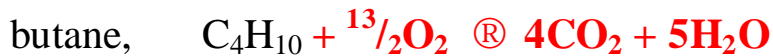


3 • What Happens When Chemicals Are Put Together?

1 • COMBUSTION REACTIONS

Write the balanced chemical equations for the combustion of the following fuels:



3 • What Happens When Chemicals Are Put Together?

2 • REACTION TERMS

There are several terms used throughout this unit.

Answer the questions with these terms:

solid, liquid, gas, aqueous, reactants, products, subscripts, coefficients, oxidation, reduction

Consider the following balanced chemical equation: $\text{C}_3\text{H}_8(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 3 \text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{l})$

- The “8” in the equation is an example of a subscript.
- The “5” in the equation is an example of a coefficient.
- $\text{C}_3\text{H}_8(\text{g})$ and $\text{O}_2(\text{g})$ are called reactants.
- The only liquid in the equation is H_2O .

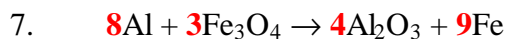
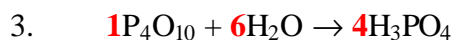
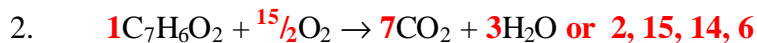
Consider the following balanced chemical equation: $\text{Zn}(\text{s}) + 2 \text{HCl}(\text{aq}) \rightarrow \text{ZnCl}_2(\text{aq}) + \text{H}_2(\text{g})$

- Which chemicals are dissolved in water? $\text{HCl}(\text{aq})$ and $\text{ZnCl}_2(\text{aq})$.
- The change of $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq})$ is called oxidation (oxidation / reduction).

3 • What Happens When Chemicals Are Put Together?

3 • BALANCING EQUATIONS

Balance the following equations:

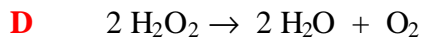
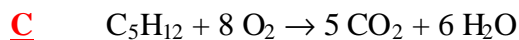
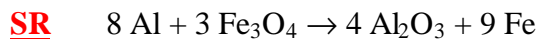
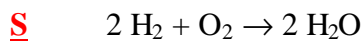
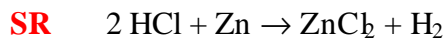


3 • What Happens When Chemicals Are Put Together?

4 • CLASSIFYING REACTIONS

For each of the following equations, classify the reaction as:

C—combustion	DR—double replacement	SR—single replacement	S—synthesis	D—decomposition
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3 • What Happens When Chemicals Are Put Together?

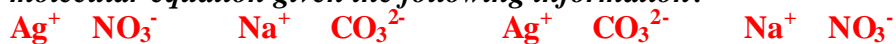
5 • PRECIPITATION REACTIONS

Circle the compounds below that would be precipitates (compounds that **do not dissolve** in water):

$K_2Cr_2O_7$	$Fe(NO_3)_3$	CuOH	MgCO₃
Ag₃PO₄	BaSO₄	PbCl₂	CaCl ₂

Note: use the Solubility Chart to determine these.

Write the balanced molecular equation given the following information:

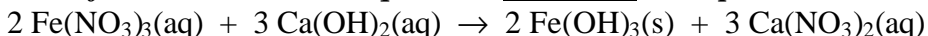


silver nitrate + sodium carbonate → silver carbonate + sodium nitrate



Balance compounds knowing the ions, write (aq) or (s) using the Solubility Chart, balance equation.

Write the ionic equation from this molecular equation. Underline the “spectator ions.”



Split the (aq)’s into separate ions. Spectators are exactly the same as reactants and products.

3 • What Happens When Chemicals Are Put Together?

6 • IONIC COMPOUNDS

Write the compound formed from these ions:

# Cations	Cation	# Anions	Anion	Formula
2	NH_4^+	1	SO_4^{2-}	(NH₄)₂SO₄
2	Fe^{3+}	3	S^{2-}	Fe₂S₃
1	Cu^{2+}	2	$C_2H_3O_2^-$	Cu(C₂H₃O₂)₂

Determine the # of ions needed to make a neutral compound and then write the formula:

# Cations	Cation	# Anions	Anion	Formula
3	NH_4^+	1	PO_4^{3-}	(NH₄)₃PO₄
1	Ba^{2+}	2	NO_3^-	Ba(NO₃)₂
2	Al^{3+}	3	CO_3^{2-}	Al₂(CO₃)₃
1	Sr^{2+}	2	OH^-	Sr(OH)₂

3 • What Happens When Chemicals Are Put Together?

7 • NAMING ACIDS

Write the formula of the acid formed from the following anions.

anion	acid formula
Cl ⁻	HCl
OH ⁻	H₂O (not acid)
S ²⁻	H₂S

anion	acid formula
SO ₄ ²⁻	H₂SO₄
PO ₄ ³⁻	H₃PO₄
C ₂ H ₃ O ₂ ⁻	HC₂H₃O₂

anion	acid formula
MnO ₄ ⁻	HMnO₄
F ⁻	HF
NO ₃ ⁻	HNO₃

Name the following acids:

formula	acid name
HBr	hydrobromic acid
HNO ₃	nitric acid
HC ₂ H ₃ O ₂	acetic acid

formula	acid name
HI	hydroiodic acid
H ₂ Cr ₂ O ₇	chromic acid
HClO ₃	chloric acid

formula	acid name
H ₂ CO ₃	carbonic acid
H ₂ S	hydrosulfuric acid
H ₃ PO ₄	phosphoric acid

Given the anion, write the formula of the acid and then name it:

anion	formula	acid name
S ²⁻	H₂S	hydrosulfuric acid
Cl ⁻	HCl	hydrochloric acid
NO ₃ ⁻	HNO₃	nitric acid
C ₂ H ₃ O ₂ ⁻	HC₂H₃O₂	acetic acid

anion	formula	acid name
SO ₄ ²⁻	H₂SO₄	sulfuric acid
ClO ₃ ⁻	HClO₃	chloric acid
F ⁻	HF	hydrofluoric acid
CO ₃ ²⁻	H₂CO₃	carbonic acid

3 • What Happens When Chemicals Are Put Together?

8 • CHEMICAL MATH

Consider the following balanced equation: $\text{C}_3\text{H}_8(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 3 \text{CO}_2(\text{g}) + 4 \text{H}_2\text{O}(\text{g})$
 Molar Masses: 45.01 32.00 44.01 18.02 g/mol

1. What mass of CO₂ is formed when 100 grams of C₃H₈ react?

$$100 \text{ g C}_3\text{H}_8 \times \frac{1 \text{ mol C}_3\text{H}_8}{45.01 \text{ g C}_3\text{H}_8} \times \frac{3 \text{ mol CO}_2}{1 \text{ mol C}_3\text{H}_8} \times \frac{44.01 \text{ g CO}_2}{1 \text{ mole CO}_2} = 293.33 \text{ g CO}_2$$

2. What volume (at STP) of O₂(g) is needed to completely react with 7.55 grams of C₃H₈?

$$7.55 \text{ g C}_3\text{H}_8 \times \frac{1 \text{ mol C}_3\text{H}_8}{45.01 \text{ g C}_3\text{H}_8} \times \frac{5 \text{ mol O}_2}{1 \text{ mol C}_3\text{H}_8} \times \frac{22.4 \text{ L O}_2}{1 \text{ mole O}_2} = 18.787 \text{ L O}_2$$

3 • What Happens When Chemicals Are Put Together?

9 • NATURAL HISTORY OF AIRS

Match the following ideas with the three gases:

O – oxygen gas

H – hydrogen gas

C – carbon dioxide gas

O 1. formed from hydrogen peroxide + yeast

H 2. also called “inflammable air”

C 3. formed from vinegar + chalk

O 4. also called “dephlogisticated air”

H 5. formed from hydrochloric acid + zinc

C 6. also called “fixed air”

C 7. turns limewater cloudy

H 8. pops with a burning splint

O 9. glowing splint re-lights

Match these substances with their chemical formulas:

B 10. chalk

a) HCl

C 11. limewater

b) CaCO₃

E 12. vinegar

c) Ca(OH)₂

A 13. hydrochloric acid

d) H₂O₂

D 14. hydrogen peroxide

e) HC₂H₃O₂

Notes about the lab: (or what was I supposed to learn from the lab)

“Dephlogisticated Air” is **oxygen gas (O₂)**

recipe: hydrogen peroxide + yeast

reaction: $2\text{H}_2\text{O}_2 \xrightarrow{\text{yeast}} 2\text{H}_2\text{O} + \text{O}_2$

test: glowing splint re-lights (because O₂ supports combustion)

“Fixed Air” is **carbon dioxide gas (CO₂)**

recipe: vinegar + chalk

reaction: $2\text{HC}_2\text{H}_3\text{O}_2 + \text{CaCO}_3 \rightarrow \text{H}_2\text{O} + \text{CO}_2 + \text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2$

test: limewater turns cloudy (forms precipitate of CaCO₃)

“Inflammable Air” is **hydrogen gas (H₂)**

recipe: mossy zinc + hydrochloric acid (swimming pool acid or muriatic acid)

reaction: $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$

test: burning splint “pops” (H₂ burns creating heat that expands the gas quickly)