

# GENERAL<sup>1</sup> CHEMISTRY

CASTROSANTO • MAAPE • ALVAREZ • RAMOS

## IMPORTANT REMINDERS

THESE MATERIALS WILL STRICTLY BE FOR REFERENCE/INSTRUCTION PURPOSES ONLY. THE CONTENTS OF THESE MATERIALS SHOULD NOT IN ANY MANNER BE SHARED OR DISTRIBUTED AS RIGHTS TO ITS ACCESS IS SOLELY GIVEN TO THE REQUESTING CLIENT. PLEASE USE PROPER CITATION/ATTRIBUTION WHEN USING THESE MATERIALS.

SERIES EDITOR  
JAIME D.L. CARO, PH.D.



## Periodic Table of Elements 1

## MODULE 1: What are the fundamentals of chemistry? 2

### LESSON 1: What is matter? 6

Matter is made up of tiny particles 6

The different phases of matter 7

How does matter change from one phase to another? 9

Pure substances and Mixtures 11

Matter has both Physical and Chemical properties 13

Matter can change physically or chemically 14

### LESSON 2: How do you present measurements? How do you separate mixtures? 18

Measurement 18

Significant figures 21

Trueness and Precision 23

Physical methods of separation 23

### LESSON 3: What do atoms look like? How do you represent them? 30

Dalton's Atomic Theory 32

The modern atomic model and its story 33

Atomic mass, atomic numbers, and writing the atomic symbol 35

Isotopes 35

### LESSON 4: What are molecules and ions? How do you name them? 40

Elements, molecules, ions, and compounds 40

Types of Chemical Formulas 44

Molecular Models 45

Naming and writing formulas of covalent compounds 46

Naming and writing formulas of ionic compounds 47

Naming polyatomic ions 49

Naming anion-containing acids 51

## **MODULE 2: How do chemical reactions occur? How are they quantified? 56**

### **LESSON 5: What are atomic mass and moles? How do you determine them? 60**

Atomic Mass	60
Avogadro's Number	57
Molar Mass	58
Mole conversion diagram	59

### **LESSON 6: What are empirical and molecular formulas? How do you derive them? 68**

Determining percent composition by mass	69
How chemical formulas are determined	72

### **LESSON 7: How are chemical reactions represented? 78**

Chemical reactions: definition	78
Balancing Chemical Equations	82

### **LESSON 8: How are the amounts of chemicals related in a reaction? 88**

Mass relationships in Chemical Reactions	88
The concept of limiting reactant	90
Percent and theoretical yields	92
Solution concentration and stoichiometry	94



## MODULE 3: What are gases?

100

### LESSON 9: What is pressure? What are the gas laws?

104

Quantifying the properties of gases	104
Boyle's Law: The relationship between pressure and volume	105
Charles' Law: Volume-Temperature Relationship	106
Avogadro's Law: Volume-Amount Relationship	108
Ideal Gas Law	110

### LESSON 10: Dalton's Law of Partial Pressures

114

### LESSON 11: What is the molar volume and molar mass of a gas? How do you determine these quantities from the Ideal Gas Law?

120

Defining molar volume and molar mass of a gas	120
How to derive the equations for molar volume and molar mass from the Ideal Gas Equation	121
Calculating for the molar volume and molar mass	122

### LESSON 12: What is the Kinetic Molecular Theory of Gases? How does this relate to the other gas laws?

128

The Kinetic Molecular Theory of Gases defined	128
How does the KMT relate to the gas laws?	129
Effusion and Diffusion	131

## **MODULE 4: What are the basic concepts of physical chemistry, organic chemistry, and biochemistry?**

**136**

### **LESSON 13: What is the dual nature of matter?**

**140**

Dual nature of matter 140

Quantum model of the hydrogen atom 144

### **LESSON 14: What are quantum numbers? How do you write electron configuration?**

**148**

Main energy level, sublevels, and orbitals 148

Quantum numbers 150

Electron configuration 152

### **LESSON 15: What are the trends of the atomic properties of the elements?**

**164**

Periodic variation in atomic properties 164

### **LESSON 16: What are ionic bonds?**

**174**

Why are noble gases stable? 174

Ionic bonding 176

Drawing ions and ionic compounds 177

Properties of ionic compounds 177

### **LESSON 17: What are covalent bonds? How do they form molecular compounds?**

**180**

Octet rule and covalent bonding 180

Drawing the Lewis dot structure of molecular compounds 182

Can a molecule, compound, or polyatomic ion have more than one Lewis structure? 185

Properties of molecular compounds 185

## **LESSON 18: How does a molecule's shape affect its polarity?** 190

Shapes of molecules	190
Bond polarity	193
Dipole moment and bond polarity	194

## **LESSON 19: What is organic chemistry?** 198

Characteristics of organic compounds	198
Functional groups	201

## **LESSON 20: What are polymers and biomolecules?** 212

Polymers	212
Biomolecules	215
Nucleic acids	217
How nucleic acids synthesize proteins	219
Carbohydrates	220
Lipids	222

## **KEY TERMS** 228

## **REFERENCES** 236