

BROOKDALE COMMUNITY COLLEGE

CHEM 101 - GENERAL CHEMISTRY I

5.0 CREDITS

COURSE SYLLABUS

LEARNING PROGRAM

GENERAL CHEMISTRY I (CHEM 101)

COURSE GOAL

The student will study the concepts of inorganic chemistry involving theoretical and laboratory experiences. The four units to be covered are:

1. Introduction, Mathematical Operations, Elements and Compound Composition and Stoichiometry
2. Aqueous Solutions, Atomic Structure and the Periodic Table
3. Bonding and Geometry of Molecules
4. Gases, Liquids, Solids and Solutions

METHOD OF EVALUATION

Formal Testing

PREREQUISITE

CHEM 100 or equivalent; MATH 151

REQUIRED MATERIALS

1. **TEXTBOOK:** Chemistry, by Raymond Chang, 9th Edition, 2007, McGraw-Hill, Inc.
2. **LABORATORY MANUAL:** Laboratory Experiments: Chemistry, The Central Science by John H. Nelson and Kenneth C. Kemp, 10th Edition, 1994, Prentice Hall
3. **SAFETY GOGGLES:** New Jersey State Law requires that all students wear appropriate splash and impact proof safety goggles while performing laboratory experiments. They are available at the College Store.

OPTIONAL MATERIALS

Student Solutions Manual by Brandon J. Cruickshank

DISABILITY SERVICES OFFICE

If you have a documented disability and would like to request accommodations and/or academic adjustments, contact the Disability Services office (732) 224-2730 or TTY (732) 842-4211.

CHEM 101 General Chemistry I

Core Competencies

The following objectives of the **Scientific Perspective**, the **Mathematical Skills Competency**, and the **Critical Thinking, Problem Solving Competency** are taught in this course.

Students will:

- 2.1 Identify a problem and analyze it
- 2.2 Recognize and construct logical forms of argumentation

- 4.1 Be able to analyze, discuss and use quantitative information
- 4.2 Be able to apply algebraic and/or geometric techniques to analyze and solve mathematical problems
- 4.3 Use appropriate problem solving technologies

- 5.1 Develop appropriate skills in observation and experimentation to solve problems
- 5.2 Be able to analyze and interpret scientific data
- 5.3 Be able to evaluate and apply appropriate technology

The course tests, quizzes, labs, and other assignments are used to assess student attainment of these competency objectives within the context of the course curriculum.

In addition, this course reinforces objective 1.1 of the **Communication Skills Competency** that states the student will “communicate information and ideas clearly and effectively in written form.” Students are required to write, using correct English, Mathematical and Chemical symbols, responses to lab and test questions requiring explanations, comparisons, and/or interpretation of results.

CHEM 101 General Chemistry I

Chemistry Department Grading and Testing Policy

GRADING STANDARD:

90 – 100	A
87 – 89.99	B+
80 – 86.99	B
77 - 79.99	C+
70 – 76.99	C
60 – 69.99	D
59 & Below	F

1. The total laboratory grade will be based on an average of fourteen (14) laboratory experiments and an average of six (6) laboratory quizzes given through the semester. The experiment average will make up 80% of the final grade and the quiz average will make up 20% of the final grade.
2. Any missed lab will be averaged in as a zero (0). Students will have the opportunity to make up one (1) missed laboratory experiment during the semester with a valid excuse. There will be time scheduled by the learning assistant in charge of the lab for this purpose.
3. Any missed laboratory quiz will not be made up.

DEPARTMENT POLICIES

Chemistry Laboratory Policies

1. Students must attend their scheduled laboratory section. Students are not allowed to attend any other lab section for any reason.
2. Students must pass both the lecture and the laboratory portion of the course.

COLLEGE POLICIES:

For information regarding:

- ◆ Brookdale's Academic Integrity Code
- ◆ Student Conduct Code
- ◆ Student Grade Appeal Process

Please refer to the **STUDENT HANDBOOK AND BCC CATALOG.**

NOTIFICATION FOR STUDENTS WITH DISABILITIES:

Brookdale Community College offers reasonable accommodations and/or services to persons with disabilities. Students with disabilities who wish to self-identify, must contact the Disabilities Services Office at 732-224-2730 or 732-842-4211 (TTY), provide appropriate documentation of the disability, and request specific accommodations or services. If a student qualifies, reasonable accommodations and/or services, which are appropriate for the college level and are recommended in the documentation, can be approved.

ADDITIONAL SUPPORT/LABS:

Learning assistants are available for help for both lab and lecture. The times of availability are posted at the learning assistants' office. For any additional information, please call the Chemistry Department at 732-224-2424.

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#1 OF 4 UNITS

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credits

CHAPTERS: 1, 2, 3

NAME OF UNIT: Introduction, Mathematical Operations, Elements and Compound Composition, and a Study of Aqueous Reactions

UNIT OBJECTIVE: To acquaint the student with the mathematics necessary to pursue the subject matter of chemistry. To review basic chemical concepts and calculations covered in the prerequisite introductory chemistry course.

Learning Objectives	Recommended Learning Experiences
1. Understand the science of chemistry and the scientific method.	READ: 1.1, 1.2, 1.3 DO: Questions and Problems 1.5, 1.6
2. Distinguish between elements, compounds, and mixtures. Give the symbols for some elements.	READ: 1.4 MEMORIZE: Table 1.1 DO: Questions and Problems: 1.9, 1.13, 1.14, 1.16
3. Distinguish between the three states of matter.	READ: 1.5
4. Distinguish between physical and chemical properties/changes.	READ: 1.6 DO: Questions and Problems 1.11, 1.12
5. List the basic SI units and the common metric prefixes and their meanings.	READ: 1.7 MEMORIZE: Tables 1.2, 1.3 DO: Questions and Problems 1.17, 1.18
6. Perform calculations involving density.	READ: 1.7 DO: Questions and Problems 1.21, 1.22, 1.54, 1.56, 1.57, 1.62
7. Convert temperatures among Fahrenheit, Celsius, and Kelvin scales.	READ: 1.7 DO: Questions and Problems 1.24, 1.26, 1.65
8. Use scientific notation to express numbers.	READ: 1.8 DO: Questions and Problems 1.30, 1.32

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Learning Objectives

Recommended Learning Experiences

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| 17. Be able to determine the formula of an ionic compound based on ion charges determined from the periodic table. | READ: 2.6
DO: Questions and Problems 2.44, 2.90 |
| 18. Write the name of an inorganic compound given its chemical formula and perform the reverse operation. Memorize the name, charge, and formula of each of the polyatomic ions in Table 2.3 | READ: 2.7
MEMORIZE: Table 2.3
DO: Questions and Problems 2.57, 2.58, 2.86 |
| 19. Identify substances as acids and bases. Distinguish between them. | READ: 2.7 |
| 20. Relate atomic mass to the abundance and mass of the isotopes. | READ: 3.1
DO: Questions and Problems 3.6 |
| 21. Do conversions involving numbers of moles, mass in grams and numbers of atoms or molecules. | READ: 3.2
DO: Questions and Problems 3.13, 3.14, 3.16, 3.18, 3.20 |
| 22. Calculate the molar mass of a compound. | READ: 3.3
DO: Questions and Problems 3.24, 3.26, 3.28 |
| 23. Describe the mass spectrometer. | READ: 3.4
DO: Questions and Problems 3.32 |
| 24. Calculate the percent composition of compounds. | READ: 3.5
DO: Questions and Problems: 3.40, 3.44, 3.46 |
| 25. Determine both the empirical formula and the molecular formula of compounds experimentally. | READ: 3.6
DO: Questions and Problems 3.50, 3.52 |
| 26. Balance chemical equations. | READ: 3.7
DO: Questions and Problems 3.57, 3.58 |
| 27. Use a balanced equation to calculate amounts of reactants and products with stoichiometry. | READ: 3.8
DO: Questions and Problems 3.62, 3.64, 3.66, 3.78 |

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CHAPTERS: 4, 7, 8

NAME OF UNIT: Aqueous Solutions, Atomic Structure and the Periodic Table

UNIT OBJECTIVE: To study reactions in aqueous solution. To study the electronic structure of the atom and its relationship to chemical properties and the periodic table.

Learning Objectives	Recommended Learning Experiences
1. Classify compounds as strong electrolytes, weak electrolytes and non-electrolytes, and distinguish between them.	READ: 4.1 MEMORIZE: Table 4.2 DO: Questions and Problems 4.7, 4.8, 4.10, 4.12, 4.14
2. Classify compounds as soluble or insoluble in water.	READ: 4.2 MEMORIZE: Table 4.2 DO: Questions and Problems 4.17, 4.19
3. Be able to write balanced molecular equations, balanced ionic equations, and balanced net ionic equations.	READ: 4.2 DO: Questions and Problems 4.22, 4.24
4. Classify compounds as strong or weak acids, strong or weak bases, or salts. Write balanced chemical equations for the neutralization of an acid and a base.	READ: 4.3 DO: Questions and Problems 4.26, 4.30, 4.32, 4.33
5. Define and give examples of: oxidation, reduction, oxidizing agent, reducing agent, oxidation number and half reaction.	READ: 4.4 DO: Questions and Problems 4.40, 4.44, 4.139
6. Calculate the oxidation number of each element in a compound.	READ: 4.4 LEARN: Oxidation number rules – pages 134 – 135 DO: Questions and Problems 4.46, 4.48

Learning Objectives	Recommended Learning Experiences
18. Describe the quantum numbers n , l , m_l and m_s .	READ: 7.6 DO: Questions and Problems 7.52, 7.54, 7.56, 7.60, 7.96
19. Describe the shapes of the s , p , and d orbitals.	READ: 7.7 DO: Questions and Problems 7.48
20. Write the electron configuration and orbital diagram of any atom. Predict if an atom is paramagnetic or diamagnetic	READ: 7.8, 7.9 DO: Questions and Problems 7.72, 7.76, 7.78, 7.84, 7.88, 7.92
21. Explain the development of the Periodic Table and how electron configurations relate to the arrangement. Use the Periodic Table to predict charges of monoatomic ions.	READ: 8.1, 8.2 DO: Questions and Problems 8.4, 8.12, 8.16, 8.20, 8.22, 8.24, 8.32
22. Explain the periodic nature of atomic radius, ionic radius, and metallic and nonmetallic behaviors.	READ: 8.3 DO: Questions and Problems 8.38, 8.40, 8.42, 8.44, 8.46, 8.78
23. Describe the periodic trends in ionization energy and electron affinity.	READ: 8.4, 8.5 DO: Questions and Problems 8.54, 8.56, 8.61, 8.62, 8.128
24. Describe the chemical behavior of each group of representative elements and of oxides.	READ: 8.6 DO: Questions and Problems 8.68, 8.86, 8.131.

Learning Objectives	Recommended Learning Experiences
10. Relate the number of electron pairs in the valence shell of an atom in a molecule to their geometrical arrangement around the atom.	READ: 10.1 DO: Questions and Problems 10.2, 10.4
11. Use VSEPR Theory to predict shapes of molecules.	READ: 10.1 STUDY: Tables 10.1, 10.2 DO: Questions and Problems 10.8, 10.12, 10.14, 10.76
12. Predict whether a molecule has a dipole moment from the molecular shape and electronegativities	READ: 10.2 DO: Questions and Problems 10.16, 10.20, 10.22, 10.24
13. Explain the concept of hybridization and its relationship to geometrical structure using Valence Bond Theory.	READ: 10.3, 10.4 DO: Questions and Problems 10.30
14. Assign hybrid orbitals to an atom knowing the number and geometrical arrangement of the atoms to which it is bonded.	READ: 10.4, 10.5 STUDY: Table 10.4 DO: Questions and Problems 10.33, 10.35, 10.42
15. Formulate the bonding in a molecule in terms of bond overlap, sigma bonds and pi bonds.	READ: 10.5 DO: Questions and Problems 10.44
16. Describe how molecular orbitals are formed by overlap of atomic orbitals.	READ: 10.6
17. Explain the relationship between bonding and antibonding molecular orbitals.	READ: 10.6 DO: Questions and Problems 10.46, 10.47

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CHAPTERS: 5, 11, 12

NAME OF UNIT: Gases, Liquids, Solids and Solutions

UNIT OBJECTIVE: To study the three states of matter. To study the physical properties of solutions.

Learning Objectives	Recommended Learning Experiences
1. Recognize substances that are gases.	READ: 5.1 DO: Questions and Problems 5.1, 5.2
2. Define the units of pressure: atm, mm Hg, Torr, and Pa. Be able to interconvert them. Describe how a barometer works.	READ: 5.2 DO: Questions and Problems 5.4, 5.5, 5.14
3. Describe how a gas responds to changes in pressure, volume, temperature, and quantity of gas. Be able to do calculations involving Boyle's Law, Charles's Law, and Avogadro's Law.	READ: 5.3 DO: Questions and Problems 5.18, 5.20, 5.22, 5.24, 5.26, 5.91
4. Solve problems using the Ideal Gas Law. Use the Ideal Gas Law in problems involving molar mass, and density.	READ: 5.4, 5.5 DO: Questions and Problems: 5.32, 5.34, 5.36, 5.44, 5.46, 5.48, 5.50
5. Use the Ideal Gas Law to do calculations from balanced chemical equations (using stoichiometry).	READ: 5.5 DO: Questions and Problems 5.60, 5.93, 5.98
6. Calculate the partial pressure of any gas in a mixture. Calculate the mole fraction of the gas.	READ: 5.6 DO: Questions and Problems 5.62, 5.64, 5.66, 5.68, 5.70
7. List and explain the assumptions on which the Kinetic Molecular Theory is based.	READ: 5.7 DO: Questions and Problems 5.72

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Learning Objectives	Recommended Learning Experiences
17. Explain the way in which the vapor pressure of a substance changes with intermolecular forces and temperature.	READ: 11.8 DO: Questions and Problems 11.86, 11.122
18. Describe the relationship between the pressure on the surface of a liquid and the boiling point of that liquid.	READ: 11.8 DO: Questions and Problems 11.66, 11.135
19. Calculate the energy change when a compound is heated, cooled or undergoes a change in phase. Know the terms associated with each kind of phase change.	READ: 11.8 DO: Questions and Problems: 11.78, 11.80, 11.84
20. Define critical temperature and pressure. Draw a phase diagram of a substance given appropriate data, and use a phase diagram to predict what phases are present at any given temperature and pressures.	READ: 11.8, 11.9 DO: Questions and Problems 11.68, 11.71, 11.90, 11.94
21. Describe the energy changes that occur in the solution process in terms of solute-solute, solvent-solvent, and solute-solvent attractive forces; describe the role of disorder in the solution process.	READ: 12.1, 12.2 DO: Questions and Problems 12.4
22. Rationalize the solubilities of substances in various solvents in terms of their molecular structures and intermolecular forces.	READ: 12.2 DO: Questions and Problems 12.5, 12.7, 12.10
23. Define various concentration units: percent by mass, mole fraction, molarity, and molality.	READ: 12.3 DO: Questions and Problems 12.16, 12.18, 12.22, 12.24