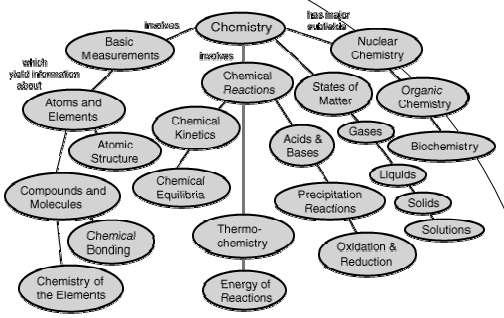
The Study of Chemistry



The Study of Chemistry

The Molecular Perspective of Chemistry

- Matter is the physical material of the universe.
- Matter is made up of relatively few elements.
- On the microscopic level, matter consists of atoms and molecules.
- Atoms combine to form molecules.
- As we see, molecules may consist of the same type of atoms or different types of atoms.

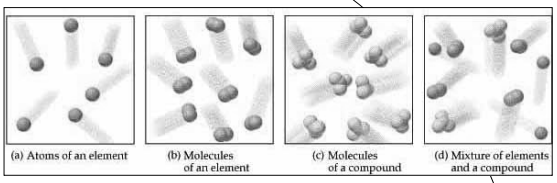
Classification of Matter

States of Matter

- Matter can be a gas, a liquid, or a solid.
- These are the three states of matter.
- Gases have no fixed shape or volume.
- Gases can be compressed to form liquids.
- Liquids have no shape, but they do have a volume.
- Solids are rigid and have a definite shape and volume.

Classification of Matter

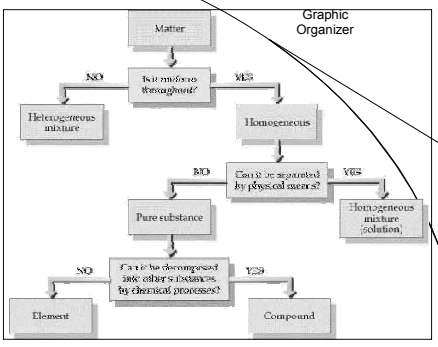
Pure Substances and Mixtures



Pure Substances and Mixtures

- If matter is not uniform throughout, then it is a ***heterogeneous mixture.***
- If matter is uniform throughout, it is ***homogeneous.***
- If homogeneous matter can be separated by physical means, then the matter is a ***mixture.***
- If homogeneous matter cannot be separated by physical means, then the matter is a ***pure substance*.**
- If a pure substance can be decomposed into something else, then the substance is a ***compound.***

Classification of Matter



Properties of Matter

Physical and Chemical Changes

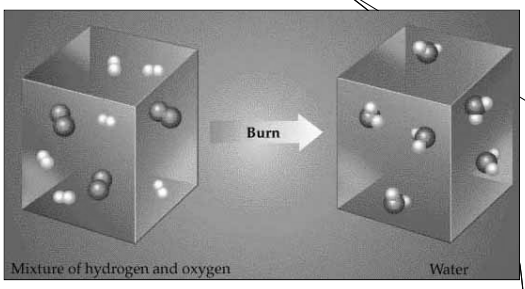
When a substance undergoes a physical change, its physical appearance changes.

Example: the melting of ice (physical change) results in a solid being converted into a liquid.

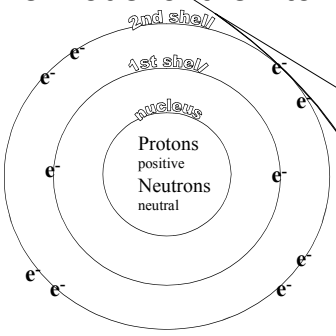
Physical changes do not result in a change of composition.

When a substance changes its composition, it undergoes a chemical change:

When pure hydrogen and pure oxygen react completely, they form pure water. In the flask containing water, there is no oxygen or hydrogen left over.



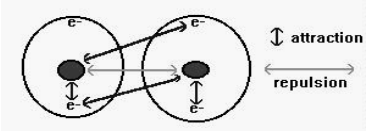
The Model of the Atom



Bonding

All bonding forces are due to **electrostatic charge**.Opposite charges attract, Like charges repel.

This diagram shows the attraction and repulsion between atoms:The outer ring (e-) is the *electron cloud*. The inner red ring is the *nucleus*.



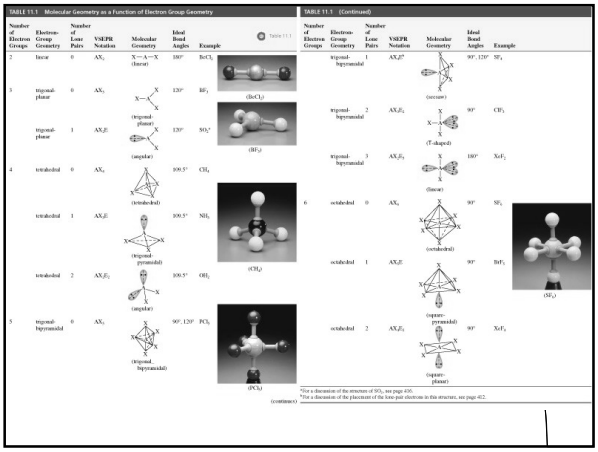


TABLE 11.1 Molecular Geometry as a Function of Electron Group Geometry

Number of Electron Groups	Electron-Group Geometry	Number of Lone Pairs	VSEPR Notation	Molecular Geometry	Ideal Bond Angles	Example
2	linear	0	AX_2	X—A—X (linear)	180°	$BeCl_2$
3	trigonal-planar	0	AX_3	(trigonal-planar)	120°	BF_3
	trigonal-planar	1	AX_2E	(angular)	120°	SO_2*
4	tetrahedral	0	AX_4	(tetrahedral)	109.5°	CH_4
	tetrahedral	1	AX_3E	(trigonal-pyramidal)	109.5°	NH_3
	tetrahedral	2	AX_2E_2	(angular)	109.5°	OH_2
5	trigonal-bipyramidal	0	AX_5	(trigonal-bipyramidal)	90°, 120°	PCl_5
	trigonal-bipyramidal	1	AX_4E	(seesaw)	90°, 120°	SF_4
	trigonal-bipyramidal	2	AX_3E_2	(T-shaped)	90°	ClF_3
	trigonal-bipyramidal	3	AX_2E_3	(linear)	180°	XeF_2
6	octahedral	0	AX_6	(octahedral)	90°	SF_6
	octahedral	1	AX_5E	(square-pyramidal)	90°	BrF_5
	octahedral	2	AX_4E_2	(square-planar)	90°	XeF_4

*For a discussion of the structure of SO_2, see page 450.
†For a discussion of the placement of the lone-pair electrons in this structure, see page 412.

(continues)

TABLE 11.1 (Continued)

Stoichiometry

- **Stoichiometry** is the branch of chemistry and chemical engineering that deals with the quantities of substances that enter into, and are produced by, chemical reactions.
- Every chemical reaction has it's characteristic proportions. The method of obtaining these from chemical formulas, equations, atomic weights and molecular weights, and determination of what and how much is used and produced in chemical processes, is the major concern of **Stoichiometry**.

What you will need

- Scientific Calculator!
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- Scientific Calculator!!!
- Notebook
- Laboratory Notebook (quadrille rule)
- Pencils
- Pens

Process

- Lecture
- Labs
- Independent Study Projects
- Group Activities
- CPS Assessments
- Quizzes
- Semester Final (20% of your grade)

Questions?