Chem 139-03 Spring 2019

# Unit 1

Please note that in the event of school closure, our course content will continue following this Unit Syllabus supplemented by required information from Canvas.

Textbook issues: You have several choices for textbook access:

> You may purchase new or used (if available) through the Bookstore. You may purchase from an outside source. You may purchase an electronic book through the publisher (Cengage) in its entirety or on an "echapter" basis. A copy of the text is on 2-hour reserve at the Library.

The outcomes below are the learning outcomes for Unit 1 and the content for the exam. These are transcribed from the text sections' "Goals," unless marked by an asterisk:

*This is an outcome covered in the text, but not stated in the chapter's "Goal" section.

**This is an outcome not in the textbook.

## Apr-1 Outcomes

1. **To understand the course outcomes and processes described in the Syllabus and Chapter 1.
2. Identify and explain the differences among observations of matter at various "levels".
3. Define the term *model* as it is used in Chemistry to represent pieces of matter too small to see.
4. *To use chemical symbols as components of models.
5. Identify and explain the differences among gases, liquids and solids in terms of visible properties, distance between particles, and particle movement.
6. Distinguish between physical and chemical properties at both the particulate level and the macroscopic level.
7. Distinguish between a pure substance and a mixture at both the macroscopic level and the particulate level.
8. *To distinguish between and use the terms homogeneous and heterogeneous mixtures and give examples of processes for their separation.

Assignments:

Reading Assignment: Skim Chapter 1. Read §2.1 through 2.5

Suggested problems: Chapter-end blue-numbered problems 1 – 35 (select a few from each section)

## Apr-3 Outcomes

1. Distinguish between elements and compounds.
2. Distinguish between elemental symbols and the formulas of chemical compounds.
3. Distinguish between atoms and molecules.
4. *To refer to the Periodic Table as a source of element symbols and begin learning names and symbols.
5. *To describe the information that a chemical equation communicates.
6. Distinguish between reactants and products in a chemical equation.
7. Distinguish between exothermic and endothermic changes.
8. Distinguish between potential and kinetic energy and *give examples of how this energy is contained within molecules.
9. State the meaning of, or draw conclusions based on the Laws of Conservation of Mass and Conservation of Energy, and *describe when the laws are <u>not</u> followed.

Reading Assignment: Read §2.6 through 2.9

Suggested problems: Chapter-end blue-numbered problems 37 – 63 (select a few from each section)

Prepared problems: Start next class.

## Apr-5 Outcomes

1. *To review the use of the metric system and the SI system of units.
2. Write in scientific notation a number given in ordinary decimal form; write in ordinary decimal form a number given in exponential notation.
3. Use a calculator to add, subtract, multiply, and divide numbers expressed in scientific notation. *Without a calculator, convert powers of 10 by moving a decimal point.
4. Convert an equivalency into two conversion factors.
5. **Relate conversion factors to proportionalities, how they are related to mathematical identities, and when they are <u>not</u> appropriate for problem-solving.
6. Learn and apply an algorithm for using conversion factors to solve quantitative problems.
7. Explain why the metric system of measurement is used in the sciences.
8. Distinguish between mass and weight.
9. Identify the metric units of mass, length, and volume, and use the prefixes micro-, milli-, centi-, and kilo *from memory to modify the base unit.
10. Given conversion factors or equalities, convert between other metric units.
11. *To know there are limits to the information in measured quantities, and describe how this introduces "uncertainty" in any measured quantity.
12. **To know when quantities, as integers or definitions, are exact and free of uncertainty.

Assignments:

Read §3.1 – 3.5

Prepared Problems: Chapter-end problems, due at start of class for peer-group review and discussion: Ch. 2, #5, 12, 22, 32, 40, 42, 54, 56

## Apr-8 Outcomes

1. *Describe the relationship between a measurement-based uncertainty and "significant figures."
2. State the number of significant figures in a given quantity *based on its ± value, and communicate certain and uncertain digits.
3. *Use the way a measured quantity is written to reveal significant figures and estimated uncertainty. **To describe the number and its ± value as a "confidence interval."
4. *To distinguish between significant figures and decimal places.
5. Round off given numbers to a specified number of significant figures.
6. Add or subtract quantities and express the result in the proper number of significant figures.
7. **Apply and interpret significant figure issues when using scientific notation.
8. Multiply or divide given measurements and express the result in the proper number of significant figures, *recognizing that this rule differs from addition and subtraction.
9. Given a metric-USCS conversion factor and a quantity, express that quantity in either unit system.
10. To prepare for lab on 4/10. Be sure to confirm location.

Assignments:

Read §3.6 – 3.8 and supplement on Significant Figures

Prepared Problems: Chapter 2, #78; Chapter 3, #2, 4, 10, 18, 24, 46, 48

## Apr-10 Outcomes

1. Given a temperature in either Celsius or Fahrenheit degrees, convert to the other scale.
2. Given a temperature in Celsius degrees or kelvins, convert it to the other scale.
3. *To recognize these conversions as derived from linear functions (**and graphs) so that proportional conversion factors cannot be used.
4. Write a mathematical expression indicating that one quantity is directly proportional to another quantity.
5. Use a proportionality constant to convert a proportionality to an equation.

6. Given the values of two quantities that are directly proportional to each other, calculate the proportionality constant, including its units.
7. Write the defining equation for a proportionality constant and identify the units in which it might be expressed; *interpret this equation as a straight-line graph with a zero intercept.
8. Given two of the following for a sample of a pure substance, calculate the third: mass, volume, and density.
9. *Use conversion factors and dimensional analysis as a guide to problem-solving tactics.
10. *Construct conversion factors from known experimental relationships.
11. To review content from lab and report expectations.

Assignments:

Read §3.9 – 3.11

Prepared Problems: Chapter 3, #52, 54, 56, 62, 64, 70, 78

## Apr-12 Outcomes

1. Identify the main features of Dalton's Atomic Theory.
2. State the meaning of, or draw conclusions based on, the Law of Multiple Proportions.
3. Identify the three major subatomic particles by symbol, charge, and approximate atomic mass, expressed in atomic mass units.
4. Describe and/or interpret the Rutherford scattering experiments and the nuclear model of the atom.
5. Explain what isotopes are and how they differ from each other.
6. For an isotope whose chemical symbol is known, given one of the following, state the other two: (a) nuclear symbol, (b) number of protons and neutrons, (c) atomic number and mass number.
7. Identify the features of Dalton's atomic theory that are no longer considered valid, and explain why.
8. Define and use the atomic mass unit (u).
9. (Section 5.5, goal #10 is not required.)

Assignments:

Read §5.1 – 5.5

Prepared Problems: Chapter 3, # 86, 94, 100, and supplemental problems (a) and (b):

a) A density determination of an object was made using a graduated cylinder and a balance. The volume was determined to by 12.2 mL and the mass of the object was 72.458 g. Determine the density and express the answer using correct significant figures.

b) Two co-workers determined the density and obtained values of 5.9281 and 5.9263 g/mL but without rounding for significant figures. Use the three densities (yours and theirs) to determine (i) the average density, (ii) the uncertainty as an average deviation, (iii) the confidence interval with significant figures correctly applied.

## Apr-15 Laboratory Outcomes

1. To practice taking measurements of mass and volume, and assigning errors.
2. **To distinguish and convert absolute vs. relative errors; to be able to calculate percent error from absolute error and relative error.
3. **To solve problems involving averaging and calculating average deviations.
4. To solve problems of density.

Please confirm lab location before class time. Safety goggles are required and will be provided for you.

Reading Assignment: Handout: Measurement

Prelaboratory Assignment: Page 5 of Experiment handout, turn in at the start of lab.

Report due: At start of class, 4/19.

## Apr-17 Outcomes

1. Distinguish between groups and periods of the periodic table and identify them by number. *Know the difference between IUPAC and traditional numbers for groups.
2. **Memorize the traditional group names alkali metals, halogens, noble gases and match them to group number.
3. Given the atomic number of an element, use a periodic table to find the symbol and atomic mass of that element, and identify the period and group in which it is found.
4. Given the elemental symbol or information from which it can be identified, classify the element as either a main group or transition element and either a metal or nonmetal.
5. **Given the name or symbol of an alkali metal, halogen, nitrogen, or oxygen, provide the other from memory.
6. **To recognize that while the names of chemicals can be assigned by formal rules, communication often uses generic and traditional names.
7. *To have memorized seven diatomic element formulas and names (section 6.2).
8. Given the name or formula of a binary molecular compound, write the other.
9. Given the name or formula of water, write the other;
10. Given the name or formula of ammonia, write the other.

Assignments:
Read §5.6 – 5.7 and 6.1 to 6.3
Prepared Problems: Chapter 5, #2, 6, 14, 18, 22

## Apr-19 Outcomes

1. *To recognize ions as atoms (or groups of atoms) that are charged by virtue of extra or fewer electrons.
2. **Given the name or symbol of a monatomic ion of an alkali metal, halogen, nitrogen, or oxygen, provide the other from memory.
3. *To assign +2 charges to all group 2 monatomic ions; to expect variable positive charges for monatomic transition metal ions and some main group cations.
4. *Be able to write and name ions derived from the following acids: $HC_2H_3O_2$, $H_2CO_3$, $HNO_3$, $H_3PO_4$, $H_2SO_4$, HCl.
5. Given the name of any ionic compound made of ions from the above outcomes, or other ions whose formulas are given, write the formula of the compound, and the reverse.

Assignments:
Read §6.4, 6.5 – 6.7 (only acids/ions in outcome #4 above), 6.8 – 6.10
Lab report (due at start of class): pp. 1 – 4 of the experiment handout.
Graded Homework (due at start of class):
Chapter 2, #42; Chapter 3, #12, 44, 66; Chapter 5, #26 (first 3 rows), 48; Chapter 6, #12, 30, 50

## Apr-22 Outcomes

1. To assess and review what we have learned, and practice problem solving.
2. Complete a graded, collaborative Group Sheet.

Assignments:
Prepared Problems: Ch.6, #12, 16, 34, 36 (see p. 164); Skill Development exercises from class.
Pick up Unit 2.

## Apr-24 Outcomes

Success on an examination! Closed book, closed notes. Content and outcomes from Unit 1.