Ontario eSecondary School
Course Outline
2018-2019

Ministry of Education Course Title: Chemistry, University Preparation	
Ministry Course Code: SCH4U	
Course Type: University Preparation	
Grade: 12	
Credit Value: 1.0	
Prerequisite(s): SCH3U, Grade 11, University Preparation	
Department: Science	
Course developed by: **Sara McCormick**	**Date: March 6th, 2019**
Length: **One Semester**	**Hours:** **110**
This course has been developed based on the following Ministry documents: 1. *Science, The Ontario Curriculum, Grades 11 and 12*, 2008, (revised) 2. *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)* 3. *Learning for All (2013)*	

COURSE DESCRIPTION/RATIONALE

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.

Prerequisite: Chemistry, Grade 11, University Preparation

OVERALL CURRICULUM EXPECTATIONS

Scientific Investigation Skills and Career Exploration

By the end of the course, students will:

- 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)

Structure and Properties of Matter

By the end of this course, students will:

- 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.

Organic Chemistry

By the end of this course, students will:

- 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;
- 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.

Energy Changes and Rates of Reaction

By the end of this course, students will:

- 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

By the end of this course, students will:

- 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
By the end of this course, students will:

- 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	*Length*
Unit 1: Structure and Properties of Matter	30 hours
Unit 2: Organic Chemistry	23 hours
Unit 3: Energy Changes and Rates of Reaction	22.5 hours
Unit 4: Chemical Systems and Equilibrium	20.5 hours
Unit 5: Electrochemistry	14 hours
Total	**110 Hours**
	3 Hour exam
	1.5 Hour Culminating Task

UNIT DESCRIPTIONS

UNIT 1: STRUCTURE AND PROPERTIES OF MATTER

In this unit, students will investigate the molecular shapes and physical properties of various types of matter. Students will also 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. Lastly, students will 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.

UNIT 2: ORGANIC CHEMISTRY

In this unit, students will investigate organic compounds and organic chemical reactions, and use various methods to represent the compound and will demonstrate an understanding of the structure, properties, and chemical behaviour of compounds within each class of organic compounds. Lastly, students will 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.

UNIT 3: ENERGY CHANGES AND RATES OF REACTIONS

In this unit, students will investigate and analyse energy changes and rates of reaction in physical and chemical processes, and solve related problems. Students will also demonstrate an understanding of energy changes and rates of reaction. Lastly, students will 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.

UNIT 4: CHEMICAL SYSTEMS AND EQUILIBRIUM

In this unit, students will investigate the qualitative and quantitative nature of chemical systems at equilibrium, and solve related problems. Students will demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause shifts in the equilibrium of chemical systems. Lastly, students will analyse chemical equilibrium processes, and assess their impact on biological, biochemical, and technological systems.

UNIT 5: ELECTROCHEMISTRY

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

The students will experience a variety of activities:

Video presentations and technological aids (research) with videos embedded to enrich the course content and clarify concepts and skills being studied.

Diagnostic and review activities (audio and video taping) can be student-lead or teacher lead to work as a review for students through audio and video made to share among each other to help reinforce the concepts and skills being studied.

Inquiry activities that will allow students to develop/practice problem solving and critical thinking skills, as well as enrich the course content and clarify concepts and skills being studied.

Brainstorming, visuals and graphic organizers are a great way for students to demonstrate their knowledge of subject matter through graphic organizers, pictures, and texts.

Individual Activities

The teacher should provide a variety of individual assignments to expand and consolidate the learning that takes place in the whole-class and small group activities. Individual activities allow the teacher to accommodate interests and needs and to access the progress of individual students. The teacher plays an important role in supporting these activities through the provision of ongoing feedback to the students, both orally and in writing. Teachers are encouraged to include individual activities such as the following in the course:

Research is completed in an online environment and the use of using reliable sources/A.P.A. formatting is reinforced.

Individual assignments - the teacher can support the student in these activities with ongoing feedback.

Oral presentations are facilitated through the use of video conferencing and video recording.

Practical extension and application of knowledge helps students develop their own voice, and gives them the ability to make personal connections, and connections to the world throughout their course.

e-Portfolios are used in which the student can self-reflect on their subject matter, and see their progress over time. It allows students a different medium of presenting their thoughts and skills learned.

ASSESSMENT, EVALUATION, AND REPORTING

Assessment: The process of gathering information that accurately reflects how well a student is achieving the identified curriculum expectations. Teachers provide students with descriptive feedback that guides their efforts towards improved performance.

Evaluation: Assessment of Learning focuses on Evaluation which is the process of making a judgement about the quality of student work on the basis of established criteria over a limited, reasonable period of time.

Reporting: Involves communicating student achievement of the curriculum expectations and Learning Skills and Work Habits in the form of marks and comments as determined by the teacher's use of professional judgement.

STRATEGIES FOR ASSESSMENT

Assessment practices can nurture students' sense of progress and competency and information instruction. Many diagnostic tools, e.g. checklists and inventories, are used at regular intervals throughout the units to encourage students' understanding of their current status as learners and to provide frequent and timely reviews of their progress.

Units conclude with unit tests and performance tasks (student designed inquiry projects and lab reports). Teachers are encouraged to share goals with students early in the course and to connect Unit learning experiences frequently and explicitly with big ideas, overall expectations, and performance tasks. The teacher could also involve students in the discussion, modification, or creation of rubrics, and teach students to use rubrics as a learning tool that can support the writing process and practice.

ASSESSMENT ACTIVITIES

- ❑ You Try! Self-check problems
- ❑ Homework assignments
- ❑ Individual conference meetings
- ❑ Diagnostic quizzes
- ❑ e-Portfolio contributions (including oral and written submissions)
- ❑ Oral presentations (conferences)
- ❑ Research projects (STSE focused)
- ❑ Inquiry Projects
- ❑ Tests & Exam

EVALUATION

The final grade will be determined as follows:

- ❑ Seventy per cent of the grade will be based on evaluation 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 per cent 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.

  (*Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Ontario Ministry of Education Publication, 2010 p.41)

Weightings	
Course Work	**70**
Knowledge/Understanding	21
Thinking/Inquiry	17.5
Communication	10.5
Application	21
Final	**30**
Performance Task	10
Final Exam	20

TERM WORK EVALUATIONS (70%)

The overview below outlines all Assessment and Evaluation activities for each unit of the course. The following weighting system should be applied when generating a student's mark:

Assignments – 3
STSE Projects - 4
Unit Tests & Inquiry Projects – 6

Unit 1 Assessment & Evaluation Overview

Lesson	Assessment for Learning	Assessment as Learning	Assessment of Learning	
			Activity	Assessment Category
1-Early History of Atomic Theory	ePortfolio [Atomic Theory Timeline] w/ submission box			
2– Spectroscopy and Bohr's Model	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]	ePortfolio [Gizmos Activity – PhotoElectric Effect]		
3- The Wave-Particle	1. You Try! Problems	ePortfolio		

Duality of Light	[Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]	[Emission and Absorption Spectra Lab]		
4 – The Wave-Particle Duality of Matter	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]	ePortfolio [Schrodinger's Cat Analogy]		
5 –Quantum Numbers	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
6 – Atomic Structure and the Periodic Table	1. Atomic Theory Quiz	ePortfolio [Periodic Table Reflection]		
7 – Lewis Structures	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
8 – The VSEPR Theory	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
9 – Polar Molecules	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
10 – Intermolecular Forces	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio [Classroom Scenario] w/ submission box			K/A/C
11 – Introduction to Experimental Design	Lab Report	ePortfolio [Inquiry Reflection Checklist]		
12 – Structure and Properties of Solids	ePortfolio [Properties of Solids Dry Lab] w/ submission box			K/A/C
13 – STSE Project			STSE Project	I/C
14 - Unit 1 Review	Unit Review [Self-Check Answers]	ePortfolio [Success Criteria		

		Checklist]		
15 - Unit 1 Summative Evaluation		ePortfolio [Inquiry Reflection Checklist]	Unit Test Scientific Investigation	K/A I/C

Unit 2 Assessment & Evaluation Overview

Lesson	Assessment for Learning	Assessment as Learning	Assessment of Learning	
			Activity	Assessment Category
1-Introduction to Hydrocarbons	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
2– Cyclical Hydrocarbons, Aromatics and Isomers	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio [Benzene Investigation] Voice recording w/ submission box			I/C
3- Alkyl Halides, Alcohols and Ethers	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
4 – Aldehydes and Ketones	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio [Famous Aldehydes/ Ketones] Padlet or Mindmap w/ submission box			I/C
5 –Carboxylic Acids and Esters	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
6 – Amines and Amides	1. You Try! Problems			K

	[Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] 3. Organic Nomenclature Quiz			
7 – Properties of Organic Compounds	ePortfolio [Properties Comparison Chart & Lab Procedure] w/ submission box			A/C I/C K/A/I/C
8 – Organic Reactions	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]	ePortfolio [Gizmos – Dehydration Synthesis]		
9 – Polymers				I/C
11 – STSE Project			STSE Project	I/C
12 Unit 2 Review	Unit Review [Self-Check Answers]	ePortfolio [Success Criteria Checklist]		
13 Unit 2 Summative Evaluation		ePortfolio [Inquiry Reflection Checklist]	Unit Test Scientific Investigation	K/A I/C

Unit 3 Assessment & Evaluation Overview

Lesson	Assessment for Learning	Assessment as Learning	Assessment of Learning	
			Activity	Assessment Category
1-Calorimetry and Molar Enthalpy	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio -Practical Applications of Calorimetry Voice recording in Poodl			I/C
2– Hess's Law	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
3- Enthalpies of Formation	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] 3. Thermochemistry			

	Quiz			
4 – Rate Laws	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
5 –Potential Energy Diagrams	ePortfolio - Potential Energy Diagram Submission using whiteboard in Poodl w/ submission box		P.E. Diagram Assignment [Dropbox Required]	K/C
6 – Reaction Rate Theories	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]		Reaction Rate Assignment [Dropbox Required]	A/C
7 – STSE Project			STSE Project	I/C
8 - Unit 3 Review	Unit Review [Self-Check Answers]	ePortfolio [Success Criteria Checklist]	Virtual conference with teacher	
9 - Unit 3 Summative Evaluation		ePortfolio [Inquiry Reflection Checklist]	Unit Test Scientific Investigation – Gizmos – "Collision Theories"	K/A I/C

Unit 4 Assessment & Evaluation Overview

Lesson	Assessment for Learning	Assessment as Learning	Assessment of Learning	
			Activity	Assessment Category
1-Chemical Equilibrium	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio [Real world equilibrium example] w/ submission box			I/C
2– The Reaction Quotient	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
3- Le Châtelier's Principle	Quiz	ePortfolio [Haber Process]		
4 – Using the Solubility Product	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]		Relevance of Solubility in the Human Body Assignment	K/A

5 – Weak Acids and Weak Bases	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
6 – Acid Base Titrations	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio [Chemist in Charge- Virtual Conference with Teacher]			K/C
7 – Buffer Systems	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
8 – STSE Project			STSE Project	I/C
9 - Unit 4 Review	Unit Review [Self-Check Answers]	ePortfolio [Success Criteria Checklist]		
10 - Unit 4 Summative Evaluation		ePortfolio [Inquiry Reflection Checklist]	Unit Test Scientific Investigation	K/A I/C

Unit 5 Assessment & Evaluation Overview

Lesson	Assessment for Learning	Assessment as Learning	Assessment of Learning	
			Activity	Assessment Category
1- Redox Reactions	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers] ePortfolio [Real World Electrochemistry Examples] w/ submission box			I/C
2– Balancing Redox Reactions	1. You Try! Problems [Self-Check Answers] 2. Lesson Problem Set [Self-Check Answers]			
3- Galvanic Cells	You Try! Problems [Self-Check Answers]		Assignment	A

4 – Electrolytic Cells and Electroplating	ePortfolio [Metallurgist for a Day- Virtual Conference with Teacher] w/ submission box			K/C
5 – STSE Project			STSE Project	I/C
6 - Unit 5 Review	Unit Review [Self-Check Answers]	ePortfolio [Success Criteria Checklist]	Virtual Conference with Teacher	
7 - Unit 5 Summative Evaluation		ePortfolio [Inquiry Reflection Checklist]	Unit Test Scientific Investigation	K/A I/C

CONSIDERATION FOR PROGRAM PLANNING

PLANNING SCIENCE PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS

Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and they work collaboratively with special education teachers, where appropriate, to achieve this goal. Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006 endorses a set of beliefs that should guide program planning for students with special education needs in all disciplines. Those beliefs are as follows: All students can succeed. Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Successful instructional practices are founded on evidence-based research, tempered by experience.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Ontario schools have some of the most multilingual student populations in the world. The first language of approximately 20 per cent of the students in Ontario's English language schools is a language other than English. Ontario's linguistic heritage includes several Aboriginal languages; many African, Asian, and European languages; and some varieties of English, such as Jamaican Creole. Many English language learners were born in Canada and raised in families and communities in which languages other than English were spoken, or in which the variety of English spoken differed significantly from the English of Ontario classrooms. Other English language learners arrive in Ontario as newcomers from other countries; they may have experience of highly sophisticated educational systems, or they may have come from regions where access to formal schooling was limited. When they start school in Ontario, many of these students are entering a new linguistic and cultural environment.

THE ROLE OF TECHNOLOGY IN THE SCIENCE PROGRAM

Information and communications technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' language learning. ICT tools include multimedia resources, databases, Internet websites, digital cameras, and word-processing programs. Tools such as these can help students to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings. Information and communications technologies can also be used to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Whenever appropriate, therefore, students should be encouraged to use ICT to support and communicate their learning.

ACCOMMODATIONS

Accommodations will be based on meeting with parent, teachers, administration and external educational assessment report. The following three types of accommodations may be provided:

- ❑ ***Instructional accommodations:*** such as changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.
- ❑ ***Environmental accommodations:*** such as preferential seating or special lighting.
- ❑ ***Assessment accommodations:*** such as allowing additional time to complete tests or assignments or permitting oral responses to test questions.

Other examples of modifications and aids, which may be used in this course, are:

- ❑ Provide step-by-step instructions.
- ❑ Help students create organizers for planning tasks.
- ❑ Allow students to report verbally using a voice or video recording.
- ❑ Permit students a range of options for reporting tasks.
- ❑ Provide opportunities for enrichment.