CHEMISTRY 130
Spring 2020

- Syllabus Review

Chapter 1: An Introduction to Chemistry
1.1 The Nature of Chemistry

- Chemistry studies substances (matter):
  - their structure,
  - their properties,
  - how they interact with each other to form new substances, and
  - how they interact with energy.

- Without chemistry life would be nasty, brutish, and short.
  - New materials, new pharmaceuticals, new energy sources, food supplies, help the environment, and many others …

- In this course, you will learn to:
  - See like a chemist: visualize atoms and molecules.
  - Talk like a chemist: know the vocabulary of chemistry.
  - Calculate like a chemist: be able to reason quantitatively.

- You will then be prepared for Chem 180, which is Chem 130 on steroids!

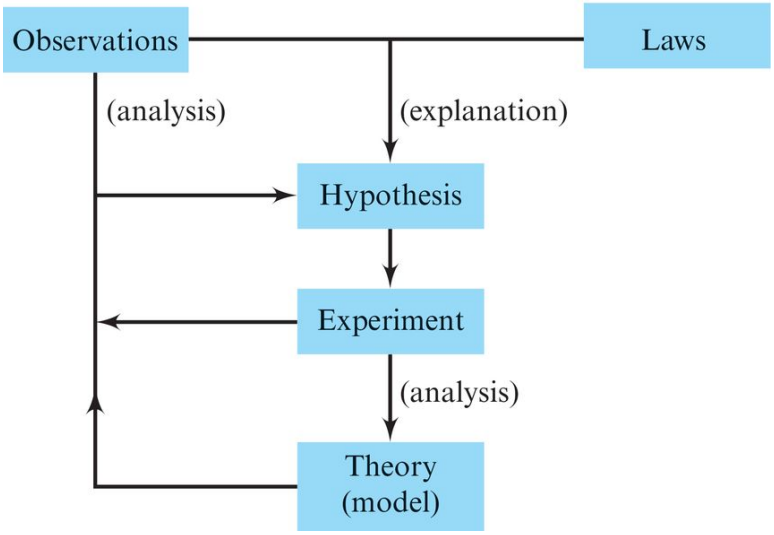
1.2 A Scientific Approach to Problem Solving

- Science is a framework for gaining and organizing knowledge, and a procedure for processing and understanding certain types of information.

- The work of scientists
  - refines our understanding of the natural world,
  - adds new ideas to our understanding, and
  - challenges the way we think nature works.

- To achieve these goals in a systematic, efficient, and repeatable fashion, a 'Scientific Method' is needed.
  - The steps in the Scientific Method illustrate the process that lies at the center of scientific inquiry.

- Elements of the scientific method:
  - Observations: Arouse curiosity and provoke questions.
  - Laws: Predict what will happen, what will be observed.
  - Hypothesis: Provides an explanation for the observation.
  - Theory (Model): One or more well-tested hypotheses that gives an overall explanation of some natural phenomenon.
  - Experiment: Tests a model's prediction against nature.

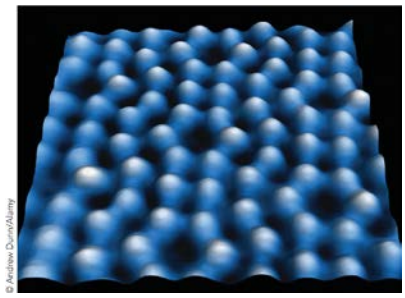


- Scientific thinking can help you in more than just chemistry!

1.3 The Particulate Nature of Matter

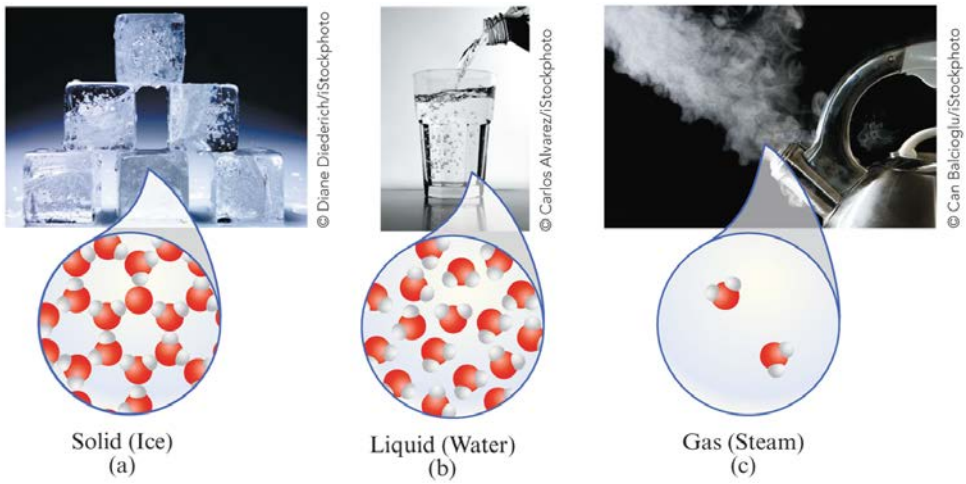
All things are made of atoms.

- Matter is anything that has mass and occupies space.

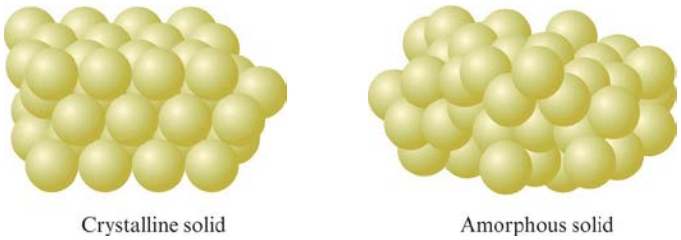


- Chemists recognize three (physical) states of matter: solid, liquid, and gas.

  - o Solid has a definite volume and shape.
  - o Liquid has a definite volume but not a definite shape.
  - o Gas has indefinite volume and no fixed shape.



- Solids can be further classified as crystalline or amorphous.



- Microscopic solid structure is reflected in the shapes we observe.

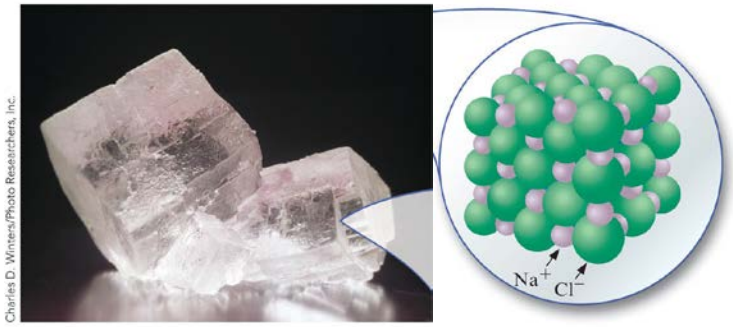


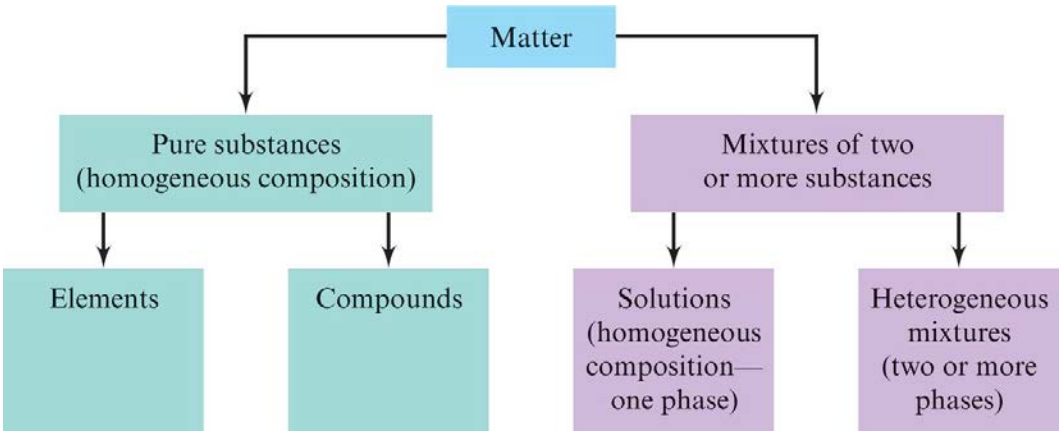
TABLE 1.1 | Common Materials in the Solid, Liquid, and Gaseous States of Matter

Solids	Liquids	Gases
Aluminum	Alcohol	Acetylene
Copper	Blood	Air
Gold	Gasoline	Butane
Polyethylene	Honey	Carbon dioxide
Salt	Mercury	Chlorine
Sand	Oil	Helium
Steel	Syrup	Methane
Sugar	Vinegar	Nitrogen
Sulfur	Water	Oxygen

TABLE 1.2 | Physical Properties of Solids, Liquids, and Gases

State	Shape	Volume	Particles	Compressibility
Solid	Definite	Definite	Rigidly clinging; tightly packed	Very slight
Liquid	Indefinite	Definite	Mobile; adhering	Slight
Gas	Indefinite	Indefinite	Independent of each other and relatively far apart	High

1.4 Classifying Matter



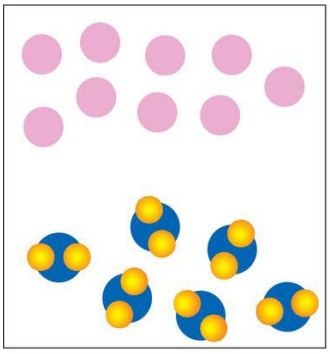
(a)

(b)

(a)

(b)

Classify the matter in the following pictures.



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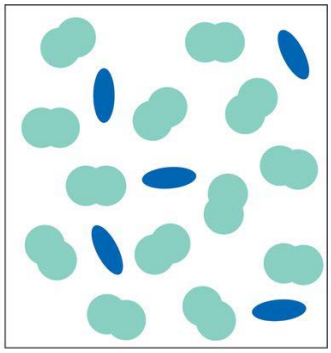

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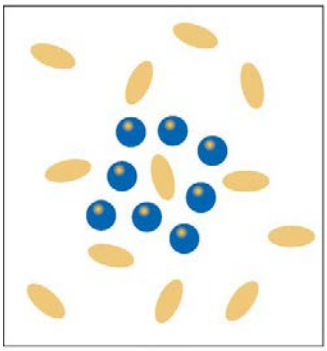


(3)

(4)

Learning Chemistry

- Learn the vocabulary.
- Memorize important information.
- Learn and practice solving problems.
- Keep working and learning from your mistakes.
- Do chemistry every day!
- Ask questions!

SUBSTANCES

All samples of a given substance have the same composition.

ELEMENTS

Each composed of one kind of atom, i.e., of same atomic number

METALS - malleable, ductile, good conductors of electricity and heat, form positive ions

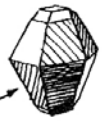
e.g., Sodium, Mercury, Copper

METALLOIDS - both metallic and non-metallic properties

e.g., Silicon, Arsenic, Carbon (graphite)

NON-METALS - poor conductors of heat and electricity, form negative ions

e.g., Oxygen, Bromine, Sulfur



COMPOUNDS

Molecular combinations of more than one element

Combinations of definite proportions of two or more elements are COMPOUNDS.

INORGANIC

ACIDS - taste sour, turn litmus red

e.g., Nitric acid, Sulfuric acid

BASES - taste brackish, turn litmus blue

e.g., Caustic Soda, Lye

SALTS - no common taste

e.g., Alum, Silver nitrate, Sodium chloride

Electrolytes (ionic compounds) Solutions are good conductors of electricity

NON-ELECTROLYTES (covalent compounds)

e.g., Ammonia (gas), Quartz, Water

ORGANIC

CARBON COMPOUNDS both electrolytes and non-electrolytes

e.g., Fats, Starch, Protein, Alcohol, Sugar

Variable combinations of substances form MIXTURES.

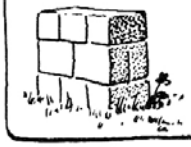
SOLUTIONS - homogeneous mixtures of substances in varying proportions

e.g., Air, Glass, Brass, Syrup

COLLOIDS - minute particles of substances suspended in other substances

e.g., Glue, India ink, Milk, Egg white, Smoke

COARSE MIXTURES - aggregations of discrete particles of substances or mixtures



e.g., Wood, Concrete, Granite