Ch. 1 Notes – INTRODUCTION TO CHEMISTRY

NOTE: Vocabulary terms are in **boldface and underlined**. Supporting details are in *italics.*

I. Chemistry

A. Why study chemistry?
Chemistry is the study of everything around us Everything can be connected to chem!

B. What is **chemistry**? some definitions…
1) *the study of matter and its changes*
2) a science that deals with the composition, structure, and properties of substances and their transformations
3) scientific study of matter, its properties, and interactions with other matter and energy
   - **substance** – matter with a definite composition (elements, compounds, etc.)

C. Some *branches of chemistry*
1) *Analytical* – chemical composition
2) *Astrochemistry* – of the cosmos (planetary atmospheres, comets, etc.)
3) *Biochemistry* – rxns. (reactions) of living organisms
4) *Environmental* – environmental issues: pollution, water quality, etc.
   ~ Ozone (O_3) vs. oxygen gas (O_2) ~ Chlorofluorocarbons (CFCs)
5) *Food and Cooking* – reactions during cooking, ingredients, etc.
6) *Geochemistry* – geological issues; petrology, etc.
7) *Inorganic* – focuses on inorganic compounds (without carbon)
8) *Nuclear* – focuses on rxns. changing of matter to energy
9) *Organic* – focuses on carbon compounds
10) *Physical* – physical characteristics and reaction mechanisms
11) *Thermochemistry* – thermodynamics; heat changes

II. Chemistry and Matter

A. Mass and weight
1) **matter**—*a substance that takes up space and has mass*
2) **mass**—*the amount of matter in an object*
3) *properties of matter—characteristics and behavior; can be physical or chemical*
4) **weight –** *Earth's gravitational pull on an object*

B. Structure and observable characteristics
1) *macroscopic view*—matter large enough to be seen
2) *submicroscopic view*—dealing with atoms
3) scientific **model**—a visual, verbal, or math explanation of data; helps you understand the relationship between macroscopic and submicroscopic views

---

III. Scientific Methods

A. A systematic approach to the process of learning
1) **scientific method**
   a) *systematic plan for testing ideas*
   b) *an organized way to solve problems*
2) **observation**—*gathering and recording information*
   a) *direct observation—made with the senses* (sight, sound, smell, touch, hearing)
   "It is hot in here."

b) *indirect observation—made with measuring instruments* (thermometers, rulers, scales, clocks, etc.) "It is 83° in the room."
c) **qualitative data**—*verbal*, not numerical, *description* (rough, bright, red...)
d) **quantitative data** —*description by numbers* (10 lbs., 98.6°, 5'4" tall…)

3) **hypothesis**
   a) *educated guess; testable prediction/explanation*
   b) can be accepted or rejected, not proven
   c) many are made initially; most likely ones are chosen to pursue

4) experimental and control setups
   a) **experiment**—*a controlled test of a hypothesis*
   b) **experimental group**—*the variable being tested is present in this group*
   c) **control group**— *the variable being tested is absent from this group*

5) **variables**
   a) *anything affecting the outcome of the experiment*
   b) examples: temperature, air quality, amount of light, humidity
   c) *only one can be tested at a time for the experiment to be valid*
   d) **independent variable**
      - *changed by the experimenter*
      - abscissa: x axis
   e) **dependent variable**
      - *changes based on what the independent variable does*
      - ordinate: y axis

6) **conclusion**—*a judgment based on information gathered during an experiment*
7) What happens next? More research!
   a) review the existing literature
   b) experimental results are shared with other scientists
   c) repeat experiments to see if results are consistent

8) **theory**
   a) *repeatedly and thoroughly tested and supported explanation*
   b) *long description which tells why*
   c) *can never be proven*

The layman's definition of theory is incorrect! ("I have a theory why they aren't talking to me.")
Theories are not guesses, nor are they wild ideas.
Real theories have substantial scientific evidence behind them.

9) **scientific law**
   a) *concise statement which tells what*
   b) *can be proven*

If a question asks for *lab design***,** include the following:

a. Your *hypothesis* and/or predictions/expected results
b. The *independent variable* - what treatments will you apply
c. The **dependent variable** - what will you measure
d. The **variables to be controlled** (very important)
e. The **organism/materials/apparatus to be used**
f. Describe what you will **actually do**
g. Describe how you will actually **take and record data**

h. Describe how the data will be **graphed and analyzed**
i. State how you will draw **a conclusion** (compare results to hypothesis and predictions)

Note: Your experimental design **needs to be at least theoretically possible** and it is very important that your conclusions/predictions be consistent with the principles involved and with the way you set up the experiment.

IV. Scientific research
- A. **Pure research**—investigation for the sake of knowledge
- B. **Applied research**—investigation to solve a specific problem