Matter and Energy

Unit 2

Chemistry

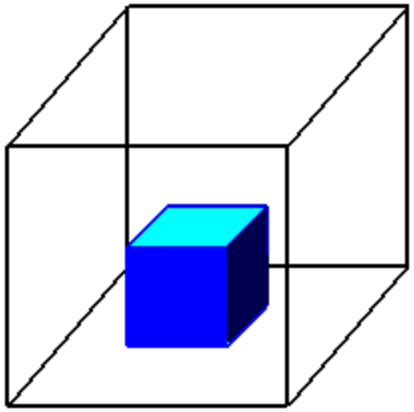
- Study of Matter
  - Composition, structure and properties
  - Changes that it undergoes
  - Energy associated with those changes

Matter

- Matter is anything that has mass and takes up space
- Exists in three phases which may change to one another under certain conditions
- All materials are made of matter, though some more easily observed than others

States of Matter

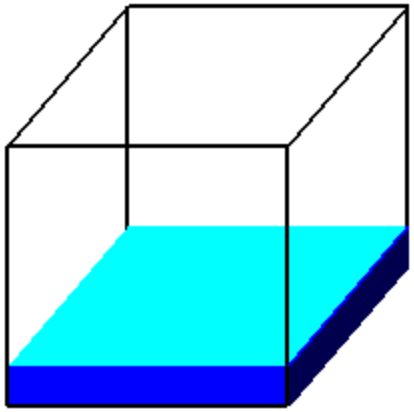
Glenn Research Center



Solid

Holds Shape

Fixed Volume

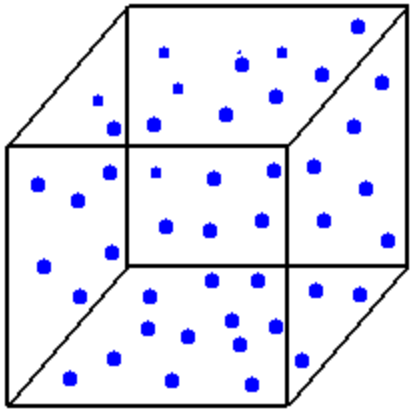


Liquid

Shape of Container

Free Surface

Fixed Volume



Gas

Shape of Container

Volume of Container

Phases of Matter

Solid (s)

- Definite shape and volume
- Crystalline structure
- Particles constantly vibrating in space
- Particles are in a definite pattern
- Particles are closely arranged
- Resists compression

Phases of Matter

Liquid (l)

- Fixed volume
- No definite shape
- Takes the shape of the container
- Particles are close together
- No regular pattern

Phases of Matter

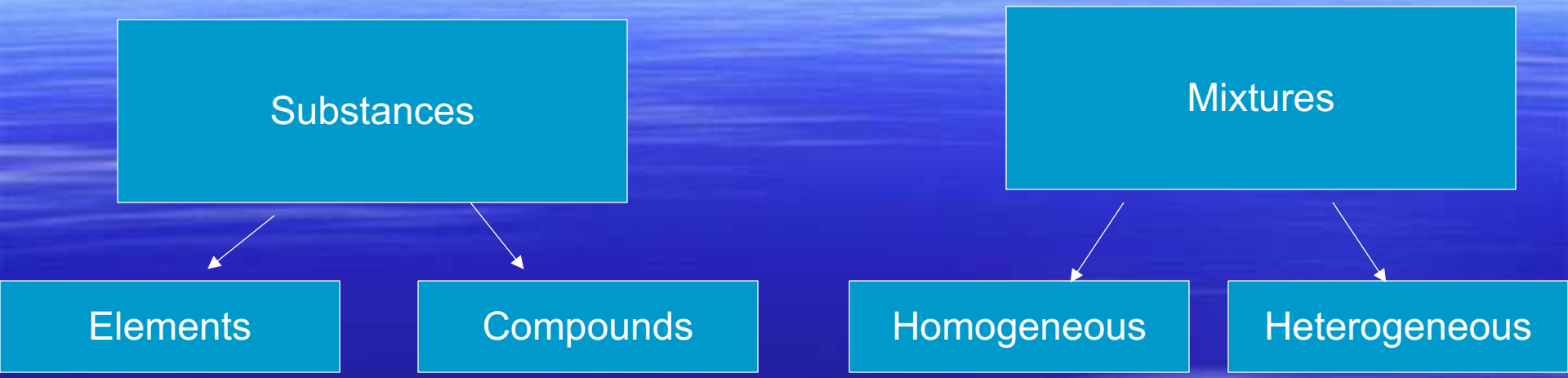
Gases (g)

No definite shape or volume

Molecules far apart and random

Entropy- degree of randomness/disorder

Matter


Substances
Mixtures
Elements
Compounds
Homogeneous
Heterogeneous

Mixtures: Solutions

- Homogeneous mixtures in which one substance, the solute is dissolved in another substance called the solvent
- Most common type is aqueous (aq) , which indicates that the substance is dissolved in water

Properties of Matter

Physical Properties:

Physical properties can be observed or measured without changing the composition of matter. Physical properties are used to observe and describe matter.

Physical properties include: appearance, texture, color, odor, melting point, boiling point, density, solubility, and many others

Chemical Properties

- **Chemical properties** of matter describes its "potential" to undergo some chemical change or reaction
- *For example:*

1. hydrogen has the potential to ignite and explode given the right conditions. This is a chemical property.
2. Metals in general have the chemical property of reacting with an acid. Zinc reacts with hydrochloric acid to produce hydrogen gas. This is a chemical property
3. Metals can rust

Physical Changes

A **physical change** takes place without any changes in molecular composition. The same element or compound is present before and after the change.

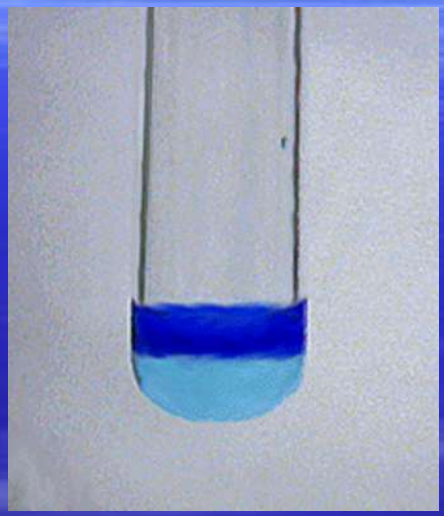
- **Melting, Boiling, vaporizing, condensing, etc**

Chemical Changes

- A **CHEMICAL CHANGE** alters the composition of the original matter. Different elements or compounds are present at the end of the chemical change. The atoms in compounds are rearranged to make new and different compounds.

Signs of a Chemical Change

- Color change
- Gas released
- Formation of a precipitate
- Generation of heat



Demos

- $Al(s) + CuCl_2 (aq) \rightarrow AlCl_3(aq) + Cu (s)$
- $Zn (s) + HCl (aq) \rightarrow ZnCl_2(aq) + H_2 (g)$
- $AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

*intro to table J and table F

*single replacement reactions vs. double

*Diatomic Elements vs Monoatomic Elements

*Transition metals- colored compounds

Particle Representations of Matter