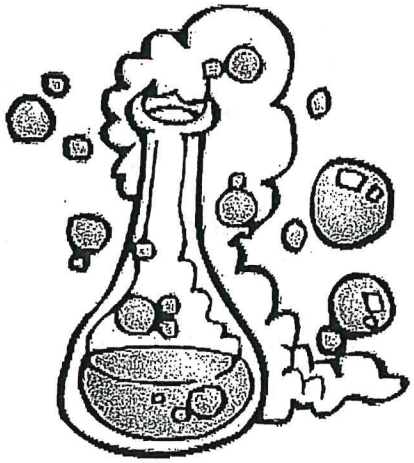
ANSWER KEY

Types of Chemical Reactions

Evidence of a Chemical Change:

- A _____ (insoluble solid) forms
- _____ formation
- Change in _____
- The production of _____ and _____

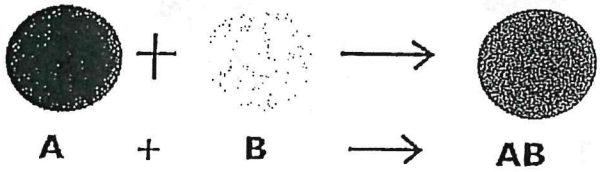


4 Main types of Chemical Reactions

1.
2.
3.
4.

Synthesis Reactions

- A synthesis reaction is a chemical reaction in which two or more reactants _____ to form a new product



Example from the textbook:

Liquid _____ + Liquid _____ _____ vapour

_____H_2 (l) + ____ O_2 (l) _____ H_2O (g)

REMEMBER HOFBrINCl?

- It is IMPORTANT to recall that oxygen and hydrogen exist as diatomic molecules.
- Hydrogen (H_2),Oxygen (O2), Fluorine (F_2), Bromine (Br_2), Iodine (I_2) Nitrogen (N_2), and Chlorine (Cl_2)

ALSO remember that these, all exist as *gases*, EXCEPT for *Bromine (liquid)* and *Iodine (solid)*

** you'll need to know this for when you're indicating the states of reactants and products in chemical equations!

Practice Synthesis Reactions:

$Ca(s) + N_2(g)$

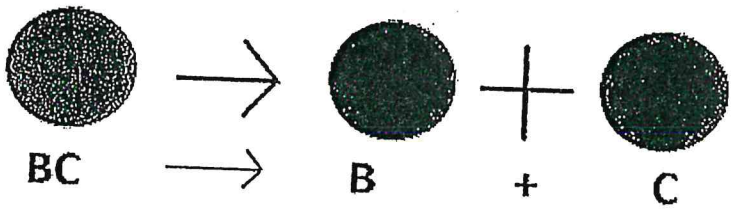
$K(s) + O_2(g)$

$Cs(s) + P_4(s)$

$Al(s) + F_2(g) \rightarrow$

Decomposition Reactions

- A **decomposition reaction** is a chemical reaction in which a compound _____ into two or more products



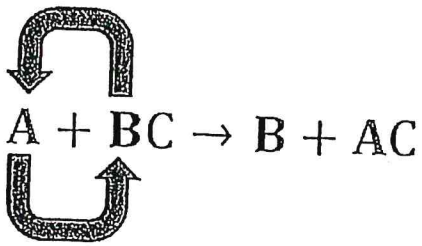
Example from the Textbook:

_____ gas is produced by the decomposition of _____.

_____ H_2O (l) _____ $H_2(g) + O_2(g)$

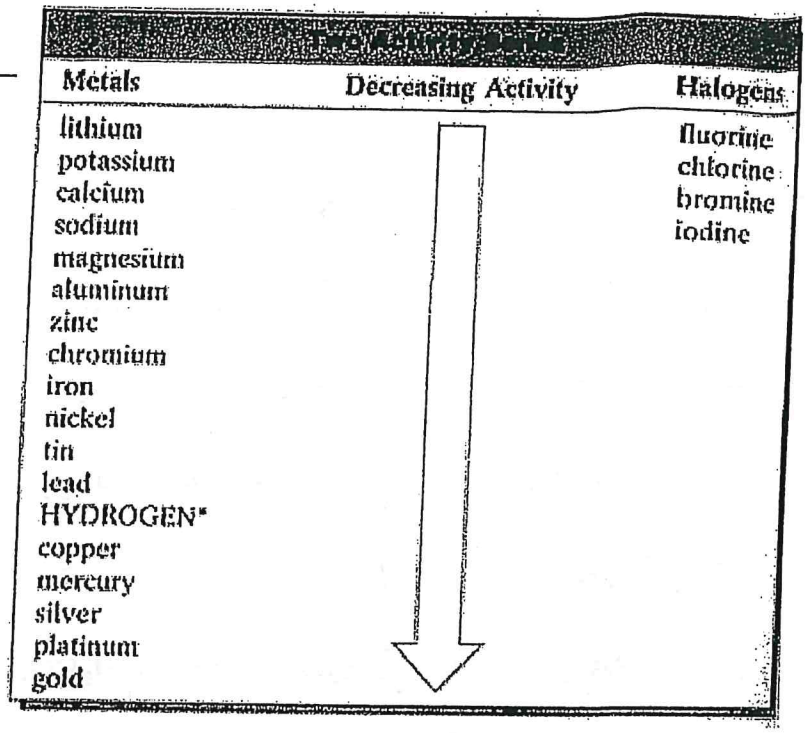
Single Displacement Reaction

- In a **single displacement reaction**, a reactive element (a metal or a non-metal) and a compound react to produce another element and another compound. Therefore, it is a chemical reaction in which an element takes the place of another element in a compound.



The Activity Series

- An _____ according to their chemical reactivity. The _____ reactive element is at the _____, and the _____ reactive is at the _____.
- A more reactive metal will _____ (or _____) a metal in a compound that is below it in the activity series

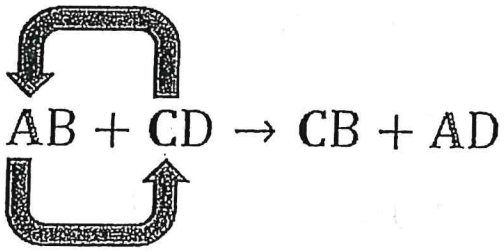


Single Displacement Reaction example:

$$Fe + CuSO_4 = Cu + FeSO_4$$

Double Displacement Reaction

- A double displacement reaction is a chemical reaction in which the positive ions of two compounds change places and form two new compounds.



Practice:

Calcium bromide + Silver nitrate

ANSWER KEY

Chemical Equations Challenge

SD 1. $SiO_2 + 2\,Mg \longrightarrow Si + 2\,MgO$

C/S 2. $2\,SO_2 + O_2 \longrightarrow 2\,SO_3$

DD 3. $3\,CaCl_2 + 2\,K3PO_4 \longrightarrow Ca_3(PO_4)_2 + 6\,KCl$

S 4. $2\,CO + O_2 \longrightarrow 2\,CO_2$

D 5. $H_2CO_3 \longrightarrow CO_2 + H_2O$

DD 6. $CaCO_3 + 2\,HCl \longrightarrow H_2CO_3 + CaCl_2$

C 7. $2\,C_4H_{10} + 13\,O_2 \longrightarrow 10\,H_2O + 8\,CO_2$ ← fraction then clear fraction by x 2.

S 8. $P_4O_{10} + 6\,H_2O \longrightarrow 4\,H_3PO_4$

SD 9. $Cu + 2\,HgNO_3 \longrightarrow Cu(NO_3)_2 + 2\,Hg$

D 10. $2\,NCl_3 \longrightarrow N_2 + 3\,Cl_2$

DD 11. $Ag_2SO_4 + 2\,NH_4I \longrightarrow (NH_4)_2SO_4 + 2\,AgI$

D 12. $2\,NaHCO_3 \longrightarrow CO_2 + Na_2CO_3 + H_2O$

SD 13. $2\,Li + 2\,H_20 \longrightarrow 2\,LiOH + H_2$

SD 14. $H_2SO_4 + Ca \longrightarrow CaSO_4 + H_2$

DD 15. $BaO + 2\,HNO_3 \longrightarrow Ba(NO_3)_2 + H_2O$

C 16. $2\,C_{10}H_{22} + 31\,O_2 \longrightarrow 20\,CO_2 + 22\,H_2O$ ← fraction then clear fraction x 2.

DD 17. $Al_2(SO4)_3 + 3\,Ca(OH)_2 \longrightarrow 2\,Al(OH)_3 + 3\,CaSO_4$

S 18. $2\,CuBr + Br_2 \longrightarrow 2\,CuBr_2$

C 19. $CH_4 + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O$

ANSWER KEY

Types of Chemical Reactions Worksheet

A. a) Classify each of the following reactions as synthesis, decomposition, single displacement or double displacement reactions
b) Balance each equation

1. $2Cu + O_2 \rightarrow 2CuO$		SYNTHESIS
2. $2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$		SINGLE DISP.
3. $2Ag + S \rightarrow Ag_2S$		SYNTHESIS
4. $2H_2O +$ electricity $\rightarrow 2H_2 + O_2$		DECOMPOSITION
5. $FeS + 2HCl \rightarrow FeCl_2 + H_2S$		DOUBLE DISPL.
6. $2NaCl \rightarrow 2Na + Cl_2$		DECOMPOSITION
7. $NaOH + HCl \rightarrow NaCl + H_2O$		DOUBLE DISPL.
8. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$		SINGLE DISPL.

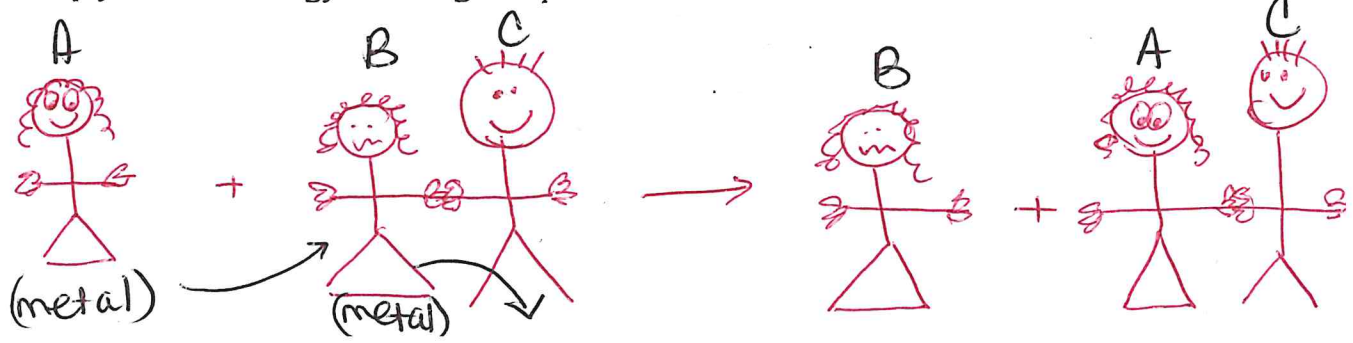
B. a) Given the type of chemical reaction fill in the missing reactants or products in the following chemical equations.
b) Balance each equation.

1. Synthesis: $2Fe + O_2 \rightarrow 2FeO$ ← I used Fe^{+2}
2. Decomposition: $ZnCO_3 \rightarrow ZnO + CO_2$
3. Single Displacement: $2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$ ← I used Cu^{+2}
4. Double Displacement: $2HCl + CaCO_3 \rightarrow CaCl_2 + H_2CO_3$
5. Single Displacement: $Br_2 + 2NaI \rightarrow I_2 + 2NaBr$
6. Decomposition: $Li_2CO_3 \rightarrow Li_2O + CO_2$

C. Classify each of the following reactions:

1. copper + silver nitrate → silver + copper(II) nitrate — SD
2. zinc + hydrochloric acid → hydrogen + zinc chloride — SD
3. calcium carbonate + hydrochloric acid → carbonic acid + carbon dioxide — DD
4. aluminum + copper(II)chloride → copper + aluminum chloride — SD

D. Make up your own analogy for a single displacement reaction:



Chemical Reactions

Name _____

1. Watch the video and then complete the chart.

Type of Reaction	Definition	★ Equation
Synthesis	See Class Notes	A + B → AB
Decomposition		AB → A + B
Single Replacement		AB + C → CB + A
Double Replacement		AB + CD → AD + CB

Colors: A = Red, B = Blue, C = Green, D = Yellow

2. Use colored pencils to circle the common atoms or compounds in each equation to help you determine the type of reaction it illustrates. Use the code below to classify each reaction.

S = Synthesis D = Decomposition SR = Single Replacement DR = Double Replacement

S $4P + 5O_2 \rightarrow P_4O_{10}$

S $2Mg + O_2 \rightarrow 2MgO$

D $2HgO \rightarrow 2Hg + O_2$

D $2Al_2O_3 \rightarrow 4Al + 3O_2$

SD $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$

S $3H_2 + N_2 \rightarrow 2NH_3$

S $2Na + Br_2 \rightarrow 2NaBr$

DD $CuCl_2 + H_2S \rightarrow CuS + 2HCl$

SD $2HgO + Cl_2 \rightarrow 2HgCl + O_2$

S $C + 2H_2 \rightarrow CH_4$

D $2KClO_3 \rightarrow 2KCl + 3O_2$

S $S_8 + 24F_2 \rightarrow 8SF_6$

DD $BaCl_2 + Na_2SO_4 \rightarrow 2NaCl + BaSO_4$

Name: _____ Date: _____

Chemical Reactions:
Balanced Chemical Equations

Learning Goal:

- ⇨ To show that the number of reactant atoms is the same as the number of product atoms in a balanced chemical equation.
- ⇨ To show the difference between a coefficient and a subscript in a balanced chemical equation.

Observations:

1. Rocket fuel may be produced from the decomposition of water.

Reactants:		$H_2O \rightarrow H_2 + O_2$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
H		→		H	
O				O	

2. Hydrogen gas and chlorine gas react to produce hydrochloric acid.

Reactants:		$H_2 + Cl_2 \rightarrow HCl$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
H		→		H	
Cl				Cl	

3. Chlorine reacts with oxygen to form dichlorine monoxide.

Reactants:		$Cl_2 + O_2 \rightarrow Cl_2O$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
Cl		→		Cl	
O				O	

4. Nitrogen gas and Hydrogen gas combine chemically to produce ammonia for fertilizers.

Reactants:		$N_2 + H_2 \rightarrow NH_3$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
N		→		N	
H				H	

5. Hydrogen peroxide is chemically broken down to produce water and oxygen.

Reactants:		$H_2O_2 \rightarrow H_2O + O_2$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
H		→		H	
O				O	

6. Natural gas (mainly methane) is burned as a heating fuel to produce carbon dioxide and water.

Reactants:		$CH_4 + O_2 \rightarrow CO_2 + H_2O$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
C		→		C	
H				H	
O				O	

7. Nitrogen gas will react with fluorine gas to produce nitrogen trifluoride.

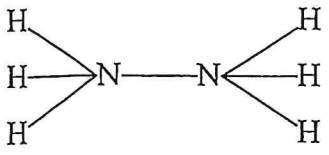
Reactants:		$N_2 + F_2 \rightarrow NF_3$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
N		→		N	
F				F	

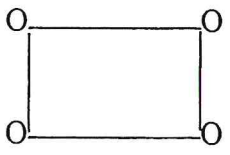
8. Carbon tetrachloride (a toxic solvent) may be produced from carbon disulfide and chlorine.

Reactants:		$CS_2 + Cl_2 \rightarrow CCl_4 + S_2Cl_2$		Products:	
symbol	# of atoms	Structural diagram of reactant molecules	structural diagram of product molecules	symbol	# of atoms
C		→		C	
S				S	
Cl				Cl	

Questions:

1. What is wrong with each of the structural diagrams below?
   Draw the correct structural diagram. (refer to your diagrams above)
   a. $2\ NH_3$ b. $2\ O_2$





Chemical Equations & Reaction Types:

Video: Examples

Video: Even #'s

PREDICT the products and write the BALANCED EQUATION for each for each of these reactions.

SINGLE REPLACEMENT: USE ACTIVITY SERIES OF METALS.

Example I: 2 $Al_{(s)}$ + 3 $Pb(NO_3)_{2\,(aq)}$ → $2Al(NO_3)_3 + 3Pb$

Example II: 1 $Cl_{2\,(g)}$ + 1 $CuI_{2\,(aq)}$ → $1CuCl_2 + 1I_2$

Example III: ____ $Ag_{(s)}$ + ____ $Ca(IO_3)_{2\,(aq)}$ → NR (Ca more reactive than Ag)

1. 1 $Zn_{(s)}$ + 1 $CuSO_{4\,(aq)}$ → $1Cu + 1ZnSO_4$

2. 1 $Cl_{2\,(g)}$ + 2 $KI_{(aq)}$ → $2KCl + 1I_2$

3. ____ $Ni_{(s)}$ + ____ $MgSO_{4\,(aq)}$ → NO RXN

4. ____ $Br_{2\,(aq)}$ + ____ $CaCl_{2\,(s)}$ → NR

5. 2 $F_{2\,(aq)}$ + 1 $ZrCl_{4\,(s)}$ → $1ZrF_4 + 2Cl_2$.

DOUBLE REPLACEMENT:

Example IV: 1 $AlBr_{3\,(aq)}$ + 3 $NaOH_{(aq)}$ → $1Al(OH)_3 + 3NaBr$

Example V: 1 $BaCl_{2\,(g)}$ + 1 $K_2SO_{4\,(aq)}$ → $2KCl + 1BaSO_4$

Example VI: 1 $(NH_4)_2S_{(s)}$ + 2 $LiC_2H_3O_{2\,(aq)}$ → $2NH_4C_2H_3O_2 + 1Li_2S$

6. 1 $FeCl_{2\,(aq)}$ + 1 $K_2S_{(aq)}$ → $1FeS + 2KCl$

7. 1 $CuSO_{4\,(aq)}$ + 2 $AgNO_{3\,(aq)}$ → $1Cu(NO_3)_2 + 1Ag_2SO_4$

8. 2 $AlCl_{3\,(aq)}$ + 3 $Na_2CO_{3\,(aq)}$ → $6NaCl + 1Al_2(CO_3)_3$

9. 1 $(NH_4)_2SO_{4\,(aq)}$ + 1 $BaCl_{2\,(aq)}$ → $2NH_4Cl + 1BaSO_4$

10. 2 $K_3PO_{4\,(aq)}$ + 1 $Fe_2O_{3\,(aq)}$ → $3K_2O + 2FePO_4$.

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

11. _____ $Zn_{(s)}$ + _____ $MgSO_{4\,(aq)}$ →

12. _____ $Zn_{(s)}$ + _____ $Ni(NO_3)_{2\,(aq)}$ →

13. _____ $KCl_{(aq)}$ + _____ $AgNO_{3\,(aq)}$ →

14. _____ $Mg_{(s)}$ + _____ $AlCl_{3\,(aq)}$ →

15. _____ $Cl_{2\,(g)}$ + _____ $KBr_{(aq)}$ →

16. _____ $Li_2SO_{4\,(aq)}$ + _____ $BaCl_{2\,(aq)}$ →

17. _____ $Pb(NO_3)_{2\,(aq)}$ + _____ $NaCl_{(aq)}$ →

18. _____ $Zn_{(s)}$ + _____ $CuCl_{2\,(aq)}$ →

19. _____ $AlCl_{3\,(aq)}$ + _____ $Pb(NO_3)_{2\,(aq)}$ →

20. _____ $Cu_{(s)}$ + _____ $Pb(NO_3)_{2\,(aq)}$ →

Name ANSWER KEY Date _____ Period _____

Single and Double Replacement Reactions Practice WS

Identify each reaction as either single replacement or double replacement and then balance the reactions.

1. $Zn + HCl \rightarrow ZnCl_2 + H_2$ Type of reaction: SD
2. $Ca_3N_2 + H_2O \rightarrow Ca(OH)_2 + H_3N$ Type of reaction: DD
3. $KI + Pb(NO_3)_2 \rightarrow KNO_3 + PbI_2$ Type of reaction: DD
4. $CuCl_2 + F_2 \rightarrow CuF_2 + Cl_2$ Type of reaction: SD
5. $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$ Type of reaction: SD
6. $Ca(OH)_2 + AgCl \rightarrow CaCl_2 + AgOH$ Type of reaction: DD
7. $Fe_3O_4 + Zn \rightarrow Fe + ZnO$ Type of reaction: SD
8. $MgBr_2 + Na_2CO_3 \rightarrow MgCO_3 + NaBr$ Type of reaction: DD
9. $Al + Hg_2S \rightarrow Al_2S_3 + Hg$ Type of reaction: SD
10. $HCl + I \rightarrow HI + Cl_2$ Type of reaction: SD

↑ mistake in formula

Determine if the reactions are Single or Double Replacement and then predict the products and balance.

1. $K_3P + Li \rightarrow$
2. $RbOH + Cu(NO_3)_2 \rightarrow$
3. $H_2SO_4 + KOH \rightarrow$
4. $Sr + AgCl \rightarrow$
5. $Na + MgCl_2 \rightarrow$

$H_3PO_4 + FeBr_3 \rightarrow$

7. $Ag + Li_2O \rightarrow$

Classifying Chemical Reactions Worksheet

Name: ANSWER KEY Period: ____

Classify each reaction as synthesis, decomposition, single replacement, double replacement or combustion. The equations are **not** balanced.

1. $PbCl_2 + 2AgNO_3 \rightarrow Pb(NO_3)_2 + 2AgCl$ — DD
2. $NH_3 + HCl \rightarrow NH_4Cl$ — S
3. $2AlCl_3 + 3Na_2SO_4 \rightarrow Al_2(SO_4)_3 + 6NaCl$ — DD
4. $Zn + S \rightarrow ZnS$ — S
5. $Al_2(SO_4)_3 + 3BaCl_2 \rightarrow 3BaSO_4 + 2AlCl_3$ — DD
6. $Al_2S_3 \rightarrow 2Al + 3S$ — D
7. $H_2SO_4 + Fe \rightarrow H_2 + FeSO_4$ — SD
8. $2C_{12}H_{22}O_{11} + 35O_2 \rightarrow 24CO_2 + 22H_2O$ — COMB.
9. $Mg(OH)_2 + H_2SO_4 \rightarrow MgSO_4 + 2H_2O$ — DD
10. $2NaOH + CuSO_4 \rightarrow Na_2SO_4 + Cu(OH)_2$ — DD
11. $C_4H_{12} + 7O_2 \rightarrow 6H_2O + 4CO_2$ — COMB
12. $4Fe + 3O_2 \rightarrow 2Fe_2O_3$ — S
13. $Mg_3(PO_4)_2 + 3H_2 \rightarrow 3Mg + 2H_3PO_4$ — SD
14. $NH_4NO_3 \rightarrow N_2O + H_2O$ — D
15. $Cl_2 + 2KBr \rightarrow 2KCl + Br_2$ — SD

Name: Solutions.

SNC 2D1

CHEMICAL EQUATIONS REVIEW WORKSHEET

"Word Equations to Skeleton Equations to Balanced Equations"

INSTRUCTIONS:

1. Convert each of the following word equations into chemical equations.
2. Balance each of the chemical equations.
3. Decide what type of reaction each word equation represents and write it into the blank provided.

reactants	→	products	type of reaction
EXAMPLE: oxygen + magnesium O_2 + Mg O_2 + 2 Mg	→	magnesium oxide MgO 2 MgO	synthesis
copper (II) sulphate + iron (III) $3CuSO_4 + 2Fe$	→	iron (III) sulphate + copper (II) $Fe_2(SO_4)_3 + 3Cu$	Single Displacement
sodium + iodine gas $2Na + I_2$	→	sodium iodide $2NaI$	Synthesis
barium hydroxide + hydrogen chloride $Ba(OH)_2 + 2HCl$	→	barium chloride + water $BaCl_2 + 2H_2O$	Double Displ.
aluminum chlorate + potassium bromide $Al(ClO_3)_3 + 3KBr$	→	aluminum bromide + potassium chlorate $AlBr_3 + 3KClO_3$	Double Displ.
methane + oxygen $CH_4 + 2O_2$	→	carbon dioxide + water $CO_2 + 2H_2O$	Combustion

iron (III) + oxygen $4Fe + 3O_2$	→	iron (III) oxide $2Fe_2O_3$	Synthesis
iron (III) chloride + sodium hydroxide $FeCl_3 + 3NaOH$	→	sodium chloride + iron (III) hydroxide $3NaCl + Fe(OH)_3$	Double Displ.
silver nitrate + chlorine $2AgNO_3 + Cl_2$	→	silver chloride + nitrate ions $2AgCl + 2NO_3^-$	Single Displac.
tin (IV) bromide + lead (II) carbonate $SnBr_4 + 2PbCO_3$	→	lead (II) bromide + tin (IV) carbonate $2PbBr_2 + Sn(CO_3)_2$	Double Disp.
hydrogen + oxygen $2H_2 + O_2$	→	water $2H_2O$	Synthesis
silver + oxygen $4Ag + O_2$	→	silver oxide $2Ag_2O$	Synthesis
copper (I) sulphate + iron (III) nitrate $3Cu_2SO_4 + 2Fe(NO_3)_3$	→	iron (III) sulphate + copper (I) nitrate $Fe_2(SO_4)_3 + 6CuNO_3$	Double Displ.

mit
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sodium hydroxide $2NaOH$	→	sodium + hydrogen + oxygen $2Na + H_2 + O_2$	Decomp.
francium oxide + magnesium iodide $Fr_2O + MgI_2$	→	francium iodide + magnesium oxide $2FrI + MgO$	Double Displ.
sodium bicarbonate + hydrogen sulphate $2NaHCO_3 + H_2SO_4$	→	sodium sulphate + carbon dioxide + water $Na_2SO_4 + 2CO_2 + 2H_2O$	Decomp.
sodium iodide + fluorine $2NaI + F_2$	→	sodium fluoride + iodine $2NaF + I_2$	Single Displ.
magnesium hydroxide + hydrogen chloride $Mg(OH)_2 + 2HCl$	→	magnesium chloride + water $MgCl_2 + 2H_2O$	Double Displ.
lithium + water $2Li + 2H_2O$	→	lithium hydroxide + hydrogen gas $2LiOH + H_2$	Single Displ.
copper (II) + silver nitrate $Cu + 2AgNO_3$	→	copper (II) nitrate + silver $Cu(NO_3)_2 + 2Ag$	single Displ.

magnesium + calcium nitrate $Mg + Ca(NO_3)_2$	→	magnesium nitrate + calcium $Mg(NO_3)_2 + Ca$	Single Displ.
sodium sulphide + hydrogen chloride $Na_2S + 2HCl$	→	sodium chloride + hydrogen sulphide $2NaCl + H_2S$	Double Displ.
nitrogen + hydrogen $N_2 + 3H_2$	→	ammonia $2NH_3$	Synth.
sulphur trioxide + water $SO_3 + H_2O$	→	hydrogen sulphate H_2SO_4	Synth.
potassium chlorate $2KClO_3$	→	potassium chloride + oxygen $2KCl + 3O_2$	Decomp.
lead (IV) + copper(II) nitrate $Pb + 2Cu(NO_3)_2$	→	copper (II) + lead (IV) nitrate $2Cu + Pb(NO_3)_4$	Single Displ.
magnesium oxide + silicon $MgO + Si$	→	magnesium + silicon oxide $Mg + SiO$	Single Displ.

Solutions

Section 4.3 Review
Conservation of Mass and Chemical Equations

Multiple Choice

For each question below, select the best answer.

1. Which of the following word equations correctly shows the reaction of magnesium with oxygen to form magnesium oxide?
   a. magnesium → oxygen + magnesium oxide
   b. magnesium oxide → magnesium + oxygen
   c. magnesium → magnesium oxide + oxygen
   d. oxygen → magnesium + magnesium oxide
   e. magnesium + oxygen → magnesium oxide

E

2. Which of the following is the correct skeleton equation of carbon dioxide breaking down into carbon and oxygen?
   a. $CO \rightarrow C + O$
   b. $C + O \rightarrow CO_2$
   c. $CO_2 \rightarrow C + O$
   d. $CO_2 \rightarrow C + O_2$
   e. $CO \rightarrow C + O_2$

D

3. Which of the following indicates a coefficient of 2?
   a. $4Ca^{2+}$
   b. 2NaCl
   c. $3O_2$
   d. $5Ca(OH)_2$
   e. $6Li_2S$

B

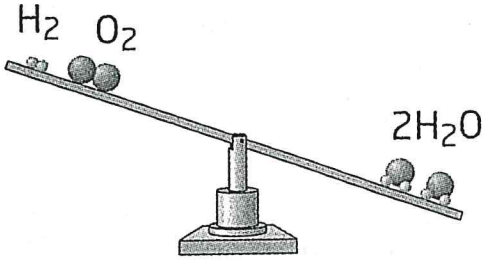
4. How many atoms of each element are in $3MgCl_2$?
   a. 3 magnesium atoms and 6 chlorine atoms
   b. 3 magnesium atoms and 2 chlorine atoms
   c. 6 magnesium atoms and 6 chloride atoms
   d. 1 magnesium atom and 2 chlorine atoms
   e. 1 magnesium atom and 6 chlorine atoms

A

5. Which abbreviation is *not* used to show the state of a chemical in a chemical equation?
   a. (aq), aqueous solution
   b. (g), gas
   c. (ℓ), liquid
   d. (f), fluid
   e. (s), solid

D

6. An image of a balance like the one below is often used to help visualize the process of balancing a chemical equation. Which of the following statements correctly describes the condition of the chemical equation represented in the model?



   a. The chemical equation is correctly balanced.
   b. The reactants need additional mass because there are not enough hydrogen atoms.
   c. The products need additional mass because there are not enough hydrogen atoms.
   d. The reactants need additional mass because there are not enough oxygen atoms.
   e. The products need additional mass because there are not enough oxygen atoms.

B

7. Which of the following is the balanced chemical equation for producing liquid water from hydrogen gas and oxygen gas?
   a. $2H_2(g) + O_2(g) \rightarrow H_2O(\ell)$
   b. $H_2O(\ell) \rightarrow H_2(g) + O_2(g)$
   c. $2H_2(g) + O_2(g) \rightarrow 2H_2O(\ell)$
   d. $H_2(g) + O_2(g) \rightarrow H_2O(\ell)$
   e. $2H_2O(\ell) \rightarrow 2H_2(g) + O_2(g)$

C

8. A scientist completely reacts 10 g of reactant A with 5 g of reactant B. What is the maximum amount of product that should form?
   a. 2 g
   b. 5 g
   c. 10 g
   d. 15 g
   e. 50 g

D

A + B → AB
10g 5g 15g

Section 4.3 Review
Conservation of Mass and Chemical Equations

Written Answer

Answer the following questions in your notebook.

9. Describe the difference between a reactant and a product of a chemical reaction.

10. Summarize the law of conservation of mass. mass of products = mass of reactants.

11. A scientist recorded the data in the table below during an experiment in which iron and sulfur, $S_8(s)$, powders reacted completely to form solid iron(III) sulfide. What mass of iron(III) sulfide did the scientist collect? Explain how you arrived at this amount.

Experimental Data

Mass of Test Tube (g)	Mass of Test Tube + Iron (g)	Mass of Test Tube + Iron + Sulfur (g)
10.0	15.0	19.3

19.3 − 10.0 g
= 9.3 g of Fe_2S_3

12. When balancing a chemical equation, which elements should you generally balance last? Explain why this is helpful. H_2, O_2, H_2O

13. Balance each of the following chemical equations.
- **a.** $Na_2SO_4(aq) + Ba(NO_3)_2(aq) \rightarrow NaNO_3(aq) + BaSO_4(s)$
- **b.** $Rb(s) + H_2O(\ell) \rightarrow RbOH(aq) + H_2(g)$
- **c.** $K_2O(s) + H_2O(\ell) \rightarrow KOH(s)$
- **d.** $Mg(s) + NH_3(g) \rightarrow H_2(g) + Mg_3N_2(s)$
- **e.** $N_2H_2(g) \rightarrow NH_3(g) + N_2(g)$

14. A friend is having difficulty balancing a chemical equation. He keeps increasing the coefficients on both sides of the chemical equation, but can't get the equation to balance. What suggestion would you make to your friend? Explain your reasoning.

15. Write a skeleton equation and a balanced chemical equation for the following word equation. You do not need to indicate the states of reactants or products.

sodium + iodine → sodium iodide

$2Na + I_2 \rightarrow 2NaI$

16. Why is it important for manufacturers of products to understand the law of conservation of mass?

- mass in must equal mass out.
- this costs money - companies do not want to lose money so very important to know law of cons. of mass.