

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 (O₃) vs. oxygen gas (O₂) ~ 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

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- 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

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- 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