

SENECA COLLEGE OF APPLIED ARTS AND TECHNOLOGY

FACULTY OF CONTINUING EDUCATION AND CONTRACT TRAINING

*ADULT ACADEMIC UPGRADING / COLLEGE PREPARATORY
PROGRAM*

SUBJECT OUTLINE

PRINCIPLES OF CHEMISTRY-12U

CHM080-12U

SUBJECT DESCRIPTION

This introductory chemistry course provides learners with a strong knowledge of chemistry as it applies to health, social and environmental issues. Emphasis is given to analyzing and communicating scientific information effectively, solving problems, and performing laboratory exercises. Units of study include nature of matter, qualitative analysis and chemical calculations. The content of the course reflects the needs of adult learners preparing to enter degree programs in industry, health and environmental sciences.

GENERAL LEARNING OUTCOMES

Upon successful completion of this course learners will be able to:

- Employ a disciplined approach to the study of chemistry, including scientific inquiry and problem solving;
- Apply chemistry principles and concepts in such areas as the nature of matter, qualitative analysis and chemical calculations;
- Apply knowledge from the course to health, technology, workplace, society and environmental issues;
- Use observational and critical thinking skills to develop pathways to solve laboratory questions;
- Select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate scientific ideas, plans, and experimental results
- Assess career choices in science and technology;
- Understand appropriate safety procedures and guidelines required in laboratories, workplaces and colleges;

SPECIFIC LEARNING OUTCOMES:

Nature of Matter

Upon successful completion of this unit learners will be able to:

1. explain the distinction between observation and inference;
2. define and classify matter;

3. distinguish between physical and chemical properties;
4. list the properties of the three basic sub-atomic particles;
5. recognize trends within the periodic table of elements;
6. list characteristics of the *s*, *p*, *d*, and *f* blocks of elements, and explain the relationship between position of elements in the periodic table, their properties, and their electron configurations;

Qualitative Analysis of Molecules

Upon successful completion of this unit learners will be able to:

7. draw Lewis structures and use them to explain covalent and ionic bonding;
8. relate the charge of an ion to the number of electrons lost or gained;
9. write, using IUPAC or traditional systems, the formulae of compounds, and recognize the formulae in various contexts;
10. predict molecular shape for simple molecules and ions and the polarity of various substances, using the VSEPR model;

Chemical Calculations

Upon successful completion of this unit learners will be able to:

11. calculate the molecular mass and molar mass of a compound using the mole concept;
12. identify types of chemical reactions;
13. write double replacement and net ionic equations;
14. solve problems involving relationships among the following variables: quantity in moles, mass, number of particles, concentration, volume of solution;
15. calculate percentage composition of a compound;
16. calculate percentage yield in a chemical reaction and identify sources of error;
17. state the effect of temperature and pressure on the volume of a fixed quantity of gas;

CREDIT STATUS:

This course is designed according to the Academic and Career Entrance Program (ACE) approved by the Ontario Ministry of Training, Colleges and University and the [Ontario high school science curriculum](#). Upon completion of both CHM080 and CHM093 students will satisfy the chemistry entry requirements for most degree and [applied degree](#) programs.

PREREQUISITES:

Minimum LBS 4 Reading English and LBS 4 Math level. Also, basic computers skills are needed for virtual labs. Students already enrolled in AAUCP should be at the MTH080 level or, at least, should have knowledge of whole numbers, decimals, ratios, fractions, percents, ratios and proportions and measurements (Chapters 1-7 in MTH070).

MODES OF INSTRUCTION:

The instructional methods of this course are composed of lectures and board demonstrations, discussions, team work/ cooperative learning activities, in-class assignments, and independent research by students. The course includes a virtual lab

component. Learners will have access to computer software and other internet resources that provide hands-on problem solving opportunities and reinforce chemistry concepts.

REQUIRED TEXTS:

Introductory Chemistry for Today by Spencer L. Seager and Michael R. Slabaugh, 5th ed. 2004, Brooks/Cole
ISBN 0953439969

REFERENCE MATERIAL:

PLATO Learning software

PROMOTION POLICY:

The passing grade is 55%.

In order to successfully complete the course a student must pass both laboratory and lecture components of this course.

A student who does not successfully complete the course, but achieved a minimum of 60% on the lab component may apply for exemption from the lab component.

MODES OF EVALUATION:

Term Tests (2 at 20% each)	40%
Quizzes/Assignments	10%
Final Examination	30%
Lab Quizzes/ Assignments/Reports	20%
Total	100%

GENERAL POLICIES AND GUIDELINES:

Laboratory Attendance:

The laboratory component of the course is essential and therefore attendance in all laboratory classes is mandatory. Students who miss a laboratory class because of documented medical or legal reasons must notify the professor immediately by phone or e-mail; otherwise, a mark of zero will be recorded for the lab. Any student who fails to attend more than three scheduled laboratory classes will not pass the laboratory component of the course.

With proper documentation and notification, students may make-up a missed laboratory class within one week. This privilege will only be accorded ONCE throughout the course.

Submission of Assignments/Lab Reports/Etc.:

All assignments, lab reports, etc. must be submitted by the time specified by the faculty. A penalty of 10% will be imposed for all material submitted late on the day it was due and a further 10% per day will be imposed.

Examinations:

Students are expected to write all tests, quizzes and the final examination when scheduled in a timely manner as stated in the college academic policies. To view Seneca College policies, please go to www.senecac.on.ca/policies. If a particular test, quiz or the final examination cannot be written because of documented medical or legal reasons, students must notify the professor immediately by phone or e-mail; otherwise, a mark of zero will be recorded.

With proper documentation and notification, students may receive an alternate date for a missed examination. This privilege will only be accorded to any one student ONCE throughout the course.

Computing Acceptable Use Policy:

All students are responsible for abiding by the College's Computing Acceptable Use Policy and for obeying Provincial and Federal laws/regulations regarding the use of computer equipment, facilities and/or networks.

GRADING SCHEME:

Grade		GPA
A+	90% - 100%	4.0
A	80% - 89%	4.0
B+	75% - 79%	3.5
B	70% - 74%	3.0
C+	65% - 69%	2.5
C	60% - 64%	2.0
D	55% - 59%	1.0
F	0% - 54%	0.0

CHEATING AND PLAGIARISM:

Cheating and plagiarism are major academic offences and carry serious penalties. First offence: A student caught cheating will receive a mark of "0" "on the work in which the offense occurred" and have a comment indicating cheating listed on their transcript. This comment will be removed upon graduation. Second or subsequent offence: "The penalty for the second offense of cheating or plagiarism is immediate expulsion from the college for the remainder of the semester or longer, depending on the circumstances." The comment will remain on the student's transcript and will not be removed upon graduation. Students are referred to College Policy on "Cheating and Plagiarism" in the College Academic Policy http://www.senecac.on.ca/home/academic_policy/.

POLICY ON DISCRIMINATION/HARASSMENT:

All students and employees have the right to study and work in an environment that is free from discrimination and/or harassment. Language or activities that defeat this objective violate the College Policy on Discrimination/Harassment and shall not be tolerated. Information and assistance are available from the Resolution, Equity and Diversity Centre (REDC) at Newham Campus, room 3015, tel. (416) 491-5050 ext. 2078 or via email at Human.Rights@senecac.on.ca.

Note: An approximate outline of topics is given below. Due to certain circumstances, some topics may not be fully covered.

TOPIC OUTLINE

Unit	Chapter/reference	Learning Outcome
Nature of Matter	Ch. 1 Matter, Measurements, and Calculations 1.1 What is Matter 1.2 Properties and Changes 1.3 A Model of Matter 1.4 Classifying Matter 1.5 Measurement Units 1.6 The Metric System 1.7 Large and Small Numbers 1.8 Significant Figures 1.9 Using Units in Calculations	1-3
	Ch. 2 Atoms and Molecules 2.1 Symbols and Formulas 2.2 Inside the Atom 2.3 Isotopes 2.4 Relative Masses of Atoms and Molecules 2.5 Isotopes and Atoms Weights 2.6 Avogadro's Number: The Mole 2.7 The Mole and Chemical Formulas	4
	Ch. 3 Electronic Structure and the Periodic Law 3.1 The Periodic Law and Table 3.2 Electronic Arrangements in Atoms 3.3 The Shell Model and Chemical Properties 3.4 Electronic Configurations 3.6 Property Trends Within the Periodic Table	5-6
Qualitative Analysis of Elements and Compounds	Ch. 4 Forces between Particles 4.1 Noble Gas Configuration 4.2 Ionic Bond 4.3 Ionic Compounds 4.4 Naming Binary Ionic Compounds 4.5 The Smallest Unit of Bionic Compounds 4.6 Covalent Bonding 4.7 Polyatomic Ions 4.8 Shapes of Molecules and Polyatomic Ions 4.9 The Polarity of Polyatomic Molecules 4.10 More About Naming Compounds 4.11 Other Interparticle Forces	7-10

Chemical Calculations	Ch. 5 Chemical Reactions 5.1 Chemical Equations 5.2 Types of Reactions 5.3 Redox Reactions 5.4 Decomposition Reactions 5.5 Combination Reactions 5.6 Replacement Reactions 5.8 Energy and Reactions 5.9 The Mole and Chemical Equations 5.10 The Limiting Reactant 5.11 Reaction Yields	11-16
	Ch. 6 The States of Matter 6.1 Observed Properties of Matter 6.2 The Kinetic Molecular Theory of Matter 6.3 The Solid State 6.4 The Liquid State 6.5 The Gaseous State 6.6 The Gas Laws 6.7 Pressure, Temperature, and Volume Relationship 6.8 The Ideal Gas Law 6.9 Dalton's Law	17

Approved by:

Leolyn Hendricks, Chair/ Principal, York Gate Campus,
Faculty of Continuing Education and Training

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FACULTY OF CONTINUING EDUCATION AND CONTRACT TRAINING

ADULT ACADEMIC UPGRADING / COLLEGE PREPARATORY PROGRAM

SUBJECT OUTLINE

APPLIED CHEMISTRY-12U

CHM093-12U

SUBJECT DESCRIPTION

This course continues CHM080-12U. Emphasis is given to analyzing and communicating scientific information effectively, solving problems, and performing laboratory exercises. Units of study include organic chemistry and chemistry in the environment.

GENERAL LEARNING OUTCOMES

- Develop the skills and strategies required for scientific inquiry and problem solving.
- Apply chemistry principles and concepts in such areas as solutions, acids and bases, and organic chemistry.
- Apply knowledge from the course to health, workplace, society and environmental issues.
- Use observational and critical thinking skills to develop pathways to solve laboratory questions
- Select and use appropriate numeric, symbolic, graphical, and linguistic modes of representation to communicate scientific ideas, plans, and experimental results
- Understand appropriate safety procedures and guidelines required in laboratories, workplaces and colleges
- Demonstrate the skills required to plan and carry out investigations using laboratory equipment safely, effectively, and accurately (e.g., select and use apparatus safely in an experiment to determine the mass of a metal deposited by electroplating);

SPECIFIC LEARNING OUTCOMES

Chemistry in the Environment

1. explain the Arrhenius definition of acids and bases;
2. differentiate between strong and weak acids with respect to dissociation;
3. identify the gases responsible for acid rain and their sources;
4. apply the terms of *concentrated* and *dilute* to acids;
5. write balanced chemical equations for neutralization reactions;
6. identify the gases responsible for acid rain, and describe their sources;
7. explain the importance of electrochemical technology to the production and protection of metals; and assess environmental and safety issues associated with these technologies.

Organic Chemistry

8. describe the characteristics of carbon atoms in terms of the type of bonding and the formation of long chains;
9. draw Lewis structures to represent covalent bonding in organic compounds;
10. identify the functional group structures that define common families (e.g., alkenes, alkynes, alcohols, aldehydes, amines etc);
11. describe, using structural formulae, typical organic reactions such as addition, combustion, hydrogenation, dehydration, addition polymerization reactions etc.;
12. explain the general properties of molecules containing oxygen or nitrogen;

Rates of Reaction, Chemical Systems and Equilibrium

13. determine energy changes for physical and chemical processes and rates of reaction, using experimental data and calculations;
14. demonstrate an understanding of the dependence of chemical technologies and processes on the energetics of chemical reactions.
15. investigate the behaviour of different equilibrium systems using the concept of chemical equilibrium, Le Chatelier's principle, and solution equilibrium
16. explain the importance of chemical equilibrium in various systems, including ecological, biological, and technological systems.

CREDIT STATUS:

This course is designed according to the Academic and Career Entrance Program (ACE) approved by the Ontario Ministry of Training, Colleges and University. Upon completion of both CHM080-12U and CHM093-12U courses students will satisfy the chemistry entry requirements for most degree and applied degree programs.

PREREQUISITES:

CHM080-12U or equivalent. Students who have completed senior high school biology or chemistry courses (either here or in another country) may enter this course after passing a chemistry diagnostic test with a score of 70% or more.

MODES OF INSTRUCTION:

The instructional methods of this course are composed of lectures and board demonstrations, discussions, team work/cooperative learning activities, in-class assignments, and independent research by students. The course includes a virtual lab component. Learners will have access to computer software and other internet resources that provide hands-on problem solving opportunities and reinforce chemistry concepts and methods.

REQUIRED TEXTS:

Introductory Chemistry for Today by Spencer L. Seager and Michael R. Slabaugh, 5th ed. 2004, Brooks/Cole, ISBN 053439969

REFERENCE MATERIAL:

PLATO Learning software

PROMOTION POLICY:

The passing grade is 55%.

In order to successfully complete the course a student must pass both laboratory and lecture components of this course.

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With proper documentation and notification, students may make-up a missed laboratory class within one week. This privilege will only be accorded ONCE throughout the course.

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Note: An approximate outline of topics is given below. The hours for each topic and the order of topics may vary. Due to certain circumstances, some topics may not be fully covered.

TOPIC OUTLINE

Unit	Chapter/Reference	Learning Outcome
Review Basic Concepts in Chemistry	Ch 1-6	
Chemistry in the Environment	Ch. 7 Solutions and Colloids 7.1 Physical States of Solutions 7.2 Solubility 7.3 The Solution Process 7.4 Solution Concentration 7.5 Solution Stoichiometry 7.7 Solution Properties	1

	<p>Ch. 9 Acids, Bases and Salts 9.1 The Arrhenius Theory 9.2 The Bronsted Theory 9.3 Naming Acids 9.4 The Self-Ionization of Water 9.5 The pH Concept 9.6 Properties of Acids 9.7 Properties of Bases</p>	2-7
Rates of Reaction, Chemical Systems and Equilibrium	<p>Ch. 8 Reaction Rates and Equilibrium 8.1 Spontaneous and Nonspontaneous Processes 8.2 Reactions Rates 8.3 Molecular Collisions 8.4 Energy Diagrams 8.5 Factors That Influence Reaction Rates 8.6 Chemical Equilibrium</p>	14-17
Organic Chemistry	<p>Ch. 11 Organic Compounds: Alkenes 11.1 Carbon: The Element of Organic Compounds 11.2 Organic and Inorganic Compounds Compared 11.3 Bonding Characteristic and Isomerism 11.4 Functional Groups 11.5 Alkane Structures 11.7 Alkane Nomenclature 11.8 Cycloalkanes 11.10 Physical Properties of Alkanes 11.11 Alkane Reactions</p>	9-10
	<p>Ch. 12 Unsaturated Hydrocarbons 12.1 The Nomenclature of Alkenes 12.3 Properties of Alkenes 12.4 Addition Polymers 12.6 Aromatic Compounds and the Benzenes Structure 12.7 The Nomenclature of Benzene Derivatives</p>	11-12
	<p>Ch. 13 Alcohols, Phenols, and Ethers 13.1 The Nomenclature of Alcohols and Phenols 13.2 Classification of Alcohols 13.3 Physical Properties of Alcohols 13.4 Reactions of Alcohols 13.5 Important Alcohols 13.6 Characteristics and Uses of Phenols 13.7 Ethers</p>	11-13
	<p>Ch. 14 Aldehydes and Ketones 14.1 The Nomenclature of Aldehydes and Ketones 14.2 Physical Properties 14.3 Chemical Properties 14.4 Important Aldehydes and Ketones</p>	11-13

Ch. 15 Carboxylic Acids and Esters 15.1 The Nomenclature of Carboxylic Acids 15.2 Physical Properties of Carboxylic Acids 15.3 The Acidity off Carboxylix Acids	11-13
Ch. 16 Amines and Amides 16.1 Classification of Amines 16.2 The Nomenclature of Amines 16.3 Physical Properties of Amines 16.4 Chemical Properties of Amines 16.7 The Nomenclature of Amides 16.3 Physical Properties of Amides 16.4 Chemical Properties of Amides	11-13

Approved by:

Leolyn Hendricks, Chair/ Principal, York Gate Campus,
Faculty of Continuing Education and Training

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