

# Virginia Western Community College

## CHM 5

### Developmental Chemistry for Health Sciences

#### **Prerequisites**

MTE 1, MTE 2, MTE 3, MTE 4, MTE 5 and MTE 6; and a placement recommendation for ENG 111, co-enrollment in ENF 3/ENG 111, or successful completion of all developmental English requirements.

#### **Course Description**

Introduces basic principles of inorganic, organic, and biological chemistry. Emphasizes applications to the health sciences. Can be used as a preparatory course for CHM 111 – CHM 112.

**Semester Credits: 4**

**Lecture Hours: 3**

**Laboratory Hours: 2**

#### **Required Materials**

##### **Textbook:**

Chemistry: An Introduction to General, Organic, & Biological Chemistry. Timberlake. 12th edition. Pearson Custom Publishing. ISBN: 9780133899573

Lab Manual: Catalyst Custom Version for VWCC. Timberlake. 1st edition. Pearson Custom Publishing. ISBN: 9780558539146

#### **Course Outcomes**

**At the completion of this course, the student should be able to:**

- Understand the basic tenets of the modern atomic-molecular theory.
- Perform basic laboratory techniques safely and accurately.
- Appreciate the relationship between chemistry and aspects of health.
- Perform calculations and metric conversions using correct significant figures and scientific notation.
- Balance chemical reactions and calculate stoichiometric relationships.
- Use the periodic chart to predict binary compound formulas, bonding, names and properties.
- Provide a foundation for Chemistry 111.

#### **Topical Description**

##### Chapter 1: Chemistry in Our Lives

- 1.1 Chemistry and Chemicals
- 1.2 Scientific Method: Thinking Like a Scientist
- 1.3 Learning Chemistry: A Study Plan
- 1.4 Key Math Skills for Chemistry

Chapter 2: Chemistry and Measurements

- 2.1 Units of Measurement
- 2.2 Measured Numbers and Significant Figures
- 2.3 Significant Figures in Calculations
- 2.4 Prefixes and Equalities
- 2.5 Writing Conversion Factors
- 2.6 Problem Solving Using Unit Conversion
- 2.7 Density

Chapter 3: Matter and Energy

- 3.1 Classification of Matter
- 3.2 States and Properties of Matter
- 3.3 Temperature
- 3.4 Energy
- 3.5 Energy and Nutrition
- 3.6 Specific Heat
- 3.7 Changes of State

Chapter 4: Atoms and Elements

- 4.1 Elements and Symbols
- 4.2 The Periodic Table
- 4.3 The Atom
- 4.4 Atomic Number and Mass Number
- 4.5 Isotopes and Atomic Mass
- 4.6 Electron Energy Levels
- 4.7 Trends in Periodic Properties

Chapter 5: Nuclear Chemistry

- 5.1 Natural Radioactivity
- 5.2 Nuclear Reactions
- 5.3 Radiation Measurement (optional)
- 5.4 Half-life of a Radioisotope
- 5.5 Medical Applications Using Radioactivity (optional)
- 5.6 Nuclear Fission and Fusion

Chapter 6: Ionic and Molecular Compounds

- 6.1 Ions: Transfer of Electrons
- 6.2 Writing Formulas for Ionic Compounds
- 6.3 Naming Ionic Compounds
- 6.4 Polyatomic Ions
- 6.5 Molecular Compounds: Sharing Electrons
- 6.6 Electronegativity and Bond Polarity
- 6.7 Shapes and Polarity of Molecules
- 6.8 Attractive Forces in Compounds

Chapter 7: Chemical Quantities and Reactions

- 7.1 The Mole
- 7.2 Molar Mass and Calculations

- 7.3 Equations for Chemical Reactions
- 7.4 Types of Reactions
- 7.5 Oxidation-Reduction Reactions
- 7.6 Mole Relationships in Chemical Equations
- 7.7 Mass Calculations for Reactions
- 7.8 Energy in Chemical Reactions

#### Chapter 8: Gases

- 8.1 Pressure and Volume (Boyle's Law)
- 8.2 Temperature and Volume (Charles' Law)
- 8.3 Temperature and Pressure (Gay-Lussac's Law)
- 8.4 The Combined Gas Law
- 8.5 Volume and Moles (Avogadro's Law)
- 8.6 Partial Pressures (Dalton's Law)
- Ideal Gas Law (not in book)

#### Chapter 9: Solutions

- 9.1 Solutions
- 9.2 Electrolytes and Nonelectrolytes
- 9.3 Solubility
- 9.4 Concentrations of Solutions
- 9.5 Dilution of Solutions
- 9.6 Properties of Solutions

#### Chapter 10: Acids and Bases and Equilibrium

- 10.1 Acids and Bases
- 10.2 Strengths of Acids and Bases
- 10.3 Acid-Base Equilibrium
- 10.4 Ionization of Water
- 10.5 The pH Scale
- 10.6 Reactions Acids and Bases
- 10.7 Buffers

#### Chapter 11: Introduction to Organic Chemistry: Hydrocarbons

- 11.1 Organic Compounds
- 11.2 Alkanes
- 11.3 Alkanes with Substituents
- 11.4 Property of Alkanes
- 11.5 Alkenes and Alkynes (optional)
- 11.6 Cis-Trans Isomers (optional)
- 11.7 Additional Reactions (optional)
- 11.8 Aromatic Compounds (optional)
- Functional Groups (not in book)

Laboratory Topics

| <u>Experiment Number</u> | <u>Experiment Title</u>                   | <u>Page</u> |
|--------------------------|---|-------------|
|                          | Check-in and Safety Rules                 |             |
| 1                        | Measurement and Significant Figures       | 7           |
| 2                        | Density and Specific Gravity              | 17          |
| 3                        | Energy and States of Matter               | 25          |
| 4                        | Atomic Structure                          | 37          |
| 5                        | Compounds and Their Formulas              | 45          |
| 6                        | Chemical Reactions and Equations          | 59          |
| 7                        | Moles and Chemical Formulas               | 69          |
| 8                        | Gases                                     | Handout     |
| 9                        | Solutions, Electrolytes and Concentration | 79          |
| 10                       | Solutions, Colloids, and Suspensions      | 91          |
| 11                       | Acids, Bases, pH, and Buffers             | 99          |
| 12                       | Acid-Base Titration (optional)            | 107         |
| 13                       | Properties of Organic Compounds           | 117         |
| 14                       | Polymers                                  | Handout     |

**Notes to Instructors**

1. Please note that a two-hour time slot is allotted to the laboratory and the student should be aware that this time will be fully utilized. The laboratory time is used not only for experimentation, but may also be used for demonstrations, movies, and problem solving. Whenever time permits, homework problems will be worked out in the beginning of the laboratory and the student is expected to participate.
2. Attendance in the laboratory is mandatory at the scheduled time. In case of an unavoidable situation, the student should contact the instructor beforehand to be excused and to see if any arrangements can be made to make up the laboratory. It may or may not be possible. Approved safety glasses must be worn in the laboratory **over the eyes** as required by state law.
3. Laboratory reports are due at the beginning of the next lab period. The report consists of the data report sheets included in the lab manual or handout. To aid not only the instructor but also especially the students, reports will not be accepted two weeks after the lab was assigned. Completion of the lab experiment followed by turning in the data and calculations on the due date with appropriate write-up insures a good grade. Grading scales for laboratory reports are at the professor's discretion, but will count towards the overall grade for the course.