



**TFS High School**  
 5635 Yong St. Suite 206,  
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**COURSE OUTLINE**  
**Chemistry 12, University Preparation**  
**SCH4U**

<b>Department</b>	Science
<b>Instructor</b>	Mr. Babak Samani
<b>Course Development Date</b>	September 2012
<b>Ministry Course Code</b>	SCH4U
<b>Credit Value</b>	1.00
<b>Ministry Curriculum Document</b>	Policy Document: <i>Science, the Ontario Curriculum, Grades 11 and 12, 2008 (Revised)</i> <a href="http://www.edu.gov.on.ca/eng/curriculum/secondary/2009science11_12.txt">http://www.edu.gov.on.ca/eng/curriculum/secondary/2009science11_12.txt</a> <a href="http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf">http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf</a>
<b>Prerequisites</b>	SCH3U  Grade 11 Chemistry, University
<b>Course Revision Date (TFS)</b>	2023

## DESCRIPTION

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.

## OVERALL EXPECTATIONS

*Students final report card grade will be based on the evidence provided of these overall curriculum expectations:*

### Scientific Investigation Skills and Career Exploration

- demonstrate scientific investigation skills in four areas: initiating and planning, performing and recording, analysing and interpreting and communicating.
- identify and describe a variety of careers related to the fields of science under study, and identify scientists, including Canadians, who have made contributions to those fields.

### Energy Changes and Rates of Reaction

- demonstrate an understanding of the energy transformations and kinetics of chemical changes;
- determine energy changes for physical and chemical processes and rates of reaction, using experimental data and calculations;
- demonstrate an understanding of the dependence of chemical technologies and processes on the energetics of chemical reactions.

### Structure and Properties of Matter

- 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;
- investigate and compare the properties of solids and liquids, and use bonding theory to predict the shape of simple molecules;
- describe products and technologies whose development has depended on understanding molecular structure, and technologies that have advanced the knowledge of atomic and molecular theory.

### Organic Chemistry

- demonstrate an understanding of the structure of various organic compounds, and of chemical reactions involving these compounds;
- 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;
- evaluate the impact of organic compounds on our standard of living and the environment.

### Chemical Systems and Equilibrium

- demonstrate an understanding of the concept of chemical equilibrium, Le Chatelier's principle, and solution equilibria;
- investigate the behaviour of different equilibrium systems, and solve problems involving the law of chemical equilibrium;
- explain the importance of chemical equilibrium in various systems, including ecological, biological, and technological systems

## Electrochemistry

- demonstrate an understanding of fundamental concepts related to oxidation-reduction and the inter-conversion of chemical and electrical energy;
- build and explain the functioning of simple galvanic and electrolytic cells; use equations to describe these cells; and solve quantitative problems related to electrolysis;
- 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	Unit Description	Time Frame
1.	<p><b>ORGANIC CHEMISTRY</b></p> <p>Students continue the explorations of organic substances that began in Grade 11. They distinguish among the different classes of organic substances including alcohols, aldehydes, ketones, carboxylic acids, esters, ethers, amines and amides, by name and by structural formula. Inquiry skills such as model building and wet laboratory procedures are used to gather data and information about the properties and types of reactions in order to predict and explain observations. Students investigate the production, uses and importance of polymers in our daily lives.</p> <p>The End-of-Unit Task involves students assessing the risks and benefits associated with the development and application of synthetic organic products and using molecular model kits to predict and explain.</p>	25
2.	<p><b>STRUCTURE AND PROPERTIES OF MATTER</b></p> <p>This unit increases student understanding of the structure of the atom by exploring the quantum mechanical model. They describe products and contributions that have advanced the knowledge of atomic and molecular theory, write electronic configurations, and explain the relationship between the position of elements in the periodic table and their properties. Students investigate solids/liquids and explain how types of chemical bonding account for the properties of ionic, molecular, covalent network and metallic substances. Students predict molecular shape using the Valence Shell Electron Pair Repulsion model. The End-of-Unit Task consists of three parts. First, students analyse the properties of an unknown solid or liquid to determine the type of substance it is (ionic, molecular, covalent network or metallic) and explain their observations. Secondly, students use the Valence Shell Electron Pair Repulsion (VSEPR) theory to predict the shape and polarity of a molecule. Thirdly, students complete a written test.</p>	22 hrs
3.	<p><b>ENERGY CHANGES AND RATES OF REACTION</b></p> <p>This unit involves the study of energy transformations and kinetics of chemical changes. Energy changes for physical and chemical processes and rates of reaction are studied through experimental data and calculations. Research is done on the dependence of chemical technologies and processes on the energetics of chemical reactions. Students may complete a large quiz at the end of both the Energy Changes and the Rates of Reaction section. For the End-of-Unit Task, students design and conduct an experiment to investigate the energy production/absorption and the rate associated with a chemical reaction. A mid-term examination, if one is planned, may take place at the end of this unit.</p>	20 hrs
4.	<p><b>CHEMICAL SYSTEMS AND EQUILIBRIUM</b></p> <p>In this unit, students increase their understanding of solutions to incorporate equilibrium systems. Students investigate the behaviour of different equilibrium systems, e.g., liquid-vapour, insoluble salts, weak acids and bases, and solve problems involving the law of chemical equilibrium. Le Chatelier's principle is used to predict how various factors affect a chemical system at equilibrium. Students explore the importance of equilibrium systems</p>	23 hrs

	in their daily lives, e.g., how they optimize the production of industrial chemicals and the role they play in biological systems. Throughout the unit, the increased encouragement and emphasis is placed on independent learning strategies, e.g., students generate their own notes and compare them with teacher expectations. In the End-of-Unit Task, students use their titration skills and their understanding of molar solubility and the common ion effect to determine an unknown concentration. Students also complete a written test	
5.	<b>ELECTROCHEMISTRY</b> In this unit, students demonstrate an understanding of fundamental concepts related to oxidation-reduction and the inter-conversion of chemical and electrical energy. Students build and explain the functioning of simple galvanic and electrolytic cells and use equations to describe these cells and solve quantitative problems related to electrolysis. Students 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. In the End-of-Unit Task students design and construct their own battery of a given voltage.	<b>20 hrs</b>
	<b>INDEPENDENT STUDY UNIT &amp; FINAL EXAM</b>	
	<b>Total</b>	<b>110 hrs</b>

#### **ASSESSMENT/EVALUATION STRATEGIES:**

Diagnostic assessment is used at the beginning of a unit to assist in determining a starting point for instruction. Assessment for Learning (AFL) provides information to students as they are learning and refining their skills. Assessment as Learning (AAL) acts as a stepping-stone for students to begin applying their understanding using critical thinking; it bridges the gap between AFL and AOL. Assessment of Learning (AOL), at the end of units and course, provides students with the opportunity to synthesize/apply/demonstrate their learning and the achievement of the expectations. The following is a list of specific assessment/evaluation strategies that the teacher may use but is not limited to:

## EVALUATION SCHEME

	Units	Duration	AFL	AAL	AOL	K 30 %	A 20 %	C 20 %	T 30 %
	Scientific Investigation Skills and Career Exploration	Integrated throughout the course							
70 %	2. STRUCTURE AND PROPERTIES OF MATTER	22	Worksheet Class Discussion	Homework Assignment Presentation	Unit Test Quiz	√	√	√	√
	3. ENERGY CHANGES AND RATES OF REACTION	20	Assigned Questions Group Discussion	Homework Assignment	Unit Test Quiz	√	√	√	√
	4. CHEMICAL SYSTEMS AND EQUILIBRIUM	23	Student - Teacher Conferencin g Worksheet	Reflective Discussion Homework Assignment	Unit Test Quiz Virtual Lab	√	√	√	√
	5. ELECTROCHEMISTRY	20	Exit Card Worksheet	Peer Pair Assessment Homework	Unit Test Quiz	√	√	√	√
	1. ORGANIC CHEMISTRY	25	Assigned Questions Group Discussion	Homework Assignment Presentation	Quiz Virtual Lab	√	√	√	√
30 %	1 - 5	Final Exam				√	√	√	√

## TEACHING AND LEARNING STRATEGIES:

- Lecture
- Discussion
- Problem posing
- Brainstorming
- demonstration
- Mathematical problem solving
- Homework
- Critical thinking
- Assignment
- Investigative Inquiry
- Lab report
- Note making

### ASSESSMENT STRATEGIES:

Quiz	Report	Presentation	Extended Investigations
Test (diagnostic)	Skills Checklist	Interview	Project

### RESOURCES:

- Textbook: McGraw-Hill Ryerson Chemistry 12; Mustoe, Dr. Frank, Michael P. Jansen, Dr. Michael Webb et al; McGraw-Hill Ryerson, 2002
- Reference: Nelson Chemistry 12; Di Giuseppe, Maurice, Hans van Kessel, Dr. Frank Jenkins et al; Nelson Thomson Learning, 2003
- Teacher generated handouts

Khan Academy: <https://www.khanacademy.org/science/chemistry>

- Other Web Links:

<http://www.chemguide.co.uk/>  
<http://www.wwnorton.com/college/chemistry/gilbert2/chemtours.asp>  
<http://www.usetute.com.au/>  
<http://www.chemistrydaily.com/chemistry/Category:Chemistry>  
<http://hyperphysics.phy-astr.gsu.edu/hbase/chemical/chemcon.html#c1>

### Achievement Chart: Science, Grades 9-12:

Categories	50-59% (Level 1)	60-69% (Level 2)	70-79% (Level 3)	80-100% (Level 4)
<b>Knowledge and Understanding</b> - Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
	The student:			
<b>Knowledge of content</b> ( <i>e.g., facts, terminology, definitions, safe use of equipment and materials</i> )	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
<b>Understanding of content</b> ( <i>e.g., concepts, ideas, theories, principles, procedures, processes</i> )	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough understanding of content
<b>Thinking and Inquiry</b> - <b>The use of critical and creative thinking skills and inquiry, research, and problem-solving skills and/or processes</b>				
	The student:			

<b>Use of initiating and planning skills and strategies</b> (e.g., <i>formulating questions, identifying the problem, developing hypotheses, selecting strategies and resources, developing plans</i> )	uses initiating and planning skills and strategies with limited effectiveness	uses initiating and planning skills and strategies with some effectiveness	uses initiating and planning skills and strategies with considerable effectiveness	uses initiating and planning skills and strategies with a high degree of effectiveness
<b>Use of processing skills and strategies</b> (e.g., <i>performing and recording, gathering evidence and data, observing, manipulating materials and using equipment safely, solving equations, proving</i> )	uses processing skills and strategies with limited competence	uses processing skills and strategies with moderate competence	uses processing skills and strategies with considerable competence	uses processing skills and strategies with a high degree of competence
<b>Use of critical / creative thinking processes, skills, and strategies</b> (e.g., <i>analysing, interpreting, problem solving, evaluating, forming and justifying conclusions on the basis of evidence</i> )	uses critical / creative thinking processes, skills, and strategies with limited effectiveness	uses critical / creative thinking processes, skills, and strategies with some effectiveness	uses critical / creative thinking processes, skills, and strategies with considerable effectiveness	use critical / creative thinking processes, skills, and strategies with a high degree of effectiveness
<b>Communication - The conveying of meaning through various forms</b>				
	The student:			
<b>Expression and organization of ideas and information</b> (e.g., <i>clear expression, logical organization</i> ) <b>in oral, visual, and/or written forms</b> (e.g., <i>diagrams, models</i> )	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
<b>Communication for different audiences</b> (e.g., <i>peers, adults</i> ) <b>and purposes</b> (e.g., <i>to inform, to persuade</i> ) <b>in oral, visual, and/or written forms</b>	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with a high degree of effectiveness	communicates for different audiences and purposes with considerable effectiveness
<b>Use of conventions, vocabulary, and terminology of the discipline in oral, visual, and/or written forms</b> (e.g., <i>symbols, formulae, scientific notation, SI units</i> )	uses conventions, vocabulary, and terminology of the discipline with limited effectiveness	uses conventions, vocabulary, and terminology of the discipline with some effectiveness	uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness	uses conventions, vocabulary, and terminology of the discipline with a high degree of effectiveness
<b>Application - The use of knowledge and skills to make connections within and between various contexts</b>				
	The student:			
<b>Application of knowledge and skills</b> (e.g., <i>concepts and processes, safe use of equipment, scientific investigation skills</i> ) <b>in familiar contexts</b>	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
<b>Transfer of knowledge and skills</b> (e.g., <i>concepts and processes, safe use of equipment, scientific investigation skills</i> ) <b>to unfamiliar contexts</b>	transfers knowledge and skills to unfamiliar contexts with limited effectiveness	transfers knowledge and skills to unfamiliar contexts with some effectiveness	transfers knowledge and skills to unfamiliar contexts with considerable effectiveness	transfers knowledge and skills to unfamiliar contexts with a high degree of effectiveness
<b>Making connections between science, technology, society, and the environment</b> (e.g., <i>assessing the impact of science on technology,</i>	makes connections between science, technology, society, and the environment	makes connections between science, technology, society, and the environment	makes connections between science, technology, society, and the environment	makes connections between science, technology, society, and the environment

<i>people and other living things, and the environment)</i>	with limited effectiveness	with some effectiveness	with considerable effectiveness	with a high degree of effectiveness
<b>Proposing courses of practical action to deal with problems relating to science, technology, society, and the environment</b>	proposes courses of practical action of limited effectiveness	proposes courses of practical action of some effectiveness	proposes courses of practical action of considerable effectiveness	proposes highly effective courses of practical action

### Learning Skills:

Learning Skills are skills and habits are essential to success in school and in the workplace. Teachers report achievement on the six Learning Skills in the table below using letter codes:

**E** = Excellent      **G** = Good      **S** = Satisfactory      **N** = Needs Improvement.

<b>Learning Skills</b>	<b>Sample Behaviors</b>
Responsibility	The student fulfils responsibilities and commitments within the learning environment; completes and submits class work, homework, and assignments according to agreed-upon timelines; takes responsibility for and manages own behavior.
Organization	The student devises and follows a plan and process for completing work and tasks; establishes priorities and manages time to complete tasks and achieve goals; identifies, gathers, evaluates, and uses information, technology, and resources to complete tasks.
Independent Work	The student independently monitors, assesses, and revises plans to complete tasks and meet goals; uses class time appropriately to complete tasks; follows instructions with minimal supervision.
Collaboration	The student accepts various roles and an equitable share of work in a group; responds positively to the ideas, opinions, values, and traditions of others; builds healthy peer-to-peer relationships through personal and media-assisted interactions; works with others to resolve conflicts and build consensus to achieve group goals; shares information, resources, and expertise and promotes critical thinking to solve problems and make decisions.
Initiative	The student looks for and acts on new ideas and opportunities for learning; demonstrates the capacity for innovation and a willingness to take risks; demonstrates curiosity and interest in learning; approaches new tasks with a positive attitude; recognizes and advocates appropriately for the rights of self and others.
Self-Regulation	The student sets own individual goals and monitors progress towards achieving them; seeks clarification or assistance when needed; assesses and reflects critically on own strengths, needs, and interests; identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; perseveres and makes an effort when responding to challenges.

### Academic Honesty: Cheating and Plagiarism:

Plagiarism is a serious offense. It is defined as taking words, phrasing, sentence structure, or any other element of the expression of another person's **ideas**, and using them as if they were your own. Plagiarism is a violation of another person's rights, whether the material taken is excessive or small. Students will be assisted in developing strategies and techniques to avoid plagiarism. They need to be aware that plagiarized term work will be penalized and could result in a mark of zero.



## Program Planning Considerations for Science

Teachers planning a program in Science must take into account considerations in a number of important areas. Essential information that pertains to all disciplines is provided in the companion piece to this document, *Science. The Ontario Curriculum, Grades 11 and 12: Some Considerations for Program Planning, 2008*. The areas of concern to all teachers include the following:

- I. ***The Role of Technology in the Curriculum.*** Using information technology will assist students in the achievement of many of the expectations in the curriculum regarding research, written work, analysis of information, and visual presentations.
- II. ***English As a Second Language (ESL):*** Appropriate accommodations in teaching, learning, and evaluation strategies will be made to help ESL students gain proficiency in English, since students taking ESL at the secondary level have limited time in which to develop this proficiency.
- III. ***Career Education:*** Expectations in this course include many opportunities for students to explore educational and career options, and to become self-directed learners.
- IV. Health and Safety in Science
- V. Environmental Education
- VI. Critical Thinking and Critical Literacy in Science
- VII. Literacy, Mathematical Literacy, and Investigation (Inquiry/Research) Skills