

## Course Outline

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**School Name:** UMC High School

**Department Name:** Science

**Ministry of Education Course Title:** Grade 12 University Chemistry

**Grade Level:** 12

**Ministry Course Code:** SCH4U

**Instructor:** Franchetta Pepito

Head Teacher: Jenna Mok

**Developed by:** Franchetta Pepito

**Date:** September 2016

**Revision Date:** September 2018

Revised by: Franchetta Pepito

**Developed from:**

Ontario Ministry of Education. (2008 revised ). *The Ontario Curriculum, 11 and 12 :*

*Science* Toronto: Ontario Ministry of Education Training.

**Suggested Free Web Resources:**

<https://phet.colorado.edu/en/simulations/category/new-> provides links to various science laboratory simulations

**Textbook:**

Chemistry 12 Study Guide, Nelson (2012)

**Prerequisite:** Chemistry Grade 11      **Credits:** 1      **Length:** 110 hours

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Head Teacher

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Vice- Principal

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Principal

## Course Description

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

### Overall Curriculum Expectations

#### **Scientific Investigation (inquiry & research) and Career Exploration:**

- demonstrate scientific investigation skills in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);
- identify and describe careers and Canadian contributions related to this field of science.

#### **Organic Chemistry:**

- assess the social and environmental impact of organic compounds used in everyday life, and propose a plan to reduce the use of harmful compounds;
- investigate organic compounds and organic chemical reactions, and use various methods to represent the compounds;
- demonstrate an understanding of the structure, properties, and chemical behaviour of compounds within each class of organic compounds.

#### **Structure and Properties of Matter:**

- assess the benefits to society and evaluate the environmental impact of products and technologies that apply principles related to the structure and properties of matter;
- investigate the molecular shapes and physical properties of various types of matter;
- demonstrate an understanding of atomic structure and chemical bonding, and how they relate to the physical properties of ionic, molecular, covalent network, and metallic substances.

#### **Energy Changes and Rates of Reaction:**

- analyse technologies and chemical processes that are based on energy changes, and evaluate them in terms of their efficiency and their effects on the environment;
- investigate and analyse energy changes and rates of reaction in physical and chemical processes, and solve related problems;
- demonstrate an understanding of energy changes and rates of reaction.

#### **Chemical Systems and Equilibrium:**

- analyse chemical equilibrium processes, and assess their impact on biological, biochemical, and technological systems;
- investigate the qualitative and quantitative nature of chemical systems at equilibrium, and solve related problems;
- demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause shifts in the equilibrium of chemical systems.

#### **Electrochemistry:**

- analyse technologies and processes relating to electrochemistry, and their implications for society, health and safety, and the environment;
- investigate oxidation-reduction reactions using a galvanic cell, and analyse electrochemical reactions in qualitative and quantitative terms;
- demonstrate an understanding of the principles of oxidation-reduction reactions and the many practical applications of electrochemistry.

## Course Content

Unit	Titles and Descriptions	Time and Sequence
Ongoing	<p><b>Scientific Investigation Skills and Career Exploration</b></p> <p>A1. demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating);</p> <p>A2. identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields.</p>	ongoing
Unit 1	<p><b>Organic Chemistry</b></p> <p>B1. assess the social and environmental impact of organic compounds used in everyday life, and propose a course of action to reduce the use of compounds that are harmful to human health and the environment;</p> <p>B2. investigate organic compounds and organic chemical reactions, and use various methods to represent the compounds;</p> <p>B3. demonstrate an understanding of the structure, properties, and chemical behaviour of compounds within each class of organic compounds.</p>	20 hours
Unit 2	<p><b>Structure and Properties of Matter</b></p> <p>C1. assess the benefits to society and evaluate the environmental impact of products and technologies that apply principles related to the structure and properties of matter;</p> <p>C2. investigate the molecular shapes and physical properties of various types of matter;</p> <p>C3. demonstrate an understanding of atomic structure and chemical bonding, and how they relate to the physical properties of ionic, molecular, covalent network, and metallic substances</p>	20 hours
Unit 3	<p><b>Energy Changes and Rates of Reactions</b></p> <p>D1. analyse technologies and chemical processes that are based on energy changes, and evaluate them in terms of their efficiency and their effects on the environment;</p> <p>D2. investigate and analyse energy changes and rates of reaction in physical and chemical processes, and solve related problems;</p> <p>D3. demonstrate an understanding of energy changes and rates of reaction.</p>	20 hours
Unit 4	<p><b>Chemical Systems and Equilibrium</b></p> <p>E1. analyse chemical equilibrium processes, and assess their impact on biological, biochemical, and technological systems;</p> <p>E2. investigate the qualitative and quantitative nature of chemical systems at equilibrium, and solve related problems;</p> <p>E3. demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause shifts in the equilibrium of chemical systems</p>	20 hours

Unit 5	<p><b>Electrochemistry</b></p> <p>F1. analyse technologies and processes relating to electrochemistry, and their implications for society, health and safety, and the environment;</p> <p>F2. investigate oxidation-reduction reactions using a galvanic cell, and analyse electrochemical reactions in qualitative and quantitative terms;</p> <p>F3. demonstrate an understanding of the principles of oxidation-reduction reactions and the many practical applications of electrochemistry.</p>	20 hours
Unit 6	<p><b>ISP Final Evaluation ( 15%)</b></p> <p><b>Strands:</b></p> <ul style="list-style-type: none"> <li>A. Scientific Investigation (inquiry &amp; research) and Career Exploration;</li> <li>B. Organic Chemistry</li> <li>C. Structure and Properties of Matter</li> <li>D. Energy Changes and Rates of Reactions</li> <li>E. Chemical Systems and Equilibrium</li> <li>F. Electrochemistry</li> </ul> <p><b>Overall Expectations:</b> A1-A2,B1-B3,C1-C3,D1-D3,E1-E3,F1-F3</p>	8 Hours
	<p><b>Final Evaluation (Written Test)</b></p> <p><b>Strands:</b></p> <ul style="list-style-type: none"> <li>B. Organic Chemistry</li> <li>C. Structure and Properties of Matter</li> <li>D. Energy Changes and Rates of Reactions</li> <li>E. Chemical Systems and Equilibrium</li> <li>F. Electrochemistry</li> </ul> <p><b>Overall Expectations:</b> B1-B3,C1-C3,D1-D3,E1-E3,F1-F3</p> <p>The final assessment task will be comprised of two parts:</p> <ul style="list-style-type: none"> <li>a) Individual Research or Project that will demonstrate an understanding of concepts learned in course</li> <li>b) Written exam</li> </ul> <p>Each of these two parts will constitute 15% of the final mark.</p>	Research 2 hours- test
	<b>Total</b>	<b>110 hours</b>

## Unit Descriptions

### Unit 1- Organic Chemistry

#### Description

In this unit, the students will investigate the various classes of organic compounds (e.g. alkanes, alkenes, alcohols, ketones etc.) using IUPAC nomenclature to name, write and create chemical and structural formulae. The students will also compare the different classes of organic compounds using molecular models and explore the types of reactions that they participate in (e.g. condensation, elimination, substitution, polymerization etc.). Finally, the students will assess the social and environmental impact that organic compounds use in our everyday life and the proposed courses of actions that will reduce their harmful effects.

#### Specific Expectations:

A. Strand A. Scientific Investigation Skills and Career Exploration: A1.1-A1.13, A2.1-A2.2

B. Structure & Properties of Matter: B1.1-B1.2, B2.1-B2.4, B3.1-B3.5

<b>Assessment For Learning (AFL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Homework Questions	X	X	X	-
Student Notes	X	X	X	-
<b>Assessment As Learning (AAL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Study Log	X	X	X	X
<b>Assessment Of Learning (AOL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
<b>Unit Test</b>	X	X	X	X
Unit Assignment: Brochure: Organic Compound	X	X	X	X

## Unit 2 - Structure and Properties of Matter

### Description

In this unit, Students will demonstrate an understanding of the atomic structure using the Quantum numbers. They will identify the different chemical bonds, and how they relate to the physical properties of ionic, molecular, covalent network, and metallic substances. Student will use VSEPR theory to predict the molecular shapes and physical properties of various types of matter. They will assess the different technologies that use the principles related to the structure of properties of matter.

### Specific Expectations:

**Strand A. Scientific Investigation Skills and Career Exploration: A1.1-A1.13, A2.1-A2.2**

**Strand C. Structure & Properties of Matter: C1.1-C1.2,C2.1-C2.6,C3.1-C3.5**

<b>Assessment For Learning (AFL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Homework Questions	X	X	X	-
Student Notes	X	X	X	-
<b>Assessment As Learning (AAL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Study Log	X	X	X	X
<b>Assessment Of Learning (AOL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
<b>Unit Test</b>	X	X	X	X
Assignment: Foldable: Atomic Theories	X	X	X	-X

### UNIT 3: Energy Changes and Rates of Reactions

#### Description:

In this unit, Students will demonstrate an understanding of energy changes and rates of reaction. They will analyse energy changes and rates of reaction in physical and chemical processes, and solve related problems. Students will also analyse the technologies and chemical processes that are based on energy changes.

#### Specific Expectations:

Strand A. Scientific Investigation Skills and Career Exploration: A1.1-A1.13, A2.1-A2.2

Strand D: Energy Changes and Rates of Reactions: D1.1-D1.2, D2.1-D2.5, D3.1-D3.8

<b>Assessment For Learning (AFL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Homework Questions	X	X	X	-
Student Notes	X	X	X	-
<b>Assessment As Learning (AAL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Study Log	X	X	X	X
<b>Assessment Of Learning (AOL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
<b>Unit 3 Test</b>	X	X	X	X
Assignment: Alternative Source of Energy: Letter to the Editor	X	X	X	-X

## Unit 4 –Chemical Systems and Equilibrium

### Description:

Students will demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause change in the equilibrium of chemical systems. They will solve problems related to different type of chemical system such as acid-base, solubility and dynamic equilibrium. Student will analyse chemical equilibrium processes, and assess their impact on biological, biochemical and technological systems.

### Specific Expectations:

Strand A. Scientific Investigation Skills and Career Exploration: A1.1-A1.13, A2.1-A2.2

Strand E. Chemical Systems and Equilibrium E1.1-E1.2, E2.1-E2.8, E3.1-E3.7

<b>Assessment For Learning (AFL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Homework Questions	X	X	X	-
Student Notes	X	X	X	-
<b>Assessment As Learning (AAL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Study Log	X	X	X	X
<b>Assessment Of Learning (AOL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
<b>Unit Test</b>	X	X	X	X
Laboratory Report - Virtual Experiment	X	X	X	-X



## Unit 5: Electrochemistry

### Description:

In this unit, students will demonstrate an understanding of the principles of oxidation-reduction reactions and use the oxidation number to balance the chemical reaction. They will investigate redox reactions using a galvanic cell, and analyse electrochemical reactions in qualitative and quantitative terms. They will analyse technologies and processes relating to electrochemistry.

### Specific Expectations:

Strand A. Scientific Investigation Skills and Career Exploration: A1.1-A1.13, A2.1-A2.2

Strand F. Electrochemistry: F1.1-F1.2, F2.1-F2.6, F3.1-F3.6

<b>Assessment For Learning (AFL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Homework Questions	X	X	X	-
Student Notes	X	X	X	-
<b>Assessment As Learning (AAL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Study Log	X	X	X	X
<b>Assessment Of Learning (AOL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
<b>Unit Test</b>	X	X	X	X

## Unit 6:ISP- Research or Laboratory Experiment

8 hours

### Description:

In this unit, students will demonstrate an understanding of the principles and concepts learned all throughout the course by researching on a selected topic that covers any . some or all of the concepts learned. Students will communicate with the teacher as to what topic they will research on through email or schoology and schedule for conferences as to progress of research or project

### Specific Expectations:

#### Strands:

- A. Scientific Investigation (inquiry & research) and Career Exploration
- B. Organic Chemistry
- C. Structure and Properties of Matter
- D. Energy Changes and Rates of Reactions
- E. Chemical Systems and Equilibrium
- F. Electrochemistry

#### Overall Expectations:

A1-A2,B1-B3,C1-C3,D1-D3,E1-E3,F1-F3

<b>Assessment For Learning (AFL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Conferences- Email or Through Schoology	X	X	X	-
Student Notes	X	X	X	-
<b>Assessment As Learning (AAL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Study Log	X	X	X	X
<b>Assessment Of Learning (AOL)</b>	<b>K/ U</b>	<b>T</b>	<b>C</b>	<b>A</b>
Research or Laboratory Report	X	X	X	X

## Teaching/Learning Strategies

A variety of strategies are used to allow students many opportunities to attain the necessary skills for success in this course. The teacher uses a variety of whole class, small group and individual activities to facilitate learning. The following is a list of specific teaching/learning strategies that the teacher may use but is not limited to:

- Research Projects
- Simulations
- Review Questions
- Virtual Laboratory
- Self-Assessment
- Independent study

## Assessment/Evaluation Strategies

Assessment For Learning (AFL) is the ongoing process of gathering and interpreting evidence about student learning for the purpose of determining where students are in their learning, where they need to go, and how best to get there. It is a combination of diagnostic and formative assessments. Assessment As Learning (AAL) is the process of developing and supporting student metacognition (self-awareness). AAL teaches students to be more self-directed learners by encouraging personal goal-setting, reflection, and self-assessment. Assessment Of Learning (AOL) is the process of collecting and interpreting evidence for the purpose of summarizing learning at a given point in time, to make judgments about the quality of student learning on the basis of established criteria, and to assign a value to represent that quality. The specific assessment/evaluation strategies used by the teacher has been listed in the unit descriptions.

Students passing courses will be marked according using the following four levels of achievement:

- Level 1 (50-59%)
- Level 2 (60-69%)
- Level 3 (70-79%) (Level 3 is the provincial standard for student achievement.)
- Level 4 (80-100%)

**Level R (<50%)** will be used to indicate students who are performing below the provincial passing standard for a course.

**Final Grade:** The final grade will include the following weighting:

<b>Knowledge And Understanding</b> 30%	<b>Thinking/Inquiry Problem Solving</b> 25%	<b>Application</b> 25%	<b>Communication</b> 30%
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**Seventy percent (70%)** 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 will be given to more recent evidence of achievement.

**Thirty percent (30%)** of the grade will be based on a final evaluation administered at or towards the end of the course. This evaluation will be based on evidence from one or a combination of the following: an examination, a performance, an essay, and/or another method of evaluation suitable to the course content. The final evaluation allows the student an opportunity to demonstrate comprehensive achievement of the overall expectations for the course. **The final evaluation will take the form of a an individually chosen research /investigation/laboratory assignment ( 15% ) and a written examination ( 15%)**

**Total 100%**

## Program Planning

In order to accommodate students' needs, the teachers of UMC High School incorporate appropriate considerations in their program planning and delivery. These considerations may include, but not be limited to:

- Providing adaptive hardware devices (e.g., large screen monitors, larger fonts, special keyboards);
- Providing appropriate environmental accommodations;
- Conferencing with Special Education staff and students to discuss modification and accommodation and to ensure physical aspects of the environment meet the needs of the student and the program;
- Providing word lists, glossaries, definition of terms, PowerPoint notes, and visual if available;
- Grouping weaker students with stronger students to assist in instructional remediation and to provide further challenge;
- Allowing more time to organize and complete assignments and lab exercises;
- Providing a choice of assignment formats where possible;
- Selecting problems that involve programming topics familiar to students to ensure better understanding of requirements;
- Using visual and audio-visual aids;
- Adjusting expectations for written work and number of assignments required;
- Providing for alternative displays of achievement (e.g., oral testing, taped answers, and scribing for students with writing difficulties);
- Providing clarification to students of assessments/evaluation tools such as rubrics and checklists;
- Selecting groups of varied or similar abilities and skills as appropriate to the activity;
- Providing of advanced tutorials and challenges for students with programming experience.