

Waterloo Collegiate Institute Science Department

Chemistry, Grade 12, University Preparation (SCH4U/W)

Prerequisite: Chemistry, Grade 11, University Preparation

This course enables students to deepen their understanding of chemistry through the study of organic chemistry, energy changes and rates of reaction, chemical systems and equilibrium, electrochemistry, and atomic and molecular structure. Students will further develop problem-solving and laboratory skills as they investigate chemical processes, at the same time refining their ability to communicate scientific information. Emphasis will be placed on the importance of chemistry in daily life, and on evaluating the impact of chemical technology on the environment.

From: The Ontario Curriculum, Grades 11 and 12 Science, page 55.

A final grade is recorded for every course, and a credit is granted and recorded for every course in which the student's grade is 50% or higher. The final grade for each course in Grades 9–12 will be determined as follows:

- Seventy per cent of the grade will be based on evaluations conducted throughout the course. This portion of the grade should reflect the student's most consistent level of achievement throughout the course, although special consideration should be given to more recent evidence of achievement.
- Thirty per cent of the grade will be based on a final evaluation in the form of an examination, performance, essay, and/or other method of evaluation suitable to the course content and administered towards the end of the course.

In all of their courses, students must be provided with numerous and varied opportunities to demonstrate the full extent of their achievement of the curriculum expectations, across all four categories of knowledge and skills.

From: The Ontario Curriculum, Grades 9 to 12, Program Planning and Assessment, page 15.

Assessment of student performance in this course is based on the level of achievement attained in each of the four categories of Knowledge and Understanding, Inquiry, Communication and Making Connections outlined in the Achievement Chart. The Achievement Chart from pages 174 and 175 of the Ontario Curriculum, Grades 11 and 12 Science has been reproduced for reference. The contribution of each category to the student's final grade in this course will be calculated as follows:

Assessments and Evaluations Conducted Throughout the Course	
1. Knowledge and Understanding	30 %
2. Inquiry	20 %
3. Communication and Making Connections	20 %
Subtotal	70 %
Examinations	30 %
Total	100 %

As indicated on Page 7 of the Student Handbook a fee of \$5 for laboratory enhancements will be collected at the beginning of this course. This fee has been reviewed and approved by the WCI Administration in June 2008.

Textbooks:

SCH 4UI: Mustoe et al, Chemistry 12, McGraw-Hill Ryerson, Toronto, 2002. ISBN: 0-07-088686-5

SCH 4UW: Brown et al, Chemistry, the Central Science, Pearson Education, 2006. ISBN: 0 13 193719 7

Achievement Chart for Science

From: The Ontario Curriculum, Grades 9 and 10 Science pages 46 – 47, and Grades 11 and 12 Science, pages 174 and 175.

Category	50-59% (Level 1)	60-69% (Level 2)	70-79% (Level 3)	80-100% (Level 4)
Knowledge/ Understanding	The student:			
-understanding of concepts, principles, laws, and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations)	demonstrates limited understanding of concepts, principles, laws, and theories	demonstrates some understanding of concepts, principles, laws, and theories	demonstrates considerable understanding of concepts, principles, laws, and theories	demonstrates thorough understanding of concepts, principles, laws, and theories
-knowledge of facts and terms	demonstrates limited knowledge of facts and terms	demonstrates some knowledge of facts and terms	demonstrates considerable knowledge of facts and terms	demonstrates thorough knowledge of facts and terms
transfer of concepts to new contexts	infrequently transfers simple concepts to new contexts	sometimes transfers simple concepts to new contexts	usually transfers simple and some complex concepts to new contexts	routinely transfers complex concepts to new contexts
understanding of relationships between concepts	demonstrates limited understanding of relationships between concepts	demonstrates some understanding of relationships between concepts	demonstrates considerable understanding of relationships between concepts	demonstrates thorough and insightful understanding of relationships between concepts
Inquiry	The student:			
application of the skills and strategies of scientific inquiry (e.g., initiating and planning, performing and recording, analysing and interpreting, problem solving)	applies few of the skills and strategies of scientific inquiry	applies some of the skills and strategies of scientific inquiry	applies most of the skills and strategies of scientific inquiry	applies all or almost all of the skills and strategies of scientific inquiry
application of technical skills and procedures (e.g., microscopes)	applies technical skills and procedures with limited competence	applies technical skills and procedures with moderate competence	applies technical skills and procedures with considerable competence	applies technical skills and procedures with a high degree of competence
use of tools, equipment, and materials	uses tools, equipment, and materials safely and correctly only with supervision	uses tools, equipment, and materials safely and correctly with some supervision	uses tools, equipment, and materials safely and correctly	demonstrates and promotes the safe and correct use of tools, equipment, and materials

Category	50-59% (Level 1)	60-69% (Level 2)	70-79% (Level 3)	80-100% (Level 4)
Communication	The student:			
communication of information and ideas	communicates information and ideas with limited clarity and precision	communicates information and ideas with moderate clarity and precision	communicates information and ideas with considerable clarity and precision	communicates information and ideas with a high degree of clarity and precision
use of scientific terminology, symbols, conventions, and standard (SI) units	uses scientific terminology, symbols, conventions, and SI units with limited accuracy and effectiveness	uses scientific terminology, symbols, conventions, and SI units with some accuracy and effectiveness	uses scientific terminology, symbols, conventions, and SI units with considerable accuracy and effectiveness	uses scientific terminology, symbols, conventions, and SI units with a high degree of accuracy and effectiveness
communication for different audiences and purposes	communicates with a limited sense of audience and purpose	communicates with some sense of audience and purpose	communicates with a clear sense of audience and purpose	communicates with a strong sense of audience and purpose
use of various forms of communication (e.g., reports, essays)	demonstrates limited command of the various forms	demonstrates moderate command of the various forms	demonstrates considerable command of the various forms	demonstrates extensive command of the various forms
use of information technology for scientific purposes (e.g. specialized databases)	uses technology with limited appropriateness and effectiveness	uses technology with moderate appropriateness and effectiveness	uses appropriate technology with considerable effectiveness	uses appropriate technology with a high degree of effectiveness
Making Connections	The student:			
understanding connections among society, and the environment	shows limited understanding of connections in familiar contexts	shows some understanding of connections in familiar contexts	shows considerable understanding of connections in familiar and some unfamiliar contexts	shows thorough understanding of connections in familiar and unfamiliar contexts
analysis of social and economic issues involving science and technology	analyses social and economic issues with limited effectiveness	analyses social and economic issues with moderate effectiveness	analyses social and economic issues with considerable effectiveness	analyses complex social and economic issues with a high degree of effectiveness
assessment of impacts of science and technology on the environment	assesses environmental impacts with limited effectiveness	assesses environmental impacts with moderate effectiveness	assesses environmental impacts with considerable effectiveness	assesses environmental impacts with a high degree of effectiveness
proposing courses of practical action in relation to science and technology-based problems	extends analyses of familiar problems into courses of practical action with limited effectiveness	extends analyses of familiar problems into courses of practical action with moderate effectiveness	extends analyses of familiar problems into courses of practical action with considerable effectiveness	extends analyses of familiar and unfamiliar problems into courses of practical action with a high degree of effectiveness

Course Outline: SCH 4UI (units may not be delivered in the order listed)

Overall Expectations: (Ontario Curriculum Grades 11 and 12 Science)	Textbook Reference: Chemistry 12
Unit 1 Organic Chemistry By the end of this course, students will: <ol style="list-style-type: none">1. demonstrate an understanding of the structure of various organic compounds, and of chemical reactions involving these compounds;2. investigate various organic compounds through research and experimentation, predict the products of organic reactions, and name and represent the structures of organic compounds using the IUPAC system and molecular models;3. evaluate the impact of organic compounds on our standard of living and the environment.	Unit 1: Organic Chemistry Ch 1: Classifying Organic Compounds Ch 2: Reactions of Organic Compounds
Unit 2: Energy Changes and Rates of Reaction By the end of this course, students will: <ol style="list-style-type: none">1. demonstrate an understanding of the energy transformations and kinetics of chemical changes;2. determine energy changes for physical and chemical processes and rates of reaction, using experimental data and calculations;3. demonstrate an understanding of the dependence of chemical technologies and processes on the energetics of chemical reactions.	Unit 3: Energy Changes and Rates of Reaction Ch 5: Energy and Change Ch 6: Rates of Chemical Reaction
Unit 3: Chemical Systems and Equilibrium By the end of this course, students will: <ol style="list-style-type: none">1. demonstrate an understanding of the concept of chemical equilibrium, Le Chatelier's principle, and solution equilibria;2. investigate the behaviour of different equilibrium systems, and solve problems involving the law of chemical equilibrium;3. explain the importance of chemical equilibrium in various systems, including ecological, biological, and technological systems.	Unit 4: Chemical Systems and Equilibrium Ch 7: Reversible Reactions and Chemical Equilibrium Ch 8: Acids, Bases and pH Ch 9: Aqueous Solution and Solubility Equilibria
Unit 4: Electrochemistry By the end of this course, students will: <ol style="list-style-type: none">1. demonstrate an understanding of fundamental concepts related to oxidation-reduction and the inter-conversion of chemical and electrical energy;2. build and explain the functioning of simple galvanic and electrolytic cells; use equations to describe these cells; and solve quantitative problems related to electrolysis;3. describe some uses of batteries and fuel cells; explain the importance of electrochemical technology to the production and protection of metals; and assess environmental and safety issues associated with these technologies	Unit 5: Electrochemistry Ch 10: Oxidation-Reduction Reactions Ch 11: Cells and Batteries
Unit 5: Structure and Properties By the end of this course, students will: <ol style="list-style-type: none">1. demonstrate an understanding of quantum mechanical theory, and explain how types of chemical bonding account for the properties of ionic, molecular, covalent network, and metallic substances;2. investigate and compare the properties of solids and liquids, and use bonding theory to predict the shape of simple molecules;3. describe products and technologies whose development has depended on understanding molecular structure, and technologies that have advanced the knowledge of atomic and molecular theory.	Unit 2: Structure and Properties Ch 3: Atoms, Electrons and Periodic Trends Ch 4: Structure and Properties of Substances