

Bergen Community College
Division of Mathematics, Science and Technology
Department of Physical Sciences

Course Syllabus
CHM 100 Introduction to Chemistry

Semester and year:
Course Number:
Meeting Times and Locations:

Instructor:
Office Location:
Phone:
Office Hours:
Email Address:

COURSE DESCRIPTION:

CHM 100 Introduction to Chemistry is designed to give the non-science major an awareness and an understanding of the fundamental concepts of modern chemistry. Topics include measurement, atomic theory, chemical bonding, the Periodic Table, chemical reactions, and stoichiometry. The course includes a writing and communications requirement that relates the topics covered to a broad historical, social, and cultural context.

CREDITS/HOURS: 4 credits/6 hours

PREREQUISITES: MAT 011 or a passing score on the Basic Skills Exam.

GENERAL EDUCATION COURSE: Yes

STUDENT LEARNING OBJECTIVES: As a result of meeting the requirements for this course, students will be able to:

1. Use Metric Units.
2. Utilize the Factor Label Method to solve problems.
3. Identify and name acids bases, salts, and other simple inorganic substances.
4. Write and understand Chemical Equations.
5. Solve chemical word problems.
6. Solve stoichiometry problems.
7. Use the scientific method of inquiry to understand how historically important experiments which employed the scientific method led to current knowledge of atomic structure.
8. Explain the basic concepts of chemical bonding.
9. Explain how modern chemical theories of atomic structure and chemical bonding can be used to propose the properties of substances encountered in everyday life in accordance with the scientific method.
10. Know and follow the rules for working safely in a chemical laboratory.
11. Demonstrate the ability to use balances, pipets, graduated cylinders, and other basic laboratory measuring equipment.
12. Demonstrate the ability to analyze data collected from using the gravity filtration procedure and proposing hypothesis regarding the results

13. Use the scientific method of inquiry to demonstrate the ability to collect data, perform calculations, and propose hypothesis in accordance with the aforementioned methodology.
14. Define and use technical terms used in Chemistry.

ASSESSMENT MEASURES:

The student learning objectives will be assessed by:

1. Assigned homework from the textbook. (optional)
2. Unit Examinations, which will include problems, definitions, and one essay.
3. Comprehensive Final Examination which will include problems, definitions, and one essay.
4. Quizzes. (optional)
5. Problem sets. (optional)
6. Laboratory reports.
7. Pre-laboratory assignments.
8. Other writing assignments.

At the discretion of the individual instructor, assessment measures may be somewhat modified.

TEXTBOOK: Basic Chemistry, 5^h Edition, Timberlake and Timberlake Pearson, Benjamin Cummings, 2017. ISBN: 13:978-0-12-413804-6

LABORATORY MANUAL:

College Publication

COURSE CONTENT (Lecture):

- Chapter 1: Chemistry in Our Lives
- Learning Chemistry
 - Elements & Compounds
 - States of Matter
 - Physical & Chemical Changes
 - Scientific Method
- Chapter 2: Measurements
- Exact Numbers & Measurements
 - Units of Measurement
 - Scientific Notation, Significant Figures & Calculations
 - Conversion Factors
 - Dimensional Analysis Problems
 - Density Problems
- Chapter 3: Matter & Energy
- Classification & States
 - Temperature & Energy
 - Specific Heat
- Chapter 4: Atoms and Elements
- Elements & Atoms
 - Mendeleev's Law & Periodicity
 - Periodic Table
 - Atom & its Structure

- Chapter 5: Electronic Structure and Periodic Trends
- Electromagnetic Radiation
 - Spectra & Energy Levels
 - Shells & Sublevels & Orbitals
 - Electron Configuration
 - Periodic Trends
- Chapter 6: Ionic and Molecular Bonding
- Types of Bonds
 - Lewis Dot Structures
 - Electronegativity
 - Nomenclature
- Chapter 10: Properties of Solids & Liquids (The Shape of Molecules)
- Electron Dot Formula
 - VSEPR Theory & Molecules
 - Electronegativity & Molecular Polarity
 - Intermolecular Forces
 - Changes of State
- Chapter 7: Chemical Quantities
- Mole and Formula Weight
 - Gram to Gram Conversions
 - Mass % Composition
 - Empirical Formula
- Chapter 8: Chemical Reactions
- Balancing Equations
 - Five Types of Reactions
- Chapter 9: Chemical Quantities in Reactions
- Mole to Mole and Formula Weight
 - Gram to Gram Conversions
 - Limiting Reagents - Optional
 - %, Yields (Theoretical, and Actual)
 - Energy Calculations & Chemical Reactions
- Chapter 12: Solutions
- Definition of Solutions
 - Electrolytes
 - Solubility
 - Molarity
 - Solution Problems
 - Colligative Properties – skip
 - Osmosis – skip
- Chapter 13: Reaction Rates & Chemical Equilibrium
- Exothermic & Endothermic
 - ΔE_{rxn}
 - Reaction Coordinate Chart
 - Activation Energy

- Chapter 14: Acids, & Bases
- Acids and Bases
 - (Strong & Weak)
 - pH
 - Buffers

- Chapter 15: Oxidation and Reduction
- Oxidation Numbers / States
 - Oxidation & Reduction
 - Batteries and Galvanic Cells
 - EMF Series
 - Preventing Rust

SKIP: Gases, Nuclear Chemistry, Organic Chemistry, & Biochemistry Chapters

COURSE CONTENT (Laboratory):

Check-in & Experiment 1.

- Safety: Laboratory Safety
- Departmental Safety Rules.
- Introduction to the Use of Laboratory
- Laboratory Report Writing.
- Equipment
- Math Review
- Significant Figures.
- Use of Unit Conversion Factors
- Metric System & Measurements

Experiment 2: Physical & Chemical Changes

- To observe physical & chemical changes
- To identify physical & chemical changes

Experiment 3: Density Determination

- To recognize that density is an intensive property and is independent of the amount of sample used.
- To recognize that the volume of an object can be determined by the volume of the water it can displace.
- To determine the density of a mixture and recognize its density is between the density of the constituents forming the mixture.

Experiment 4: Specific Heat of Metal

- To practice the concept of conservation of energy
- To demonstrate that heat flows from the hot object to the cold object
- To demonstrate that metals are good conductors of heat because of their low specific heats.

Experiment 5: Flame Test and Chemical Fingerprinting

- To demonstrate the characteristic colors produced by metals vaporized in a flame.
- To identify unknown metallic ions by means of their characteristic flame color.
- To validate that elements which belong to the same group on the periodic table possess similar properties

Experiment 12: Paper Chromatography

- To practice the technique of paper chromatography
- To separate mixtures of substances in a qualitative manner
- To use intermolecular force as a means of chemical resolution.

Experiment 6: Lewis Dot Structure & VSEPR

- To compose Lewis Structures for the variously bonded covalently bonded molecules.
- To use model kits to construct the molecules/ions for the purpose of exploring their structures & shapes.
- To predict molecular shapes using VSEPR Rules

Experiment 7: Qualitative Analysis of Anions

- To test the solubility of a set of anions in solutions.
- To use litmus paper, a centrifuge, and a dropper in the laboratory

Experiment 8: Water of Hydration

- To use evaporation techniques to explore the % composition property

Experiment 10 Empirical Formula

- To synthesize an oxidized metal by adding heating.
- To determine the empirical formula of a compound based upon its % composition by weight.

Experiment 9: Types of Chemical Reactions

- To classify reactions based upon observed changes.
- To identify the type chemical reaction.
- To predict products of a chemical reaction.

Experiment 11: Percent Yield of a Chemical Reaction.

- To determine the theoretical yield from a double replacement reaction
- To determine the percent yield from a chemical reaction
- To determine the limiting (& excess) reactant in a chemical reaction (optional)

Experiment 14: Solutions and pH

- To practice preparing an aqueous solution.
- To practice diluting aqueous solutions
- To measure the pH of an aqueous solution

Experiment 13: Oxidation Reduction

- To practice calculating the oxidation number of various elements in a compound.
- To demonstrate predict reactivity based upon the activity series.
- Balance redox reactions (optional)

SUPPLEMENTARY READINGS / MATERIALS:

Tro, Nialdo, Introductory Chemistry, Pearson/ Prentice Hall

Zumdahl and DeCoste, Introductory Chemistry: A Foundation, Brooks/Cole

The McGraw-Hill Dictionary of Chemistry, McGraw-Hill, 2203

OTHER REQUIREMENTS:

A calculator is required. Calculators attached to cellular telephones may not be used during exams. Any student who has a cellular telephone accessible during an exam will be considered to be engaged in academic dishonesty.

ASSESSMENT MEASURES:

Assigned homework problems from the textbook	not more than 5%
Quizzes	not more than 15%
Class participation	not more than 5%
Unit Examinations (3 or 4)	50-65%
Laboratory work	20-25%
Final Examination (Comprehensive)	10-20%
Writing assignment	not more than 5%

GENERAL GRADING POLICY:

1. A missed exam will result in a grade of zero for the exam. Make-up examinations will be administered according to the instructor's grading policy. Alternately, the instructor may provide for substitution of the student's final examination grade for the grade on a missed exam.
2. Academic dishonesty on the part of the student will result in a grade of zero on the given paper, quiz, or examination. A grade of zero resulting from academic dishonesty will not be replaced, or omitted, regardless of any other provision in the instructor's grading policy. **The student should read the Bergen Community College statement on academic integrity that is to be found in the college catalog.**
3. At the discretion of the instructor, the grade on the final examination may be substituted for the lowest unit exam grade for the purpose of calculating the course grade provided that the final examination grade is higher than the lowest unit examination grade.
4. A passing grade in the course requires acceptable levels of work in **both** the lecture and the laboratory sections of the course. Acceptable levels of work will mean a score of 60% or greater.
5. A writing assignment will be given unless essay questions are included in the unit examinations. This may involve chemistry topics in the news or the analysis of one or more journal articles. The writing assignment will count **no more** than 5% of the course grade.
6. Laboratory: Students will be required to complete pre-laboratory assignments and laboratory reports for each laboratory class. Laboratory reports will be due at the laboratory session following the one in which the experiment is completed. At the instructor's discretion a late laboratory report may be accepted for a reduced grade. No student will be permitted to submit more than two laboratory reports late during the semester. A missed report counts (grade = 0). Instructor's will make an effort to assist a student in making up a missed laboratory class but the possibility of making up a missed laboratory depends on scheduled classes and space in those classes. The laboratory grade will be based primarily on average of the student's laboratory report grades (90%) and the student's level of completion of the pre-laboratory assignments (10%). The student's laboratory grade will count 20% to 25% of the course grade.
7. Instructors may make small modifications to the General Grading Policy for the course and will give each student a copy of the grading policy for the given section.

INSTRUCTOR'S GRADING POLICY:

Each Instructor will provide a written copy of the grading policy for the given section of the course.

ATTENDANCE/LATENESS POLICY:

All students are expected to attend every meeting of the course punctually. The individual instructor's attendance/lateness policy will be provided, in writing, at the beginning of the course. Attendance will be kept by the instructor for administrative and counseling purposes.

Students who are late to the laboratory class and have missed the instructions, including safety instructions, for the laboratory experiment may be refused permission to perform the experiment.

OTHER POLICIES:

1. The use of portable electronic devices such as pagers and cellular telephones is not permitted while class is in session. Students carrying such devices should silence them before entering the classroom or laboratory.
1. Calculators will be required for the course and students are responsible for bringing a calculator to all quizzes, exams, and laboratory classes. The calculators used for exams cannot be calculators attached to cellular telephones nor can they be graphing calculators. Any student who has a cellular telephone accessible during an exam will be considered to be engaged in academic dishonesty.

STUDENT AND FACULTY SUPPORT SERVICES:

1. Students are encouraged to get assistance with any and all aspects of the course in a **timely** manner.
2. Students should make note of the instructor's office hours and should see the instructor for assistance with understanding concepts or problem solving.
3. *The STEM Learning Center in Room S-315 and the Tutoring Center (L-125) provide student support in chemistry, math and other sciences. The "walk-in" tutorial center in A113 will provide help on specific topics but fuller explanations are available in the Tutorial Center in L-125. Problem sessions on specific topics will be provided. REWRITE.*
4. The BCC library provides extensive support services for student research.
5. A wide variety of services are available to students with documented disabilities. It is highly recommended that students with any manner of documented disabilities contact the Office of Specialized Services (www.bergen.edu/oss).
6. Computer Laboratories on campus have many free-time hours during which students may use the computers for graphing exercises or word-processing

Course Outline and Calendar
CHM 100 Introduction to Chemistry

Week	Topic/Activity/Assignments	Student Learning Objectives
1.	Chapter 1: Chemistry in Our Lives <ul style="list-style-type: none"> • Learning Chemistry • Elements & Compounds • States of Matter • Physical & Chemical Changes • Scientific Method Chapter 2: Measurements <ul style="list-style-type: none"> • Exact Numbers & Measurements • Units of Measurement • Scientific Notation, • Significant Figures & Calculations 	7*, 14, 1, 5, *Using the Scientific Method of Inquiry
2.	Chapter 2: Measurements <ul style="list-style-type: none"> • Conversion Factors • Dimensional Analysis Problems • Density Problems Chapter 3: Matter & Energy <ul style="list-style-type: none"> • Classification & States • Temperature & Energy • Specific Heat 	1, 2, 5, 7*, *Using the Scientific Method of Inquiry
3.	<u>Review</u> <u>Test 1</u>	
4.	Chapter 4: Atoms and Elements <ul style="list-style-type: none"> • Elements & Atoms • Mendeleev's Law & Periodicity • Periodic Table • Atom & its Structure Chapter 5: Electronic Structure and Periodic Trends <ul style="list-style-type: none"> • Electromagnetic Radiation • Spectra & Energy Levels • Shells & Sublevels & Orbitals • Electron Configuration • Periodic Trends 	9 9
5.	Chapter 6: Ionic and Molecular Bonding <ul style="list-style-type: none"> • Types of Bonds • Lewis Dot Structures • Electronegativity • Nomenclature <u>Review</u>	8
6.	<u>Test 2</u> Chapter 10 Properties of Solids & Liquids <ul style="list-style-type: none"> • Electron Dot Formula VSEPR Theory & Molecules • Electronegativity & Molecular Polarity 	5, 7*, 8, 9 *Using the Scientific Method of Inquiry
7.	Chapter 10 Properties of Solids & Liquids <ul style="list-style-type: none"> • Electronegativity & Molecular Polarity • Intermolecular Forces • Changes of State Chapter 7: Chemical Quantities <ul style="list-style-type: none"> • Mole and Formula Weight 	5, 7*, 8, 9 6

	<ul style="list-style-type: none"> • Gram to Gram Conversions • Mass % Composition • Empirical Formula 	
	Review	*Using the Scientific Method of Inquiry
8.	Test 3 Chapter 8: Chemical Reactions <ul style="list-style-type: none"> • Balancing Equations • Five Types of Reactions 	4, 5
9.	Chapter 9: Chemical Quantities in Reactions <ul style="list-style-type: none"> • Mole to Mole and Formula Weight • Gram to Gram Conversion • Limiting Reagents - Optional • %, Yields (Theoretical, and Actual) • Energy Calculations & Chemical Reactions 	6
10.	Chapter 12: Solutions <ul style="list-style-type: none"> • Definition of Solutions • Electrolytes • Solubility • Molarity • Solution Problems • Colligative Properties – skip • Osmosis – skip 	5, 10
	Review	
11.	Test 4 Chapter 13: Reaction Rates & Chemical Equilibrium <ul style="list-style-type: none"> • Exothermic & Endothermic • ΔE_{rxn} • Reaction Coordinate Chart • Activation Energy 	5, 10
12.	Chapter 14: Acids, & Bases <ul style="list-style-type: none"> • Acids and Bases • (Strong & Weak) • pH • Buffers Chapter 15: Oxidation and Reduction <ul style="list-style-type: none"> • Oxidation Numbers / States • Oxidation & Reduction • Batteries and Galvanic Cells • EMF Series • Preventing Rust 	3 4
13.	Review Test 5	
14.	Review Final Exam	
Review sessions can be used for additional instructional time as per the instructor's preference. Quizzes can be substituted for Tests as per the instructor's preference.		

Week	Experiment	Student Learning Objectives
1.	Check-in Safety: Instructor will review department safety rules. Intro to use of lab equipment, Math Review, Exp. 1	10
2.	Exp 2 Physical & Chemical Changes	11, 13*
3.	Exp 3 Density Determination	11, 13*
4.	Exp 4 Specific Heat of Metal	11, 13*
5.	Exp 5 Flame Test and Chemical Fingerprinting	11, 13*
6.	Exp 12 Paper Chromatography	11, 13*
7.	Exp 6 Lewis Dot Structure & VSEPR	11, 13*
8.	Exp 7 Qualitative Analysis of Anions	11, 13*
9.	Exp 10 Empirical Formula	11, 13*
10.	Exp 8 Water of Hydration	11, 13*
11.	Exp 9 Types of Chemical Reactions	11, 13*
12.	Exp 11 Percent Yield of a Chemical Reaction	12, 13*
13.	Exp 14 Solutions and pH	11, 13*
*Using the Scientific Method of Inquiry		

All BCC students enrolled in credit courses are entitled to a WebAdvisor account. With WebAdvisor, you may register online, pay your bill, check your schedule, room assignments, GPA, and find out what courses you need to take. To find out more about WebAdvisor, or to sign up online, visit <http://go.bergen.edu>! While there, please make sure you give us your preferred email address. You'll find directions how to do this at <http://go.bergen.edu/email>. 5/18