Course Outline

School Name:	KEEWAYTINOOK INTERNET HIGH SCHOOL
Department Name:	Science
Ministry of Education Course Title:	Chemistry
Grade Level:	12
Ministry Course Code:	SCH4U

Teacher's Name: Raj Budhram

Developed by: Raj Budhram Date: November 2013

Revision Date: August 2021

Developed from:
Ontario Ministry of Education. (2008). *The Ontario curriculum, grades 11 and 12: Science.* Toronto ON: Queen's Printer for Ontario.

Text: None

Prerequisite: SCH3U

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval: 

Approval Date: September 16, 2021

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.

Overall Curriculum Expectations

Scientific Investigation Skills and Career Exploration

- Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analyzing and interpreting, and communicating);
- Identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields.

Organic Chemistry

- Assess the social and environmental impact of organic compounds used in everyday life, and a course of action to reduce the use of compounds that are harmful to human health and environment.
- Investigate organic compounds and organic chemical reactions, and use various methods to represent compounds.
- Demonstrate an understanding of the structure, properties, and chemical behaviour of compounds within each class of organic compounds.

Structure and Properties of Matter

- 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 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, technological systems.
- Investigate the qualitative and quantitative nature of chemical systems at equilibrium, and solve 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 health and safety, and the environment.
- Investigate oxidation-reduction reactions using a galvanic cell, and analyse electrochemical 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

1. Organic Chemistry	19 hours
2. Structure and Properties of Matter	19 hours
3. Energy Changes and Rates of Reaction	25 hours
4. Chemical Systems and Equilibrium	22 hours
5. Electrochemistry	25 hours
Total	110 hours

Unit Descriptions

Unit 1 – Organic Chemistry
In this unit, students will build molecular models of organic compounds and they will conduct an experiment to compare three isomeric alcohols reactions with potassium permanganate. They will learn that organic compounds have predictable chemical and physical properties determined by their respective structures, and organic chemical reactions and their applications have significant implications for society, human health, and the environment. Also, students will assess the impact on human health, society, and the environment of organic compounds used in everyday life in their communities and they will propose a course of action to reduce the use of the compounds.

Unit 2 – Structure and Properties of Matter
In this unit, students will observe and analyze the physical properties of various substances and determine the type of bonding present in each substance. They will learn that the nature of the attractive forces that exist between particles in a substance determines the properties and limits the uses of that substance. Also, they will learn that technological devices based on the principles of atomic and molecular structures can have societal benefits and costs. The students will realize that the technological devices are not currently available in most remote FNMI communities because of cost. However, in the future they may become more affordable and therefore more readily accessible.

Unit 3 – Energy Changes and Rates of Reaction
In this unit, students will conduct an inquiry to determine the heat change for the dissociation of ammonium chloride in water. In addition, they will plan and conduct an inquiry to determine how a change in temperature of reactant, concentration of reactant, and surface area of the reactant affect the rate of reaction of chalk and vinegar. Students will learn that energy changes and rates of chemical reactions can be described quantitatively, the efficiency of chemical reactions can be improved by applying optimal conditions, and technologies that transform energy can have societal and environmental costs and benefits. Also, students will analyse the use of fossil fuel, solar power, hydro power, and wind power in their communities, and evaluate them in terms of their efficiency and impact on the environment. Students will realize that in the future their communities have to reduce the use of fossil fuels and increase the use of alternative sources of energy such as wind and solar energy.

Unit 4 – Chemical Systems and Equilibrium
In this unit, students will analyze a video on the Le Chatelier's Principle. They will learn that chemical systems are dynamic and respond to changing conditions in predictable ways. Moreover, they will learn that applications of chemical systems at equilibrium have significant implications for nature and industry. The concepts learned in this unit may not be used by students in remote northern communities. However, the concepts are used in chemical industries in urban areas, so if FNMI students want to seek future position in chemical industries, it is important to learn about the concepts.

Unit 5 – Electrochemistry
In this unit, students will conduct an inquiry to investigate the redox reaction of copper (II) sulphate pentahydrate and magnesium, and they will build a galvanic cell and measure its cell potential. Students will learn that oxidation and reduction are paired chemical reactions in which electrons are transferred from one substance to another in a predictable way, and that the control and

applications of oxidation and reduction reactions have significant implications for industry, health and safety, and the environment. Also, students will be able to apply the concepts that they learned in this unit to prevent the corrosion of metals in their communities.

Teaching/Learning Strategies

This course is organized into an eight-week series of lessons and activities that is presented to students in remote northern communities via the internet. The eighth week is used for course consolidation, review, and the final examination. Teacher and students communicate over the internet through timely activity feedback, emails, messages, video and audio calls. Classroom mentors assume the role of liaison between the teacher and student while also supporting a holistic approach to motivate, engage and support each individual student.

A variety of strategies will be used in the online delivery of this course. Some instructional strategies include:

- Academic vocabulary and language
- Cooperative learning
- Adapting to learning styles/multiple intelligences
- Analysis of student work
- Conferencing
- Discovery/Inquiry-based learning
- Generating and testing hypotheses
- Graphic organizers
- Hands-on learning
- Homework and practice
- Identifying similarities and differences
- Modelling
- Sketching to learn
- Mentoring
- Visualization

Learning goals will be discussed at the beginning of each assignment and success criteria will be provided to students. The success criteria are used to develop the assessment tools in this course, including rubrics and checklists.

Evaluation

The final grade will be determined as follows (Ontario Ministry of Education, 2010):

- 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 should be given to more recent evidence of achievement.
- Thirty percent 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 (p. 41).

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. Toronto ON: Queen's Printer for Ontario.

Type of Assessment	Category	Details	Weighting (%)

Term Work (70%)	Knowledge/ Understanding	Identify and describe careers related to the fields of science under study, and describe the contributions of scientists, including Canadians, to those fields; Demonstrate an understanding of the structure, properties, and chemical behaviour of compounds within each class of organic compounds; 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; Demonstrate an understanding of energy changes and rates of reaction; Demonstrate an understanding of the concept of dynamic equilibrium and the variables that cause shifts in the equilibrium of chemical systems; Demonstrate an understanding of the principles of oxidation-reduction reactions and the many practical applications of electrochemistry.	12
	Thinking	Demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analyzing and interpreting, and communicating); Investigate organic compounds and organic chemical reactions, and use various methods to represent compounds; Investigate the molecular shapes and physical properties of various types of matter; Investigate and analyse energy changes and rates of reaction in physical and chemical processes solve related problems; Investigate the qualitative and quantitative nature of chemical systems at equilibrium, and solve problems; Investigate oxidation-reduction reactions using a galvanic cell, and analyse electrochemical in qualitative and quantitative terms.	17
	Communication	Expression and organization of ideas and information; Communication for different audiences and purposes in oral, visual, and/or written forms; Use of conventions, vocabulary, and terminology of the discipline in oral, visual, and/or written forms.	17
	Application	-assess the social and environmental impact of organic compounds used in everyday life, and a course of action to reduce the use of compounds that are harmful to human health and environment; - 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; - analyse technologies and chemical processes that are based on energy changes, and evaluate	24

		them in terms of their efficiency and their effects on the environment; - analyse chemical equilibrium processes, and assess their impact on biological, biochemical, technological systems; - analyse technologies and processes relating to electrochemistry, and their implications for health and safety, and the environment.	
Final Evaluation (30%)	Culminating Activity (15%)	Knowledge/Understanding	2.5
		Thinking	4
		Communication	4
		Application	4.5
	Exam (15%)	Knowledge/Understanding	2.5
		Thinking	4
		Communication	4
		Application	2.5
		TOTAL	**100**

Assessment/Evaluation Strategies

A variety of assessment and evaluation methods, strategies and tools are required as appropriate to the expectation being assessed. These include diagnostic, formative, and summative within the course and within each unit.

Assessment *for* learning and assessment *as* learning is obtained through a variety of means, including the following:

- Ongoing descriptive feedback;
- Self-assessment (e.g., weekly self-assessment of learning, relative to specific course content as well as in contextual school, community and Land based learning);
- Peer assessment (e.g., peer feedback on personal goals related to course specific content and generalised throughout the school day);
- Mentor observations (e.g. of specific course expectations during Land based and cultural activities as well as during course specific activities);
- Conversations with student on a regular basis to verbalize observations, ask questions, and clarify understanding.

Evidence of student achievement (assessment *of* learning) is collected from various sources, including the following:

- Ongoing assessment/observations of most consistent work, with consideration given to most recent work;
- Conversations with students (e.g., discussion about the harmful effects of commonly used organic compounds and what can the people in the communities do to reduce the harmful effects;
- Summative unit activities (e.g., explain what are some alternative sources of energy that can be used in FNMI communities in the future);
- Culminating activity;
- Exam.

The Ministry of Education's 2010 document, *Growing Success*, outlines the seven fundamental principles that guide best practice in the assessment and evaluation of students. KiHS teachers use practices that:

- are fair, transparent, and equitable for all students;

- support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- are communicated clearly to students and parents at the beginning of the course and at other points throughout the school year or course;
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement;
- develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning (p.6).

Resources

Aboriginal Access to Engineering. (n.d.). *Carol Ann Budd*. https://www.aboriginalaccess.ca/adults/role-models/budd

EnWave. (n.d.). *Home*. EnWave. https://www.enwave.com/

Factmonster. (2017, Feb. 21). *The three R's of the environment.* Fact Monster. https://www.factmonster.com/math-science/earth-environment/the-three-rs-of-the-environment

Ojibwe People's Dictionary. (n.d.). https://ojibwe.lib.umn.edu/

Ontario Ministry of Education. (n.d.). *Indigenous education strategy.* http://www.edu.gov.on.ca/eng/aboriginal/

Ontario Ministry of Education. (2008). *The Ontario curriculum, grades 11 and 12: Science.* http://www.edu.gov.on.ca/eng/curriculum/secondary/2009science11_12.pdf

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf

Ontario Ministry of Education. (2016). *Ontario schools, kindergarten to grade 12: Policy and program requirements.* http://edu.gov.on.ca/eng/document/policy/os/index.html

Ontario Ministry of Labour. (2017). *Youth workers*. https://www.labour.gov.on.ca/english/atwork/youngworkers.php

Rathier, M. (2013, June 20). Le Chatelier's Principle [Video]. YouTube. https://www.youtube.com/watch?v=RjFW3smI1fY

Toulouse, P.R. (2016). What matters in Indigenous education: Implementing a vision committed to holism, diversity and engagement. https://peopleforeducation.ca/wp-content/uploads/2017/07/MWM-What-Matters-in-Indigenous-Education.pdf

Program Planning

This course is offered to Indigenous students living in isolated, northern Ontario communities. It is offered by qualified teachers in a blended classroom with a balance of academic, wellness, land-based learning, local language and culture to support the success of the whole student. This course uses the internet for instruction, demonstration and research. It utilizes a student-centered semi-virtual classroom which capitalizes on the strengths of internet program delivery to minimize the disadvantages of geographic remoteness.

Students are presented with 1320 minutes of instruction/activity via the internet over the period of one week. All lessons, assignments, questions and course material is presented in this manner, with approved print materials available as a student resource in each classroom. The student and instructor communicate via the internet, while a classroom mentor (a fully qualified teacher) assists students in completing tasks in a timely manner and provides support as required.

Indigenous and local content is used throughout the course to meet students' learning needs. Opportunities for outdoor activities and land-based learning are also incorporated and students are encouraged to use local knowledge in their products. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required. Opportunities have been provided for students to apply ideas and concepts encountered in this course to their lives as an individual and as a member of a First Nations community. Teachers consult the Ontario Ministry of Education policies, guidelines and important initiatives when planning a comprehensive program in this area.