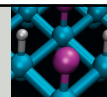


Welcome to CHM 2045!

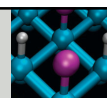
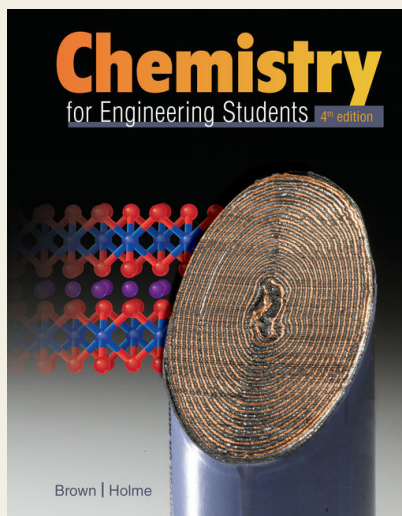


Chemistry I

Florida Polytechnic University – Fall 2018
Instructor: Dr. Pushpika Katugampola

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1



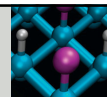
Chapter 1

Introduction to Chemistry

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2

Modern Chemistry



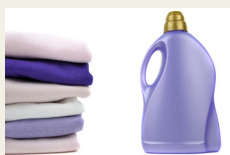
- **Chemistry** is a science that studies the composition of matter and its properties.
- Chemistry is divided into several branches:
 - **Organic chemistry** is the study of substances containing carbon.
 - **Inorganic chemistry** is the study of all other substances that don't contain carbon.
 - **Biochemistry** is the study of substances derived from plants and animals.
 - **Green chemistry** is the design of chemical processes that reduce waste and hazardous substances

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3

Why should you care?

Chemistry plays a significant role on your everyday life:



soaps/detergents



cell phone
battery

medicine



toothpaste



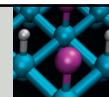
sunscreen



nail polish removal



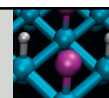
Chemicals used when cooking



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Why chemistry needed for Engineers:



- Passing the class
- Understanding the role of Chemistry in many areas of engineering and technology....engineering applications
- Exposing to various problem-solving techniques

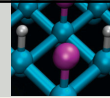


This will help you to develop and diversify your skills

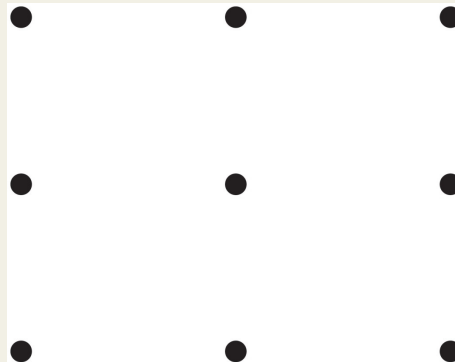
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6

Problem Solving



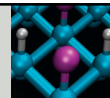
- Connect the dots using *only* four connecting straight lines.
- Experiment until you find a solution.



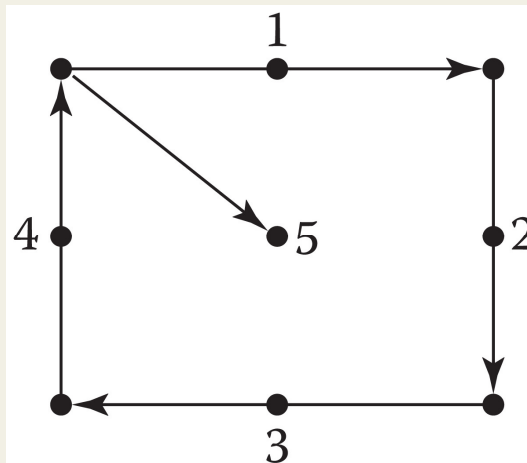
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7

Problem Solving, Continued



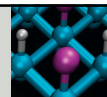
- Connect the dots using *only* four straight lines.
- Experiment until you find a solution.
- Did you have to use five straight lines?
- No matter which dot we start with, we still need five lines.



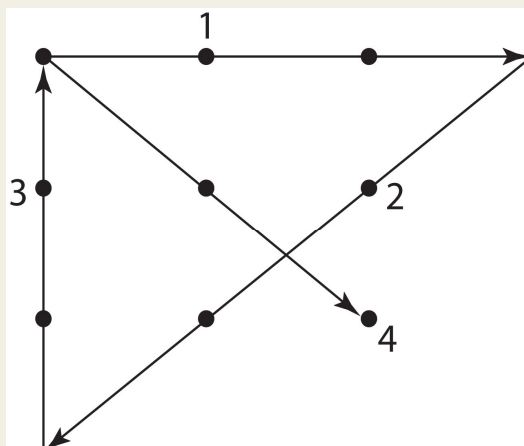
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8

Problem Solving, Continued



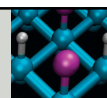
- Are we confining the problem?
- We need to go beyond the nine dots to answer the problem.
- Or “Think Outside Of The Box”



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Critical Materials

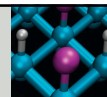


- **Critical materials** possess unique chemical and physical properties that allow them to play vital roles in technology
 - Their supply is at risk due to disruption
e.g. **Neodymium, Dysprosium, Europium, Terbium**
 - Lithium is considered a **near-critical material** because of its use in lithium batteries, which power many devices
 - Chemists and engineers are considering ways to replace critical materials with other elements that may be less prone to disruption

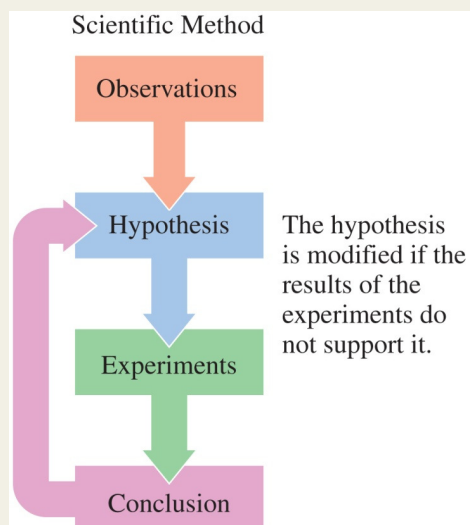
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10

The Scientific Method



- Chemists use the **scientific method** to solve problems.



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Example for Scientific Method

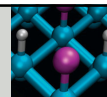
Suppose you visit a friend in her home, and soon after you arrive, you begin to sneeze.

- You **observe** that your friend has a new cat.
- You ask yourself why you are sneezing and form a **hypothesis** that you are allergic to cats.
- You perform **experiments** to test your hypothesis by visiting other friends with cats.
- If you sneeze after leaving the other homes with cats, you come to the **conclusion** that your hypothesis is correct.

Chemistry: An Introduction to General, Organic, and Biological Chemistry, Twelfth Edition

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The Study of Chemistry

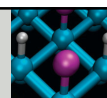


- The study of chemistry involves three levels of understanding or three perspectives
 - ✓ Macroscopic
 - ✓ Microscopic
 - ✓ Symbolic

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The Macroscopic Perspective



- Matter is anything that has mass and can be observed
- Matter is observed through two types of changes
 - ✓ Physical changes
 - ✓ Chemical changes

Cobalt



Cobaltite ore (Cobalt + other elements such as As and S)



Pure Cobalt

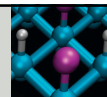


Cobalt used in blue pigments

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The Macroscopic Perspective (continued 1)



- **Physical properties**

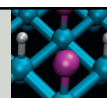
- we can measure without changing the identity of the substance being observed
- E.g. mass, **density**, color, viscosity, hardness, malleability and temperature
- The density (mass density) of an object is a ratio of its mass to its volume

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

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The Macroscopic Perspective (continued 2)



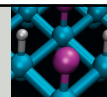
- **Chemical properties**

- ✓ Associated with chemical changes that a substance can undergoes
- ✓ E.g. **Combustion** (some materials burn in oxygen)
Corrosion - the degradation of metals in the presence of air and moisture
Pure aluminum metal reacts with acid, such as in soft drinks, to form an aluminum salt and hydrogen gas

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The Macroscopic Perspective (continued 3)

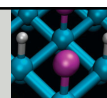


- There are **three phases of matter**
 - ✓ **Solids** are hard and do not change their shapes easily at ordinary temperatures
 - ✓ **Liquids** adapt to the shape of the container they fill
 - ✓ **Gases** expand to occupy the entire volume of their containers

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The Microscopic or Particulate Perspective

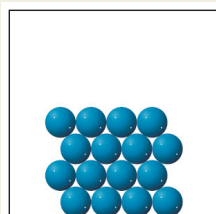
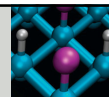


- Matter is composed of **atoms** and **molecules**
- **Atoms are minute particles that cannot be made any smaller**
- An **element** is composed of atoms with identical physical and chemical properties
- **Molecules** are groups of atoms held together by attractive forces, whose identity is different from the atoms alone

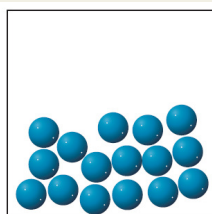
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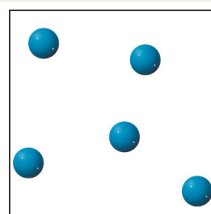
The Microscopic Perspective



Solid



Liquid



Gas

- Solid: Particles maintain a regular ordered structure
 - Maintains size and shape
- Liquid: Particles remain close but no longer ordered
 - Takes shape of container
- Gas: Particles are widely separated and move independently of one another
 - Fills available volume of container

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