C}_2\text{H}_5\text{OH}(\text{aq}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$
- $2\text{C}_2\text{H}_2(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
 - 2.0 mol
 - 2.5 mol
- $\text{BaCl}_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow \text{BaCO}_3(\text{s}) + 2\text{NaCl}(\text{aq})$
 - double-displacement
- $2\text{Al}_2\text{O}_3(\text{l}) \rightarrow 4\text{Al}(\text{s}) + 3\text{O}_2(\text{g})$

CHAPTER 8 REVIEW

Chemical Equations and Reactions**SECTION 2****SHORT ANSWER** Answer the following questions in the space provided.

1. Match the equation type on the left to its representation on the right.

- | | |
|---------------------------|-----------------------------------|
| _____ synthesis | (a) $AX + BY \rightarrow AY + BX$ |
| _____ decomposition | (b) $A + BX \rightarrow AX + B$ |
| _____ single-displacement | (c) $A + B \rightarrow AX$ |
| _____ double-displacement | (d) $AX \rightarrow A + X$ |

2. _____ In the reaction described by the equation $2Al(s) + 3Fe(NO_3)_2(aq) \rightarrow 3Fe(s) + 2Al(NO_3)_3(aq)$, iron has been replaced by

(a) nitrate. (c) aluminum.
(b) water. (d) nitrogen.

3. _____ Of the following chemical equations, the only reaction that is both synthesis and combustion is

(a) $C(s) + O_2(g) \rightarrow CO_2(g)$.
(b) $2C_4H_{10}(l) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$.
(c) $6CO_2(g) + 6H_2O(g) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$.
(d) $C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(aq) + 6H_2O(l)$.

4. _____ Of the following chemical equations, the only reaction that is both combustion and decomposition is

(a) $S(s) + O_2(g) \rightarrow SO_2(g)$.
(b) $2C_4H_{10}(l) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$.
(c) $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$.
(d) $2HgO(s) \xrightarrow{\Delta} 2Hg(l) + O_2(g)$.

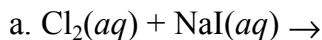
5. Identify the products when the following substances decompose:

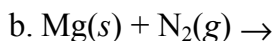
- | | |
|-------|--------------------------|
| _____ | a. a binary compound |
| _____ | b. most metal hydroxides |
| _____ | c. a metal carbonate |
| _____ | d. the acid H_2SO_3 |

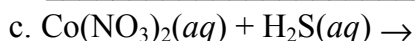
6. The complete combustion of a hydrocarbon in excess oxygen yields the products _____ and _____.

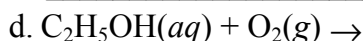
SECTION 2 *continued*

7. For the following four reactions, identify the type, predict the products (make sure formulas are correct), and balance the equations:









8. Acetylene gas, C_2H_2 , is burned to provide the high temperature needed in welding.

a. Write the balanced chemical equation for the combustion of C_2H_2 in oxygen.

_____ b. If 1.0 mol of C_2H_2 is burned, how many moles of CO_2 are formed?

_____ c. If 1.0 mol of C_2H_2 is burned how many moles of oxygen gas are consumed?

9. a. Write the balanced chemical equation for the reaction that occurs when solutions of barium chloride and sodium carbonate are mixed. Refer to the table in Chapter 13 for solubility.

b. To which of the five basic types of reactions does this reaction belong?

10. For the commercial preparation of aluminum metal, the metal is extracted by electrolysis from alumina, Al_2O_3 . Write the balanced chemical equation for the electrolysis of molten Al_2O_3 .

Chemical Equations and Reactions

Teacher Notes and Answers

SECTION 3

SHORT ANSWER

- Choose from Cu, Ag, Au, Pt, Sb, Bi, and Hg.
- Fe forms an oxide in nature, and Ag does not, because it is much less active.
- F₂
 - K
 - H
- $2\text{Al}(s) + 6\text{CH}_3\text{COOH}(aq) \xrightarrow{50^\circ\text{C}} \text{Al}(\text{CH}_3\text{COO})_3(aq) + 3\text{H}_2(g)$
 - no reaction
 - $2\text{Cr}(s) + 3\text{CdCl}_2(aq) \rightarrow 2\text{CrCl}_3(aq) + 3\text{Cd}(s)$
 - no reaction
- $\text{Ca}(s) + 2\text{H}_2\text{O}(l) \rightarrow \text{Ca}(\text{OH})_2(aq) + \text{H}_2(g)$
 - Both are alkali metals and readily form a stable 1+ ion by ejecting an s¹ electron. Rb has a larger radius than Na and holds its electron less tightly, making it more reactive.
- Gold has a low reactivity and therefore does not corrode over time.
- In single-displacement reactions, if the activity of the free element is greater than that of the element in the compound, the reaction will take place.
- Yes; because aluminum is above copper in the activity series, aluminum metal will replace copper in copper(II) nitrate.
 $2\text{Al}(s) + 3\text{Cu}(\text{NO}_3)_2(aq) \rightarrow 2\text{Al}(\text{NO}_3)_3(aq) + 3\text{Cu}(s)$

CHAPTER 8 REVIEW

Chemical Equations and Reactions**SECTION 3****SHORT ANSWER** Answer the following questions in the space provided.

1. List four metals that will *not* replace hydrogen in an acid.

2. Consider the metals iron and silver, both listed in the table, *Activity Series* in **Section 3** of the text. Which one readily forms an oxide in nature, and which one does not?

- _____
3. In each of the following pairs, identify the more active element.

_____ a. F_2 and I_2

_____ b. Mn and K

_____ c. Cu and H

4. Use the information in the text to predict whether each of the following reactions will occur. For each reaction that will occur, complete the chemical equation by writing in the products formed and balancing the final equation.









SECTION 3 *continued*

5. Very active metals will react with water to release hydrogen gas and form hydroxides.
- a. Complete, and then balance, the equation for the reaction of Ca(s) with water.
- _____
- b. The reaction of rubidium, Rb, with water is faster and more violent than the reaction of Na with water. Use the atomic structure and radius of each metal to account for this difference.
- _____
- _____
- _____
6. Gold, Au, is often used in jewelry. How does the relative activity of Au relate to its use in jewelry?
- _____
- _____
7. Explain how to use an activity series to predict the outcome of a single-displacement reaction.
- _____
- _____
- _____
8. Aluminum is above copper in the activity series. Will aluminum metal react with copper(II) nitrate, $\text{Cu}(\text{NO}_3)_2$, to form aluminum nitrate, $\text{Al}(\text{NO}_3)_3$? If so, write the balanced chemical equation for the reaction.
- _____
- _____
- _____