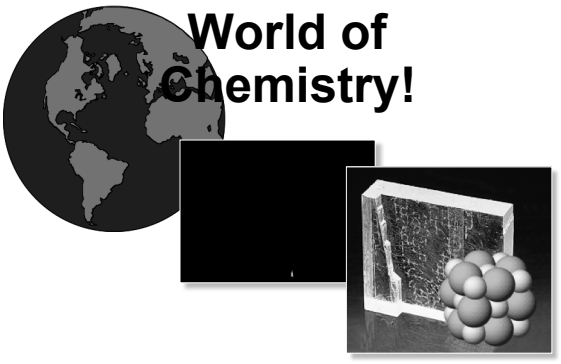
Chemistry 104 Chapter One PowerPoint Notes

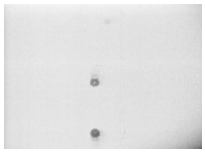
Welcome to the World of Chemistry!



The Nature of Chemistry

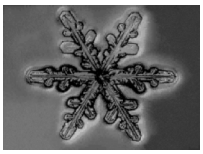
What is Chemistry?

What is Matter?



MAR

The Nature of Chemistry



How does Matter Change?

How does Matter interact?

MAR

The Nature of Chemistry

Why study Chemistry?

Chemistry as a Human Endeavor

Dr. Jacqueline Barton, California Institute of Technology

MAR

Chemistry 104 Chapter One PowerPoint Notes

The Art (?) of Chemistry

Chemistry and Art?!?

Dr. Roald Hoffman, 1981 Nobel Prize in Chemistry

Stick to the chemistry, Roald!

"There was no question that
the reaction worked
but transient colors were seen
in the slurry of sodium methoxide in
dichloromethane
and we got a whole lot of products
for which we can't sort out the
kinetics
the next slide show will show
the most important part
very rapidly
within two minutes
and I forgot to say on further
warming
we get in fact the ketone…"

What's CH 104 Sec 71 Like?

- Two **lectures** per week (M & W) and two **labs** per week (T & Th) - *generally!*
- **Lab reports, problem sets** and **quizzes** during "lab"
- **Three midterm exams**, a **lab final** and **lecture final**
- Look at **CH 104 Schedule** to see what's due each week!
- **Compressed schedule**! No make up labs, quizzes or exams if missed!

CH 104 Lectures

- **Exams** given in "lecture"
- Get **PowerPoint notes** on CH 104 website - *very helpful!* - **http://mhchem.org/104**
- **Write notes as you listen** - helps increase memory retention
- **Lecture augments text but does not replace it** - must read the book! practice problems!
- Keep up with reading, assignments, etc.

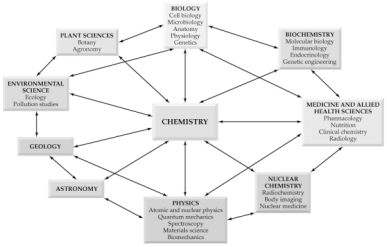
How To Do Well in CH 104

- **Complete** all assigned problem sets and seminar problems
- Do as many unassigned problems as possible - improves speed, knowledge
- Work in **study groups** to test each other, complete assignments, etc.
- Use the **chemistry tutors** in the tutoring center above the library
- Contact me if you have any questions!

Chemistry 104 Chapter One PowerPoint Notes

Chemistry: The Central Science

Chemistry is often referred to as "***The Central Science***" because it is crucial to all other sciences.



The Branches of Chemistry

- **Organic - carbon, nitrogen, oxygen**
- **Inorganic - metals, everything "non-carbon"**
- **Analytical - Spectroscopy, "how much", "what kind"**
- **Physical - measurement, where physics meets chemistry**
- **Biochemical - the chemistry of life**
- ***also:*** **geochemistry, astrochemistry, radiochemistry, medicinal chemistry, etc.**

Basic Terms of Chemistry

Matter: Anything that has mass and occupies space – things you can see, touch, taste, or smell.

Property: a characteristic that can be used to describe a substance.

Size, color, temperature are familiar properties of matter. Less familiar properties include:

Chemical composition: what matter is made of.

Chemical Reactivity: how matter behaves, *reactions*.

Physical and Chemical Change

A Physical Change does not alter the chemical makeup of a substance. Change is reversible.

Example: Melting of solid ice; only change in form takes place and change is reversible.

A Chemical Change alters chemical composition of a substance. Change is irreversible.

Example: Rusting of iron; iron combines with oxygen and produces a new substance (rust).

Chemistry 104 Chapter One PowerPoint Notes

States of Matter

Matter exist in three forms: *solid*, *liquid*, and *gas*.

Solids have definite shape and volume.

Liquids have definite volume but changes shape to fill containers.

Gases have neither definite volume or definite shape.

Most substances, such as water, can exist in all three states depending on the temperature.

The conversion of a substance from one state into another is known as *change of state.*

The **solid, liquid** and **gaseous** states of water are shown below:

(a) Ice: A solid has a definite volume and a definite shape independent of its container.

(b) Water: A liquid has a definite volume but a variable shape that depends on its container.

(c) Steam: A gas has both variable volume and shape that depend on its container.

Classification of Matter

Pure Substance: Uniform in its chemical composition and properties. Sugar and water are pure substances.

Mixture: Composition and properties may vary. Different amounts of sugar dissolved in water will determine sweetness of water.

Sugar water is an example of a mixture.

Elements and Compounds

Elements cannot be broken down chemically into simpler substances, "building blocks" of nature.

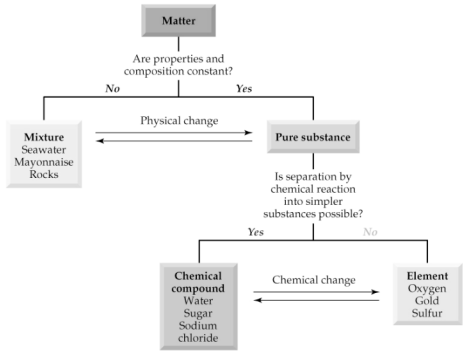
Hydrogen, oxygen, and nitrogen are example of elements.

Chemical Compounds can be broken down into elements or other compounds.

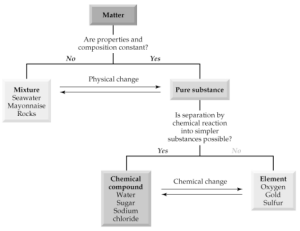
Water is a chemical compound since it can be broken down into hydrogen and oxygen.

Chemistry 104 Chapter One PowerPoint Notes

The classification of matter scheme:



Test yourself:



pizza ☐

Coke ☐

water ☐

silicon ☐

iron ☐

rust ☐

An Example of a Chemical Reaction

When the element nickel, a solid metal, is mixed with a colorless solution of hydrochloric acid in a test tube, the nickel is slowly eaten away, the colorless solution turns green, and a colorless gas bubbles out of the test tube.

$Ni_{(s)} + 2\ HCl_{(aq)} \rightarrow NiCl_{2(aq)} + H_{2(g)}$

Note *states of matter*

Chemical Elements and Symbols

Approximately 113 Elements are known.

Only 90 of these elements occur naturally, remaining elements synthesized in lab.

Some familiar elements are iron, tin, carbon, oxygen, hydrogen, sulfur, etc.

Some unfamiliar elements are niobium, rhodium, thulium, californium, etc.

Chemistry 104 Chapter One PowerPoint Notes

Chemical Symbols

Each element has its own unique *symbol*.

One or *two* letter symbols are used to represent elements.

First letter is always *capitalized* and the second letter is always a *lower case*.

Some symbols came from elements' modern names such as 'H' for hydrogen, 'O' for oxygen, 'N' for nitrogen, etc.

Chemical Symbols

A few symbols for elements from their *Latin* names. *Example:* 'Na' for sodium from Latin *Natrium*.

Naturally occurring elements are not equally abundant. Oxygen and silicon together: 75% of earth's crust.

Chemical Formula: A notation for a chemical compound using element symbols and subscripts to show how many atoms of each element are present.

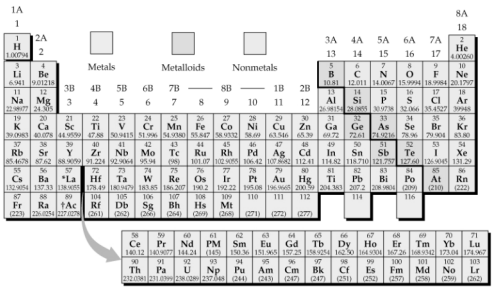
The formula for water is H_2O.

H_2O indicates that two hydrogens and one oxygen combined together to produce water.

Every formula described similarly

H_2O	CH_4	$C_{12}H_{22}O_{11}$
2 H atoms 1 O atom	1 C atom 4 H atoms	12 C atoms 22 H atoms 11 O atoms

Elements and the Periodic Table



Metals, nonmetals, and metalloids appear in distinct places on the periodic table

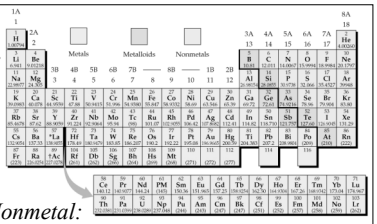
Chemistry 104 Chapter One PowerPoint Notes

Metals (left side)
- Solids at room temperature (except Hg)
- Good conductor of heat & electricity
- Malleable, give up electrons

Nonmetals (right side)
- Eleven gases, five solids, one liquid (Br)
- Like to absorb electrons generally

Metalloids (between)
- Properties between metals and nonmetals
- Used in semi-conductors

Test yourself:



Metal, Metalloid or Nonmetal:

Li

Au

Si

Se

Cl

Ne

End of Chapter 1

To review and study for Chapter 1, look at the "Concepts to Remember" at the end of Chapter One