



# **ILLINOIS VALLEY COMMUNITY COLLEGE**

## **COURSE OUTLINE**

**DIVISION: Natural Sciences and Business**

**COURSE: CHM 1004 Chemistry**

Date: Spring 2021

Credit Hours: 4

Pre/Co-requisite(s): MTH 0920

Delivery Method:  **Lecture**                      **2 Contact Hours** (1 contact = 1 credit hour)  
 **Seminar**                              **1 Contact Hours** (1 contact = 1 credit hour)  
 **Lab**    **2 Contact Hours** (2-3 contact = 1 credit hour)  
 **Clinical**                                      **0 Contact Hours** (3 contact = 1 credit hour)  
 **Online**  
 **Blended**

Offered:  **Fall**     **Spring**     **Summer**

IAI Equivalent –**Only for Transfer Courses**-go to <http://www.itransfer.org>: PI 902L

### **CATALOG DESCRIPTION:**

This is an introductory course in chemistry suitable as a general education laboratory science course or as a preparatory course for general chemistry. Basic concepts, terminology and mathematical skills are emphasized. Concepts of matter and its classification, energy, atomic structure, periodic table, chemical compounds and their nomenclature, mole concept, chemical reactions, reaction stoichiometry, and introductory organic chemistry are covered.

## GENERAL EDUCATION GOALS ADDRESSED

*[See last page for Course Competency/Assessment Methods Matrix.]*

### Upon completion of the course, the student will be able:

*[Choose up to three goals that will be formally assessed in this course.]*

- To apply analytical and problem solving skills to personal, social, and professional issues and situations.
- To communicate successfully, both orally and in writing, to a variety of audiences.
- To construct a critical awareness of and appreciation for diversity.
- To understand and use technology effectively and to understand its impact on the individual and society.
- To develop interpersonal capacity.
- To recognize what it means to act ethically and responsibly as an individual and as a member of society.
- To recognize what it means to develop and maintain a healthy lifestyle in terms of mind, body, and spirit.
- To connect learning to life.

### EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

*[Outcomes related to course specific goals. See last page for more information.]*

#### Upon completion of the course, the student will be able to:

##### Topic 1: Chemistry: An Introduction

Students will be able to:

- 1.1. Understand the importance of learning chemistry – a central science
- 1.2. Define Chemistry
- 1.3. Understand Scientific thinking and describe the method scientists use to study nature

##### Topic 2: Matter & Classification

Students will be able to:

- 2.1. Understand the definition of matter and its classification
- 2.2. Distinguish between Pure Substances and Mixtures
- 2.3. Learn how to separate mixtures
- 2.4. Distinguish between Elements and Compounds
- 2.5. Distinguish between Physical & chemical changes

##### Topic 3: Measurements and Energy

Students will be able to:

- 3.1. Show how very large or very small numbers can be expressed in scientific notation
- 3.2. Learn the English, metric, and SI systems of measurement
- 3.3. Use the metric system for measuring Length, Volume, Mass & Density
- 3.4. Understand how uncertainty in measurements arises and how it can be indicated using Significant Figures
- 3.5. Learn how to determine significant figures in a calculated result
- 3.6. Learn how to use Dimensional Analysis (unit analysis) to solve problems
- 3.7. Learn the three temperature scales and how to interconvert between them
- 3.8. Learn about different forms of Energy, energy units and how heat energy can be measured

#### **Topic 4. Chemical Foundations**

Students will be able to:

- 4.1. Learn about Atoms and the Dalton's atomic theory
- 4.2. Learn about the particles that make up atoms (subatomic particles) and their discovery
- 4.3. Learn the properties of subatomic particles and their function
- 4.4. Understand Rutherford's Gold Foil experiment to characterize the atom's structure
- 4.5. Learn about isotopy, atomic number and mass number
- 4.6. Learn about the Periodic Table, its classification into columns and rows, and its classification into metals, nonmetals and metalloids
- 4.7. Learn about ions and how the periodic table can be used to predict the ions formed by elements

Ions & Periodic Table

#### **Topic 5: Chemical compounds & Nomenclature**

Students will be able to:

- 5.1. Learn the two categories of compounds: Ionic and Molecular compounds
- 5.2. Learn how to determine the Formulae of compounds
- 5.3. Learn how to name Ionic and Molecular compounds
- 5.4. Learn how to name Binary acids and polyatomic acids

#### **Topic 6: Chemical Reactions & Equations**

Students will be able to:

- 6.1. Learn the clues that show a chemical reaction has occurred
  - 6.2. Learn the characteristics of a chemical reaction and information given by chemical equation
- Writing and balancing chemical Equations
- 6.4. Learn how to write and balance chemical equations
  - 6.5. Learn the major categories of reactions: synthesis, decomposition, single displacement, double displacement and combustion reactions

#### **Topic 7: Reactions in Aqueous Solution**

Students will be able to:

Learn to describe reactions in solution by writing molecular, complete ionic, and net ionic equations

#### **Topic 8. Chemical Composition**

Students will be able to:

- 8.1. Understand the concept of average mass and explore how counting can be done by weighing.
- 8.2. Understand the mole concept and Avogadro Number
- 8.3. Learn how to convert among moles, mass, and number of particles in a given sample
- 8.4. Learn how to find the percent of a given element in a compound
- 8.5. Understand the meaning of empirical formula and learn how to calculate it
- 8.6. Learn how to calculate the molecular formula of a compound if given empirical formula and molar mass

#### **Topic 9. Chemical Quantities**

Students will be able to:

- 9.1. Understand the molecular and mass information given in a balanced equation
- 9.2. Use balanced equations to determine the relationships between moles of reactants and products
- 9.3. Understand the meaning of limiting reactant and how to calculate the yield of a reaction

### Topic 10. Electron Configuration

Students will be able to:

- 10.1. Learn about the arrangement of electrons in shells
- 10.2. Learn about the shapes of orbitals designated by s, p, and d
- 10.3. Learn about the principal energy levels and how electrons are arranged into orbitals
- 10.4. Electron configuration of elements from atomic number 1 to 30

### Topic 11. Chemical Bonding and Intermolecular Forces

Students will be able to:

- 11.1. Learn about ionic and covalent bonds and explain how they are formed
- 11.2. Learn how to write Lewis structures
- 11.3. Understand bond polarity and its relationship to electronegativity
- 11.4. Understand molecular structure and bond angles
- 11.5. Understand Intermolecular forces: hydrogen bonding, dipole-dipole interaction and London dispersion forces
- 11.6. Physical properties influenced by intermolecular forces

### Topic 12. Radioactivity

Students will be able to:

- 12.1. Learn the types of radioactive decay
- 12.2. Learn to write nuclear equations that describe radioactive decay
- 12.3. Understand half-life
- 12.4. Understand how objects can be dated by radioactivity

### Topic 13. Organic Chemistry

Students will be able to:

- 13.1. Define Organic Chemistry
- 13.2. Learn about alkanes and their structural isomers
- 13.3. Learn how to name hydrocarbons: alkanes,
- 13.4. Recognize simple functional groups in organic compounds
- 13.5. Understand hydrocarbons alkanes, alkenes, alkynes and their reactions
- 13.6. Learn about simple alcohols and carboxylic acid

## MAPPING LEARNING OUTCOMES TO GENERAL EDUCATION GOALS

*[For each of the goals selected above, indicate which outcomes align with the goal.]*

Goals	Outcomes
First Goal	
To apply analytical and problem solving skills to personal, social, and professional issues and situations	Students will be able to: - perform mathematical calculations & develop problem solving techniques - utilize, interpret and present given chemical data or data collected in the lab - demonstrate an understanding of the general introductory concepts of chemistry and chemical reactions - perform basic laboratory techniques and systematic approaches to laboratory/research procedures - demonstrate an understanding and the application of chemistry to their daily lives

## **COURSE TOPICS AND CONTENT REQUIREMENTS:**

See above outcomes and competencies.

## **INSTRUCTIONAL METHODS:**

Large and small group activities, lecture, laboratory experiments, class demonstrations, blackboard assignments, class discussion, online videos and literature/internet research on topics.

## **INSTRUCTIONAL MATERIALS:**

Introductory Chemistry, Zumdahl/DeCoste, 9th ed. Cengage Learning, 2017.

General laboratory equipment

Separate laboratory notebook for use in lab

Visorog Safety goggles for use in lab

Blackboard course registration

Laboratory technique videos

Laboratory Experiment Handouts (mostly inquiry based labs available as a packet from the bookstore)

Labworks graphing package available on the lab computers (any graphing package is sufficient including Microsoft Excel)

Instructor developed activities and supplies

## **STUDENT REQUIREMENTS AND METHODS OF EVALUATION:**

Assessment methods include:

Homework

Lab reports

Tests

Quizzes

Discussion both in class and on-line

Written Assignments

A= 90-100

B= 80-89

C= 70-79

D= 60-69

F= 0-59

## **OTHER REFERENCES**

Khan Academy (Youtube)

## Course Competency/Assessment Methods Matrix

(Dept/# Course Name)	Assessment Options																																	
<p>For each competency/outcome place an "X" below the method of assessment to be used.</p>	<b>Assessment of Student Learning</b>	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment		
<p>Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.</p>	<b>Direct/ Indirect</b>	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D								
<p>1. Students will be able to perform mathematical calculations and problem solving techniques to utilize interpret and present given chemical data or data collected in the lab</p>				X					X					X																		X		
<p>2. Students will be able to demonstrate an understanding of the general introductory concepts of chemistry and chemical reactions</p>				X			X	X																										
<p>3. Students will be able to demonstrate an understanding of the basic concepts of energy and energy change</p>				X			X	X																										X

