Chapter 8
Study Guide - Answers

A. Chemical Reactions

1. Describe a chemical reaction: a process in which one or more substances are converted into new substances in order for the atoms to achieve full valence shells and therefore greater stability
2. The substances present before a chemical reaction occurs are called the reactants.
3. The substances present after a chemical change has occurred are called the products.
4. Chemical reactions occur because atoms can reach more stable arrangements.
5. A chemical equation is a way of describing what occurs in a chemical reaction.
6. In a chemical equation the symbol "→" means "yields" or "produces", and the symbol "+" means "and".
7. In a chemical equation the reactants are placed on the left of the arrow, and the products on the right of the arrow.

B. Balancing Chemical Equations

8. The Law of Conservation of Matter states "matter can be neither created nor destroyed in a chemical reaction" or "the mass of the reactants must equal the mass of the products in a chemical reaction".
9. Why do we balance chemical equations? To ensure that the equation accurately shows the proportions in an actual chemical reaction and that it obeys the Law of Conservation of Matter.
10. What must be equal in a balanced chemical equation? "The number of each type of element in the reactant and products", or "the mass of the reactants and the mass of the products" .
11. What is the difference between a subscript and a coefficient in a chemical equation? A subscript describes the number of atoms of an element in a particular formula unit, whereas a coefficient describes the number of formula units.
12. The number of atoms of an element in a compound is shown using subscripts.
13. The number of molecules present in a balanced chemical equation is shown using coefficients.
14. Name four rules of balancing equations:
    a. The number and type of each atom in the reactants must be the same as those in the products.
    b. Always use coefficients that result in the lowest whole number ratio of substances.
    c. Never, never, never change a subscript when attempting to balance an equation.
    d. Always balance single species substances last because changing their coefficients will not affect others.
15. What do each of the following symbols mean?
    a. (s) solid b. (l) liquid c. (g) gas

d. (aq) aqueous solution e. (cr) crystalline solid

16. Balance each of the following equations:

a. ___1___$CoCO_3$ → ___1___CoO + ___1___CO_2

b. ___1___HCl + ___1___NaOH → ___1___H_2O + ___1___NaCl

c. ___2___Al + ___3___Cl_2 → ___2___$AlCl_3$

d. ___1___Zn + ___2___HCl → ___1___$ZnCl_2$ + ___1___H_2

e. ___2___Ag + ___1___S → ___1___Ag_2S

f. ___1___$Mg(ClO_3)_2$ → ___1___$MgCl_2$ + ___3___O_2

g. ___3___$BaCl_2$ + ___2___H_3PO_4 → ___1___$Ba_3(PO_4)_2$ + ___6___HCl

h. ___2___C_4H_{10} + __13__O_2 → ___8___CO_2 + __10__H_2O

C. Types of Equations

Type of Equation	General Formula	Description	Example
Synthesis or "direct combination"	A + B → C	Multiple substances combine to form one substance	$N_2 + H_2 \rightarrow NH_3$
Decomposition	A → B + C	One substances breaks into multiple substances	$H_2O \rightarrow H_2 + O_2$
Combustion	$C_xH_y + O_2 \rightarrow H_2O + CO_2$	A hydrocarbon (or carbohydrate) reacts with oxygen to form CO_2 & water	$CH_4 + O_2 \rightarrow H_2O + CO_2$
Single Replacement	Element + Compound → Element + Compound	A free element reacts with a compound and releases a different element from the compound	$Zn + HCl \rightarrow ZnCl_2 + H_2$
Double Replacement	Compound + Compound → Compound + Compound	Two compounds react to form two different compounds	$CaCO_3 + HCl \rightarrow CaCl_2 + H_2CO_3$

17. Label each chemical equation based on its type.

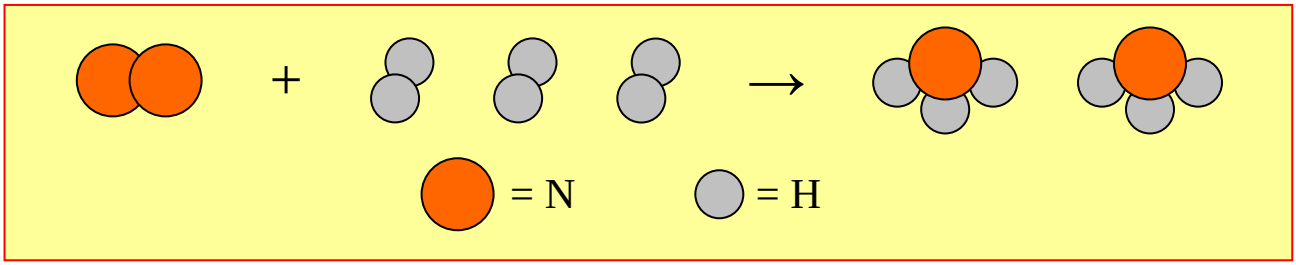
$C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$ combustion

$N_2 + H_2 \rightarrow NH_3$ direct combination or synthesis

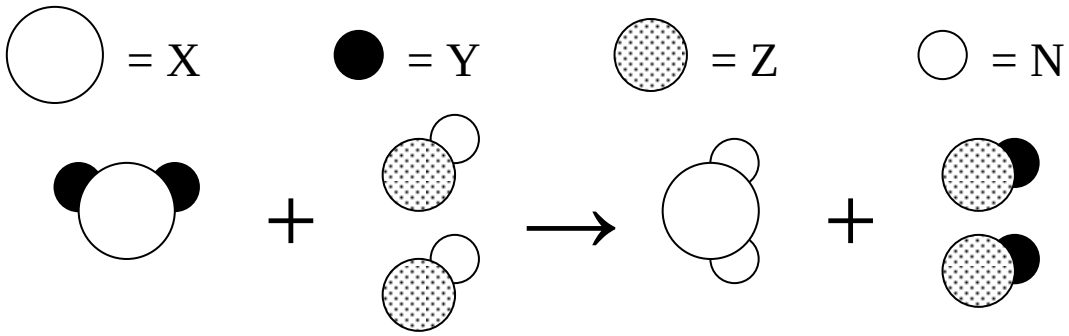
$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$	single replacement
$CrO_3 + H_2O \rightarrow H_2CrO_4$	direct combination/synthesis
$Mg(ClO_3)_2 \rightarrow MgCl_2 + O_2$	decomposition
$BaCl_2 + H_3PO_4 \rightarrow Ba_3(PO_4)_2 + HCl$	double replacement

18. Draw a ball & stick model of the following equation. ***Be sure to balance the equation first.***

$$N_2 + 3H_2 \rightarrow 2NH_3$$



19. Write an equation to represent the reaction shown in the model below.



$$XY_2 + 2ZN \rightarrow XN_2 + 2ZY$$