



**Cihan University Sulaimaniya**  
**College of Health Sciences**  
**Department of Anesthesia**



# **General Chemistry**

**For First Stage**  
**First Semester**

**Swara Jalal Mohammed**

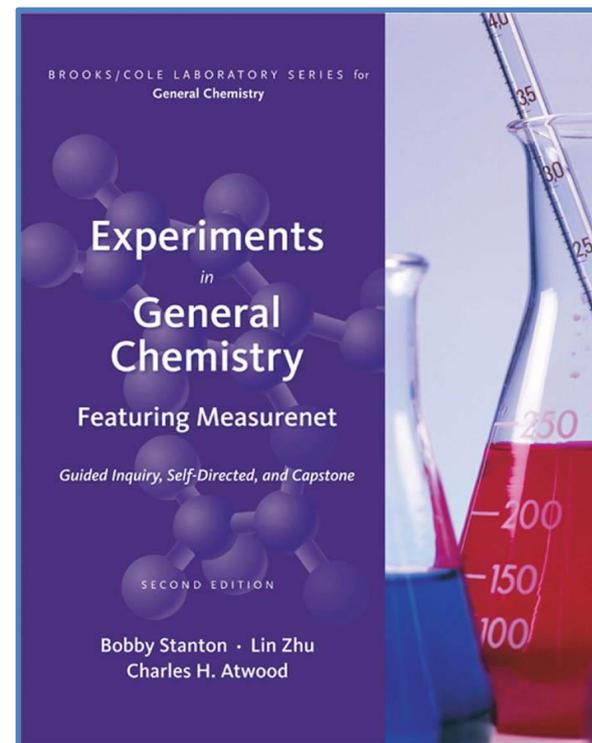
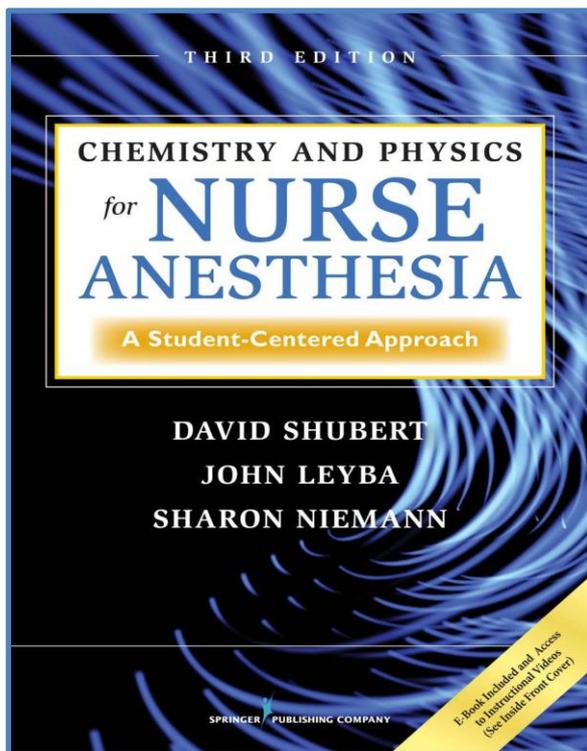
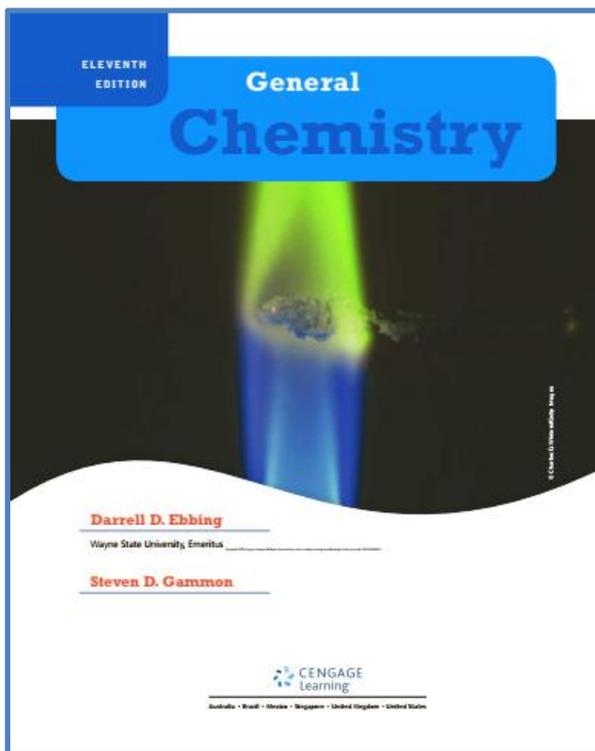
**Assistant professor**

**Organic Chemistry, Synthetic Chemistry, Carbon nanomaterials**

**[swara.jalal@sulician.edu.krd](mailto:swara.jalal@sulician.edu.krd)**

**(2024 – 2025)**

# References



- General chemistry/ **Darrell D. Ebbing and Steven D. Gammon**/ 11<sup>th</sup> edition.
- Chemistry and Physics for Nurse Anesthesia, A Student Centered Approach / **David Shubert, and John Leyba** / 3<sup>rd</sup> edition.
- Experiments in General Chemistry: Featuring Measurement / **Bobby Stanton, Lin Zhu, Charles H. Atwood** / 2nd edition.

# Assessment scheme

## Grades distributions will be as follows:

- **Theory: 30 Marks (Attendance, Assignments, Quizzes, and Presentation)**
- **Practice: 20 Marks (Attendance, Quizzes, Reports, and Other activities)**

## Final Grade distributions will be as follows:

- **Theory: 30 marks (30 Marks on paper exam)**
- **Practice: 20 Marks (20 Marks on paper exam)**
- **The total marks for the semester is 100%**



# Chapter: one

- **1.1 Introduction to Chemistry**
- **1.2 The Study of General Chemistry**
- **1.3 Branches of Chemistry**
- **1.4 The Scientific Method**
- **1.5 Classifications of Matter**
- **1.6 Physical and Chemical Properties of Matter**
- **1.7 Measurement**

# 1.1 Introduction to Chemistry

## ➤ What is chemistry?

- **Chemistry** is the study of the properties of **matter** and the changes it undergoes. **Elements** and **compounds** are substances that take part in chemical transformation.
- Chemistry is largely an **experimental science**, and a great deal of knowledge comes from laboratory research.
- **Applied chemistry** is the using of chemistry to attain certain goals, in fields like medicine, agriculture, and manufacturing.
- **Pure Chemistry** gathers knowledge for knowledge sake.

## Which comes first?

- **Pure chemistry** usually comes first, applied later called technology and can not be good or bad.
- **Applied chemistry** can be good or bad depending on use.

## 1.2 The Study of General Chemistry

- ❑ General chemistry is the branch of chemistry that deals with the **structure, composition, and properties of matter** and the **changes it undergoes**.
- ❑ Anesthesia students need to understand the **basic principles of general chemistry**, as they will encounter many applications of chemistry during clinical practice. **Some of the topics that are relevant for anesthesia students include:**
  - **1. Molecular structure and bonding:** This topic covers how atoms form molecules by sharing or transferring electrons, and how the shape and polarity of molecules affect their interactions and functions. For example, anesthesia students need to know how different **types of anesthetics** (such as **inhalational, intravenous, or local**) bind to **specific receptors or channels** in the **nervous system** and alter the transmission of nerve impulses.

## 1.2 The Study of General Chemistry

- **2. Acid-base chemistry:** This topic covers how acids and bases react with each other and with water, and how the pH of a solution affects its properties and reactions. For example, anesthesia students need to know how to monitor and adjust the acid-base balance of patients during surgery, as changes in pH can affect the metabolism, oxygen delivery, and drug effects in the body.
- **3. Gas laws:** This topic covers how the pressure, volume, temperature, and amount of a gas are related, and how gases behave under different conditions. For example, anesthesia students must know how to use and calibrate anesthesia machines and ventilators, which deliver controlled amounts of oxygen and anesthetic gases to the patients.

## 1.2 The Study of General Chemistry

- **4. Solutions and solubility:** This topic covers how substances dissolve in solvents, and how the concentration, temperature, and pressure affect the solubility and the rate of dissolution. For example, anesthesia students need to know how to prepare and administer different types of intravenous solutions and drugs, and how to avoid precipitation or crystallization of the solutes.

## 1.2 The Study of General Chemistry

- **5. Chemical kinetics and equilibrium:** This topic covers how the rate of a chemical reaction depends on the concentration, temperature, and catalysts, and how the equilibrium state of a reversible reaction is determined by the ratio of the reactants and products. For example, anesthesia students need to know how to predict and control the onset, duration, and recovery of anesthesia, which depend on the rate and direction of the chemical reactions between the anesthetics and the biological molecules.
- These are some of the main topics of general chemistry that are important for anesthesia students. However, many more topics and concepts are relevant and useful for the practice of anesthesia. Therefore, anesthesia students should have a solid foundation in general chemistry and be able to apply their knowledge to various clinical scenarios.

## 1.3 Branches of Chemistry

- ❑ There are several ways to classify the branches of chemistry, but one common way is to divide them into **five main categories: organic, inorganic, analytical, physical, and biochemistry.**
  
- **1. Organic chemistry** is the study of **carbon and its compounds**, which are the basis of life and many synthetic materials. Organic chemistry deals with the structure, properties, and reactions of organic molecules, such as hydrocarbons, alcohols, acids, esters, amines, and polymers.
  
- **2. Inorganic chemistry** is the study of compounds that **do not contain carbon, or contain carbon but not in the form of C-H bonds**. Inorganic chemistry covers the chemistry of metals, nonmetals, and their compounds, such as oxides, sulfides, halides, and salts.

## 1.3 Branches of Chemistry

- **3. Analytical chemistry** is the study of the composition and quality of matter, and the development of methods and instruments to measure and identify it. Analytical chemistry involves both **qualitative and quantitative analysis**, using techniques such as spectroscopy, chromatography, electrophoresis, and mass spectrometry.
- **4. Physical chemistry** is the study of the physical and mathematical aspects of chemistry, and the application of physics to chemical phenomena. Physical chemistry deals with the thermodynamics, kinetics, equilibrium, and quantum mechanics of chemical systems, and how they affect the structure, behavior, and interactions of molecules.

## 1.3 Branches of Chemistry

- **5. Biochemistry** is the study of **the chemical processes and molecules** that occur in living organisms, such as proteins, nucleic acids, carbohydrates, lipids, and metabolites. Biochemistry explores the molecular basis of life, and how biochemical reactions regulate and affect the functions of cells, tissues, and organs.
- These are the five main branches of chemistry, but there are many more sub-branches and types of chemistry shared with other disciplines, such as **agrochemistry, astrochemistry, geochemistry, medicinal chemistry, and more.**

## 1.4 The Scientific Method

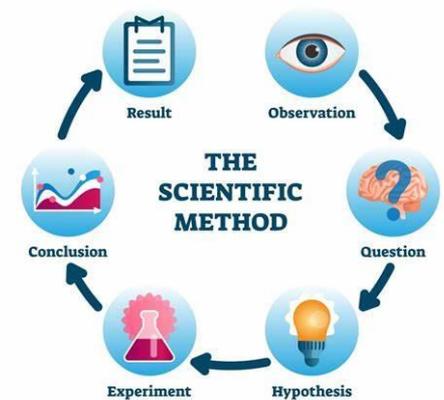
- ❑ The scientific method is a systematic process of making observations, asking questions, forming hypotheses, testing predictions, and drawing conclusions based on evidence. It is widely used in various fields of science, including chemistry and anesthesiology.
- ❑ For anesthesia students in general chemistry, the scientific method can help them understand the basic principles and concepts of chemistry that are relevant to their practice. For example, they can learn about the chemical properties and interactions of different anesthetic agents, such as inhalational or volatile anesthetics, and how they affect the central nervous system and other organs. They can also learn about the biochemical processes and pathways that are involved in anesthesia, such as metabolism, elimination, and pharmacokinetics.

## 1.4 The Scientific Method

- ❑ Some of the steps of the scientific method for anesthesia students in general chemistry are:
    - **1. Observation:** Observe a phenomenon or a problem related to anesthesia and chemistry, such as the effects of different anesthetic agents on blood pressure, heart rate, or oxygen saturation.
    - **2. Question:** Ask a specific and testable question about the observation, such as how the concentration of an anesthetic agent affects the blood pressure of a patient.
    - **3. Hypothesis:** Form a tentative explanation or prediction based on existing knowledge, such as higher concentrations of an anesthetic agent will lower the blood pressure of a patient.
    - **4. Experiment:** Design and experiment to test the hypothesis, such as measuring the blood pressure of different patients who receive different concentrations of an anesthetic agent.
-

## 1.4 The Scientific Method

- **5. Analysis:** Analyze the data and results of the experiment, such as using statistical methods to compare the mean blood pressure of different groups of patients.
- **6. Conclusion:** Draw a conclusion based on the analysis, such as there is a significant difference in the blood pressure of patients who receive different concentrations of an anesthetic agent.
- **7. Communication:** Communicate the findings and implications of the conclusion, such as writing a report, presenting a poster, or publishing a paper.



## 1.5 Classifications of Matter

- ❑ Classification of matter is the process of grouping substances based on their **physical and chemical properties**.
- ❑ There are two main types of classification: **pure substances** and **mixtures**.
- ❑ **1. Pure substances** are substances that have a fixed composition and cannot be separated into simpler substances by physical means.
- ❑ There are two types of pure substances: **elements and compounds**.
- **Elements** are substances that consist of only one type of atom, such as hydrogen, oxygen, or gold.
- **Compounds** are substances that consist of two or more types of atoms chemically bonded together, such as water, carbon dioxide, or sodium chloride.

# 1.5 Classifications of Matter

- ❑ **2. Mixtures** are substances that have a variable composition and can be separated into simpler substances by physical means.
- ❑ There are two types of mixtures: **homogeneous and heterogeneous.**
- **Homogeneous mixtures** are mixtures that have a uniform appearance and composition throughout, such as air, salt water, or vinegar.
- **Heterogeneous mixtures** are mixtures that have a non-uniform appearance and composition, such as oil and water, sand and sugar, or blood.

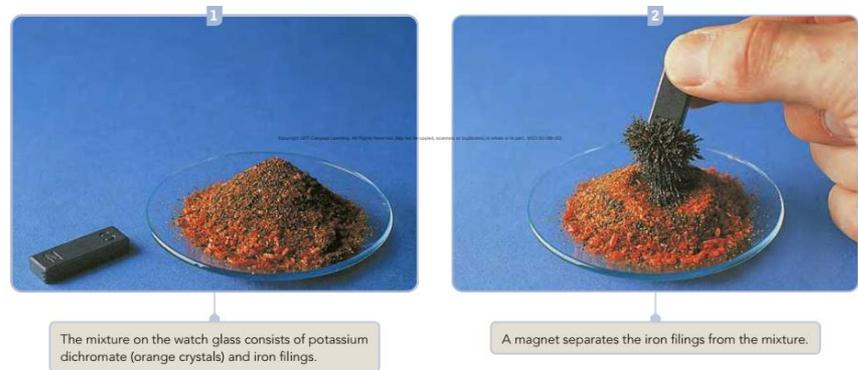
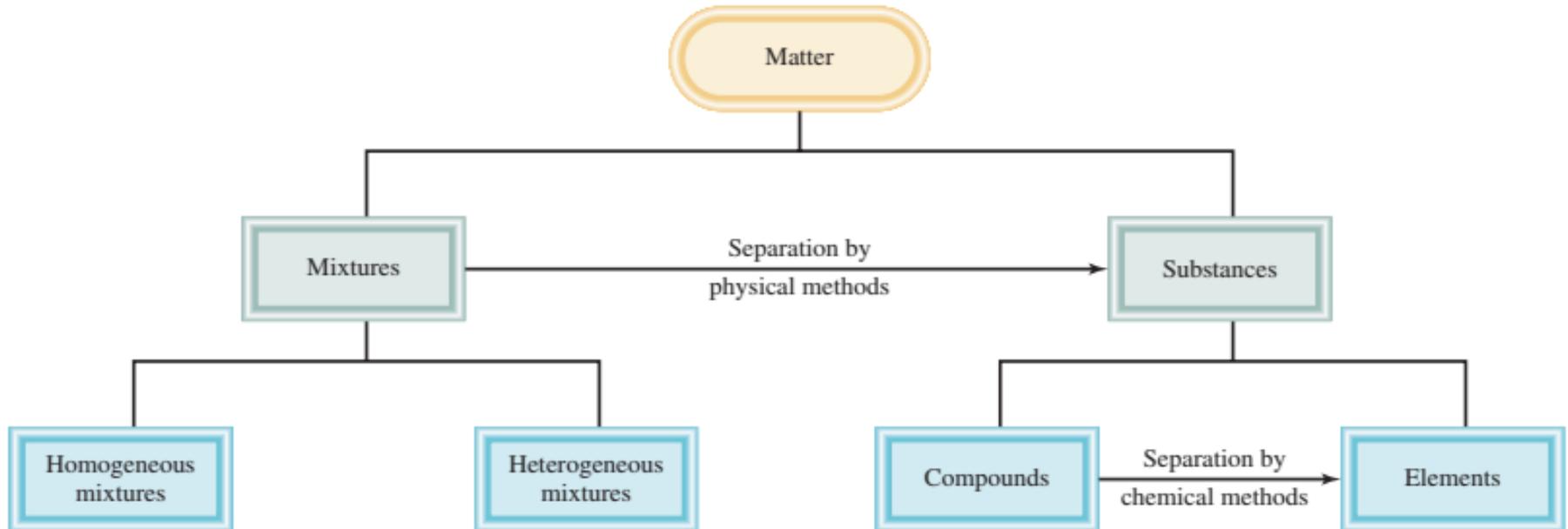


Figure 1.15 ▲  
A heterogeneous mixture

# 1.5 Classifications of Matter

□ Here is a diagram that summarizes the classification of matter:



**Figure**  
*Classification of matter.*

## 1.6 Physical and Chemical Properties of Matter

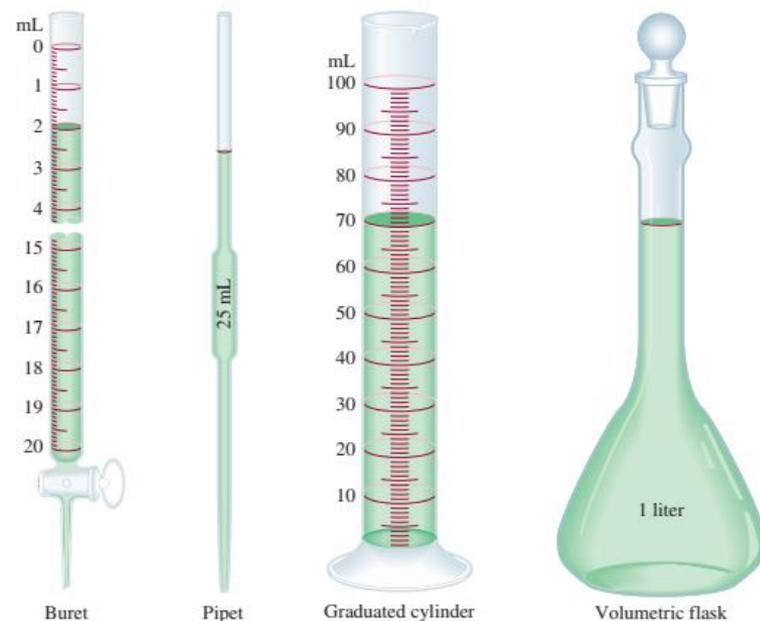
- ❑ **Physical and chemical properties** of matter are two ways of describing the characteristics and behavior of matter.
- ❑ **Physical properties** are those that can be observed or measured **without** changing the identity or composition of the substance. For example, the color, shape, size, density, melting point, and boiling point of a substance are physical properties
- ❑ **Chemical properties** are those that determine how a substance can undergo **chemical changes** or reactions with other substances. For example, the flammability, acidity, reactivity, and toxicity of a substance are chemical properties.

## 1.6 Physical and Chemical Properties of Matter

- ❑ **To observe a chemical property, a chemical change must occur, which results in the formation of new substances with different properties. Some signs of a chemical change are:**
  - **Change in color or odor**
  - **Formation of a precipitate (a solid substance) or a gas**
  - **Release or absorption of heat, light, or sound**
  - **Change in pH (acidity or alkalinity)**

## 1.7 Measurement

- ❑ Chemists use measurements to compare the properties of different substances and to assess changes resulting from an experiment.
- ❑ Several common devices enable us to make simple measurements of a substance's properties: The **meter** stick measures **length**; the **burette**, the **pipet**, the **graduated cylinder**, and the **volumetric flask** measure **volume**. The **balance** measures **mass**; the **thermometer** measures **temperature**.
- ❑ These instruments provide measurements of **macroscopic properties**, which can be **determined directly**.
- ❑ **Microscopic properties**, on the atomic or molecular scale, must be determined by an **indirect method**.



# Macroscopic vs Microscopic Properties

More Information Online [WWW.DIFFERENCEBETWEEN.COM](http://WWW.DIFFERENCEBETWEEN.COM)

	Macroscopic Properties	Microscopic Properties
DEFINITION	Macroscopic properties of matter are the properties in bulk matter.	Microscopic properties are the properties of the constituents of bulk matter.
VISIBILITY	Visible to naked eye.	Invisible to naked eye.
UNIT OF MEASUREMENT	In a scale that is visible to naked eye, which includes centi-, kilo-, mega-, etc.	In a scale that is invisible to naked eye, which includes milli-, micro-, nano-, pico-, etc.
EXAMPLES	Volume, pressure, temperature, density, etc.	Intermolecular forces, chemical bonding, atomicity, etc.