# CHEM 112.02 Introductory Chemistry II Fall 2023

#### **INSTRUCTOR**

Michael S. Elioff, PhD office: Caputo Hall 320 phone: 717-871-7417 email: michael.elioff@millersville.edu

#### **OFFICE HOURS**

Tuesdays: 10:45 am – 1:00 pm; CAPUTO 320 Wednesdays: 1:30 pm – 2:00 pm; CAPUTO 320 Thursdays: 10:45 am – 1:00 pm; CAPUTO 320

# LECTURES

Tuesdays & Thursdays 9:25 – 10:40 am 149 Roddy Hall

#### **RECITATION & LABORATORY**

A: Wednesday 9:00 – 9:50 am RODDY 153; 10:00 – 10:50 am CAPUTO 332

B: Wednesday 2:00 - 2:50 pm CAPUTO 211; 3:00 - 4:50 pm CAPUTO 332

#### **COURSE TEXTBOOK**

*Chemistry*, 10<sup>th</sup> edition, by Steven S. Zumdahl, Susan A. Zumdahl, and Donald J. LaCoste; Brooks/Cole publishers, 2016; ISBN-13: 978-1305957404

#### LABORATORY MANUAL

No purchase will be required. Instructions for laboratory exercises have been posted to the Desire2Learn website. Print them out and read them before lab.

#### SUPPLEMENTAL MATERIAL

Photocopied handouts may be provided when appropriate. Calculator with root function, logs, and antilogs will be required for exams and homework. Some cheap calculators that work well are the Casio FX250HC, the Sharp 501WBBL, and the Texas Instruments TI30X. All these calculators are available for less than ten dollars. *Required for lab:* Safety goggles and shoes.

## **COURSE CONTENT:**

Chemistry has been called the most "central" science since topics discussed in chemistry find relevance in biology, physics, medicine, law, economics, ecology, materials science, environmental studies, and geology. Chemistry is the study of matter, and matter is anything that takes up space and has non-zero rest mass. Therefore, chemical understanding is central to scientific wisdom. In CHEM 111, we defined chemistry, distinguished between chemical and physical processes, and introduce some simple chemical concepts. This semester we will continue to examine important concepts in chemistry. We will consider kinetics and equilibrium, and we will study acid-base chemistry in greater detail. At Millersville University the two semesters of freshman chemistry are numbered CHEM 111 and CHEM 112. The general outline of coverage for each semester is:

# **CHEM 111**

- Chapter 1: Chemical foundations
- Chapter 2: Atoms, molecules, and ions
- Chapter 3: Stoichiometry
- Chapter 4: Chemical reactions & solution chemistry
- Chapter 5: Gases & gas laws
- Chapter 6: Thermochemistry
- Chapter 7: Periodicity & electronic structure
- Chapter 8: Bonding: general concepts
- Chapter 9: Bonding: orbitals
- Chapter 10: Liquids and solids
- Chapter 11: Solutions

# **CHEM 112**

- Chapter 12: Chemical kinetics
- Chapter 19: Nuclear chemistry
- Chapter 13: Chemical equilibrium
- Chapter 14: Acid-base chemistry
- Chapter 15: Equilibria in acid-base solutions
- Chapter 16: Solubility and precipitation equilibria
- Chapter 17: Thermodynamic Spontaneity
- Chapter 18: Electrochemistry
- Chapter 20: Representative elements
- Chapter 21: Chemistry of transition metals (as time permits)

# **COURSE OBJECTIVES**

1. To introduce to the student the principles, laws, and theories of chemistry.

2. To provide the student with a theoretical and empirical understanding of the principles, laws and theories of chemistry.

3. To develop in the student the ability to think critically and to solve quantitative chemical problems and to promote original thought on the part of the student and encourage the use of logic in the solution of problems.

4. To develop an ability in the student to learn and work independently as well as learning and working with a team of peers.

5. To illustrate, in a laboratory setting, the fundamental laws of chemistry.

6. To develop in the student an appreciation for laboratory safety and environmental sensitivity.

#### GRADING

Grading will be as follows: A 1000-point scale will be used to determine the final grade. The lecture portion of the course is worth 75% of the overall grade and the lab portion is worth 25%. For the lecture portion of the course, there will be four regular examinations, each worth 10% of your overall course grade. The final exam will be worth 20% of your overall grade. Additionally, there will be on-line assessments in the Desire2Learn environment which will be worth 15% of the overall grade.

In the lab portion of the course, experimental results (ten data sheets which are multipage *Reports* from the lab handouts) will be worth 18 points each, except for the last two, which are 17 points each. Quizzes will be worth 10 points each. Using this simple 1000-point scale you should be able to assess your performance at any point during the semester.

The maximum possible points are as follows:

Exam 1 100 Exam 2 100 Exam 3 100 - Lecture: 750 points Exam 4 100 Final Exam 200 On-line/in-class components 150. Data sheets (9) 160 Lab: 250 points Ouizzes (9)

#### Total

1000 points

900 guarantees at least an A-800 guarantees at least a B-700 guarantees at least a C-600 guarantees at least a D-

#### EXAMINATIONS

All examinations will count toward the course grade and it is expected that students will take all of the examinations at their regularly scheduled times. If you miss an exam without a valid excuse you will receive a score of zero. With a valid excuse, you may be allowed a special make-up exam in some circumstances, but I cannot guarantee that it will be equally difficult as the regular exam.

## HOMEWORK

Approximately ten problem sets will be suggested. Their completion is optional, and they will not be graded or returned if submitted, but you are advised to attempt at least one of each type of problem suggested as preparation for the course examinations. Suggested homework problems will be posted on the Desire2Learn on-line course soon after the semester begins and will remain posted until the end of the course. We will have time during the recitation period to work some of these problems together.

## **ON-LINE COMPONENTS**

Approximately ten assessments will be administered using the Desire2Learn learning management system. Be sure to follow all instructions for submitting assessments. Be sure to visit <u>https://wiki.millersville.edu/display/d2ldocs/Home</u> very soon after the first class meeting. It is the responsibility of the student to stay abreast of the due dates.

#### LABWORK

**Data Sheets (Reports):** Your completed data sheets are due at the end of each class. All data sheets are graded on a ten-point basis. You will be graded on the precision of your answers and how completely you answer the questions.

# INSTRUCTIONS FOR LABORATORY EXERCISES

Please arrive on time, as you will not be given extra time to finish the experiment beyond the designated time. *Please read the experiment before coming to lab.* You will have an idea about what to expect in the laboratory and you will feel more comfortable with the experiment. It is never a good idea to read the experiment, for the first time, as you are performing the laboratory exercise. Prepare for the lab before you come to the lab. Take a moment to write down the purpose of the experiment, look over any tables you might need, and answer prelab questions. Data sheets with complete calculations are due at the conclusion of each lab. It is expected that all students will complete all laboratory exercises, and all labs will count toward the final lab grade as described above.

#### ATTENDANCE

General chemistry concepts require a mathematical framework for their presentation. Concepts are cumulative in the sense that the student must master introductory concepts and derivations in order to fully understand more advanced topics in general chemistry. We will continue to build upon material mastered earlier, hence poor attendance will affect your class grade. *Attendance is necessary in all lab meetings. If you cannot attend lab, due to illness or other emergency, you must contact me before the class period, or as soon thereafter as possible.* The last day to drop this course without penalty is April 3. See http://www.millersville.edu/registrar/academic-calendar/ for important dates.

#### **DISABILITY STATEMENT**

It is the responsibility of students who have professionally diagnosed disabilities to notify the instructor so that appropriate modifications can be made to meet any special learning needs. Specific questions should be directed to the Office of Learning Services, at 717-871-5554.

#### ACADEMIC DISHONESTY

Academic dishonesty includes unfairly advancing one's own academic performance or the performance of another, as well as intentionally limiting the academic performance of another student. Penalties for academic dishonesty will depend on the situation, ranging from a zero grade for the exam or assignment, to course failure. Your university's accreditation is based, in part, on academic standards of excellence. Academic dishonesty will devalue your degree.

# Fall 2023 Tentative Examination Schedule (subject to change):

Day	Date	Topic
Thurs.	September 14	Chapters 12, 13, and 19
Thurs.	October 5	Chapters 14 and 15
Thurs.	November 2	Chapters 16 and 17
Thurs.	November 23	Chapters 18 and 20

Final exam over chapters 12-21: Wednesday, December 6, 2:45 – 4:45 pm

# Fall 2023 Tentative Lab Schedule:

Dates given are all Wednesdays.

August 23 – Discuss laboratory safety. Check into lockers. Lab 1: Kinetics Part A. (See Exp. 15, pages 133 – 136 of laboratory manual.)

August 30 – Kinetics Part B. See above. Q1

September 6 – Le Châtelier's principle in equilibrium (Exp. 14, pp. 127 – 130). Q2

**September 13** – Qualitative analysis, Unknown I (Exp. 33/34, pp. 281 – 290 & 291 – 298). Q3

September 20 – Qualitative analysis, Unknown I, continued. (Exp. 35, pp. 299 – 308).

**September 27** – Qualitative analysis, Unknown II (Exp. 36, 2 from group IV, pp. 309 – 318). Q4

**October 4** – Qualitative analysis, Unknown II, continued (Exp. 37, 1 from group V, pp. 319 – 324).

**October 11** – University holiday. No labs this week.

**October 18** – Titration curves and ionization constant determination of a weak acid (Exp. 19, pp. 169 - 173). Q5

October 25 – Qualitative analysis, Unknown III, (Exp. 38, pp. 325 – 332). Q6

**November 1** – Qualitative analysis, Unknown III, continued

**November 8** – Buffer systems (Exp. 20, pp. 179 – 185). Q7

**November 15** – Electrolysis (Exp. 24, pp. 209 – 211), also complete previous experiment. Q8

November 22 – University holiday. No labs this week.

November 29 – Investigation of Voltaic Cells (Exp. 25, pp. 217 – 226). Q9

**December 6** – Final exam week. No labs this week.