Ontario eSecondary School
Course Outline
2022-2023

Ministry of Education Course Title: Science	
Ministry Course Code: SNC1W	
Course Type: De-streamed	
Grade: 9	
Credit Value: 1.0	
Prerequisite(s): None	
Department: Science	
Course developed by: Victoria Townsend	**Date:** August 31, 2022 **Revised:** TBD
Length: One Semester	**Hours:** 110

This course has been developed based on the following Ministry documents:

1. *Science SNC1W, The Ontario Curriculum (2022)*
2. *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)*
3. *Learning for All (2013)*

COURSE DESCRIPTION/RATIONALE

This course enables students to develop their understanding of concepts related to biology, chemistry, physics, and Earth and space science, and to relate science to technology, society, and the environment. Throughout the course, students will develop and refine their STEM skills as they use scientific research, scientific experimentation, and engineering design processes to investigate concepts and apply their knowledge in situations that are relevant to their lives and communities. Students will continue to develop transferable skills as they become scientifically literate global citizens.

OVERALL CURRICULUM EXPECTATIONS

A. STEM Skills, Careers, and Connections

By the end of this course, students will:

- A1. STEM Investigation Skills - apply scientific processes and an engineering design process in their investigations to develop a conceptual understanding of the science they are learning, and apply coding skills to model scientific concepts and relationships
- A2. Applications, Careers, and Connections - analyse how scientific concepts and processes can be applied in practical ways to address real-world issues and in various careers, and describe contributions to science from people with diverse lived experiences

In the subsequent strands, students integrate learning from Strand A into Strand B, C, D and E as they investigate concepts, develop and apply skills, and make meaningful connections to their lives, their communities, and the environment.

B. Sustainable Ecosystems and Climate Change (Biology)

By the end of this course, students will:

- B1. Relating Science to Our Changing World - assess impacts of climate change on ecosystem sustainability and on various communities, and describe ways to mitigate these impacts
- B2. Investigating and Understanding Concepts - demonstrate an understanding of the dynamic and interconnected nature of ecosystems, including how matter cycles and energy flows through ecosystems

C. The Nature of Matter (Chemistry)

By the end of this course, students will:

- C1. Relating Science to Our Changing World - assess social, environmental, and economic impacts of the use of elements, compounds, and associated technologies
- C2. Investigating and Understanding Concepts - demonstrate an understanding of the nature of matter, including the structure of the atom, physical and chemical properties of common elements and compounds, and the organization of elements in the periodic table

D. Principles and Applications of Electricity (Physics)

By the end of this course, students will:

- D1. Relating Science to Our Changing World - assess social, environmental, and economic impacts of electrical energy production and consumption, and describe ways to achieve sustainable practices
- D2. Investigating and Understanding Concepts - demonstrate an understanding of the nature of electric charges, including properties of static and current electricity

E. Space Exploration (Earth and Space Science)

By the end of this course, students will:

- E1. Relating Science to Our Changing World - evaluate social, environmental, and economic impacts of space exploration and of technological innovations derived from space exploration
- E2. Investigating and Understanding Concepts - demonstrate an understanding of the components, characteristics, and associated phenomena of the solar system and the universe, and the importance of the Sun to processes on Earth

COURSE CONTENT

Unit	*Length*
Unit 0: Welcome and Intro to STEM	1 hour
Unit 1: Sustainable Ecosystems and Climate Change (Biology)	24 hours
Unit 2: Nature of Matter (Chemistry) and Midterm	28 hours
Unit 3: Characteristics and Applications of Electricity (Physics)	24 hours
Unit 4: Space Exploration (Earth and Space Science)	23 hours
Unit 5: Cumulative Assessments (Final Project and Final Exam)	10 hours
Total	**110 Hours**

UNIT DESCRIPTIONS

UNIT 1: Sustainable Ecosystems and Climate Change (Biology)
In this unit, students will develop an understanding of sustainable ecosystems and how sustainability is related to various ecological factors and processes, such as biodiversity, air and water quality, and soil health. Students assess how human activities impact the environment, including how they contribute to climate change, and explore ways to address some of the impacts. Students will investigate the flow of energy and the cycling of matter in the environment and the importance of these natural processes in maintaining a dynamic equilibrium in ecosystems. In doing so, students will interpret, investigate, apply, analyze, design for, and evaluate the following big ideas:

- Environmental sustainability depends on the dynamic equilibrium of ecosystems.
- The cycling of matter and flow of energy within and between Earth's four spheres are natural processes that help maintain balance in ecosystems.
- Human activities, including activities that contribute to climate change, impact environmental sustainability, and it is our collective responsibility to mitigate these impacts.

UNIT 2: Nature of Matter (Chemistry)
In this unit, students will explore the relevance of chemistry to their daily lives by investigating the use and safe disposal of various elements and compounds. Additionally, they assess the impacts of chemical processes and technologies on society and the environment. Students will investigate the nature of matter by studying properties of elements and compounds, the structure of atoms, and the relationship between the atomic structure of elements and the organization of the periodic table. In doing so, students will interpret, investigate, apply, analyze, design for, and evaluate the following big ideas:

- Atoms are the building blocks of matter.
- There is a relationship between the atomic structure of elements, their properties, and the organization of the periodic table.
- Elements and compounds have specific physical and chemical properties, which determine their uses.
- The use of elements and compounds in consumer products and chemical technologies has both positive and negative impacts on society, the economy, and the environment.

UNIT 3: Characteristics and Applications of Electricity (Physics)
In this unit, students will develop an understanding of the impacts of electrical energy production and consumption on society, the environment, and the economy, and explore ways to achieve sustainable practices. Students will also investigate the nature of electric charges, including properties of static and current electricity, and explain the relationships between various electrical quantities.In doing so, students will interpret, investigate, apply, analyze, design for, and evaluate the following big ideas:

- The distinct properties of static and current electricity can be explained by the behaviour of electric charges.
- Electrical energy can be produced from renewable and non-renewable sources and converted to other forms of energy to meet various needs.

- The production and consumption of electrical energy has social, economic, and environmental impacts that can be addressed through sustainable practices.

UNIT 4: Space Exploration (Earth and Space Science)
In this unit, students investigate the impacts of space exploration on society, the environment, and the economy, and the importance to society of technological innovations resulting from space exploration. Students also learn about the components of the solar system and the universe and the Sun's relationship to processes on Earth. In doing so, students will interpret, investigate, apply, analyze, design for, and evaluate the following big ideas:

- The solar system and the universe have various components with distinct characteristics that can be investigated and quantified.
- The Sun plays a critical role in sustaining life on Earth and in contributing to renewable energy production.
- Space observation, space exploration, and associated space exploration technologies advance our understanding of the universe, and have social, economic, and environmental impacts.

UNIT 5: Cumulative Assessments (Final Project and Final Exam)
For the final project, students will relate all four units to the Canadian tar sands project. Students will analyze science concepts and theories from each unit in the context of a real life engineering and science application, establishing a basis of scientific analysis to evaluate this project in terms of innovation (science and engineering), the environment, and social issues including eco-justice and indigenous rights. Equal emphasis is placed on knowledge, thinking, communication and application. Finally, students will finish the course with a two hour, comprehensive proctored exam.

TEACHING AND LEARNING STRATEGIES

The students will experience a variety of activities:

Presentations with embedded videos are utilized to outline concepts, explain theory with the use of examples and practice questions, and incorporate multi-media opportunities for students to learn more (e.g. online simulations, quizzes, etc.)

Virtual simulations are interactive websites that provide students with an opportunity to ask questions, explore hypotheses, relate variables, examine relationships, and make connections between theory and application in a safe environment that promotes intellectual risk taking and curiosity.

Virtual labs are interactive websites that provide students with an opportunity to follow a procedure to test hypotheses using scientific apparatus, gather and record observations, analyze observations using formula and relevant theory/concepts, and then formulate conclusions that relate hypotheses to analysis.

Articles are examples of concepts and theories being discussed in the public realm and with respect to current events. They are snapshots not only of why scientific theories/concepts/applications are relevant but also provide a window into the broader context of scientific knowledge and understanding. Students learn through reading and analysis that science is deeply related to, and intertwined with, society and the diverse perspectives of lived experience.

Cases are summaries of real life problems wherein students relate scientific theories/concepts/formulas towards solving the problem in a real world context. In this course, cases are also used to role play the role of an engineer or scientist, so students explore the work of an engineer/scientist - not only what they do but also how they do it and why.

Diagrams are visual representations of scientific ideas and concepts. They provide another perspective to organize ideas. Visuals are thought to promote cognitive plasticity - meaning, they can help us change our minds or help us to remember an idea. One type of diagram is a process diagram. This helps us to look at the sequence of events or tasks that lead to a result - e.g. the sequence of events that leads to an algae bloom.

Charts are visual representations of scientific ideas and concepts using math. In doing so, they support analysis. For example, you can have a pie chart that shows Canada's energy sources.

Maps are visual representations that relate scientific ideas/concepts/applications to geographic data. For example, we can understand that based on how the earth revolves around the sun and rotates on its axis, different areas of the world see the sun rise and set at different times. We can plot this data on a map to show time zones.

Drawings and schematics are engineering ideas explained visually. For example, an electric circuit can be explained using symbols, which makes it possible to communicate ideas universally, clearly and succinctly.

Tables involve organizing information in terms of categories (rows and columns). This helps us to understand the relationships between ideas and data, as well as highlight trends.

End of unit conversations and Poodlls are opportunities for students to express their ideas, problem solving, and thought processes with a teacher who provides immediate feedback.

Design projects are an opportunity for students to put their learning to the test in a real-world scenario, to address a design problem with a direct connection to people, the environment, economics, etc. Students collect information, apply problem solving, and use critical thinking to develop practical solutions that directly address their design problems.

Research projects are an opportunity to apply inquiry skills to a practical problem or question. Students perform research to gather information, evaluate quality sources, analyze findings, evaluate their analysis, and synthesize their findings into conclusions. Throughout, students apply both creative thinking and critical thinking. New questions are also developed to continue learning in loops.

Reflection is an opportunity for students to look back at concepts and theories with new eyes, to relate theory to practice, and to align learning with their own values and beliefs.

Discussions with the instructor are facilitated through video conferencing with their subject teacher, concerning the concepts and skills being studied. This enables two-way communication between the student and the instructor, to share ideas as well ask questions in dialogue. This also helps to build a relationship between the student and instructor.

Practical extension and application of knowledge are integrated throughout each lesson through examples, cases, design, simulation, labs, research, discussion, etc. The goal is to help students to make connections between what they learn in the classroom and how they understand and relate to the world around them and their own lives. The goal is to make learning come alive as a dynamic opportunity for students to be more aware that science is all around them and enable them to create more meaning in their lives.

Individual activities/assignments the majority of the assessments are completed individually at a student's own pace and are intended to expand and consolidate the learning in each lesson. Individual activities allow the teacher to accommodate interests and needs and to assess the progress of individual students. For this reason, students are encouraged to discuss IEPs (Individual Education Plans) with their teacher and to ask to modify assessments if they have a unique interest that they feel could be pursued in the assessment. The teacher plays an important role in supporting these activities by providing ongoing feedback to students, both orally and in writing.

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. These assessments are not for marks.

- In assessment for learning (AFL), teachers provide students with descriptive feedback and coaching for improvement.
- In assessment as learning (AAL), teachers help students develop their capacity to be independent, autonomous learners who are able to set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning.

Evaluation: Assessment of Learning (AOL) 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

A number of assessments are used throughout the unit, typically one per lesson. Students are urged to complete each assessment fully to truly test their knowledge and understanding of concepts. This provides the teacher with an opportunity to provide feedback that can improve a student's learning (AFL/AOL) and evaluate it (AOL). Students are encouraged to ask the teacher if they have questions relating to an assessment, especially an AOL to ensure that the student receives the best mark possible. Assessment practices can nurture a student's sense of progress and provide a motivation for continued learning. A variety of assessment designs are incorporated in each unit, to ensure that students are learning and assessing their learning in a variety of ways. Rubrics and marking schemes are outlined where appropriate, and students are encouraged to self-evaluate their work using these tools.

ASSESSMENT ACTIVITIES

- ❑ True and false questions
- ❑ Definition questions
- ❑ Fill in the blank (e.g. with tables) questions
- ❑ Short answer questions
- ❑ Long answer questions
- ❑ Reflections
- ❑ Graphs - plotting and analyzing
- ❑ Drawings / diagrams / sketches / schematics - creating, labeling, and analyzing
- ❑ Problem solving calculations
- ❑ Lab reports
- ❑ Simulation, lab, and case study worksheets
- ❑ Research projects and reports
- ❑ Design projects and reports
- ❑ End of unit conversations (google meets)
- ❑ End of unit poodll elevator pitches (1 minute speech recording)
- ❑ Midterm exam
- ❑ Final exam

EVALUATION

The final grade will be determined as follows:

- 70% 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.
- 30% of the grade will be based on a final evaluation administered at the end of the course. This evaluation will be based on evidence from a final project and final exam, both comprehensive of the course. The final evaluation is opportunity for the student 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)

TERM WORK EVALUATIONS (70%):

Evaluation Item	Description	Category	Weight
Unit 1 Boreal Forest Research Study	Students will research ecology concepts that relate to the Boreal Forest.	K, I, C, A	7
Unit 1 Climate Change Elevator Pitch	Students will create a one minute speech about why climate change matters based on scientific evidence.	K, I, C, A	3.5
Unit 1 Wildlife Crossing Assessment	Students will evaluate a wildlife crossing using the environmental assessment model.	K, I, C, A	7
Unit 2 Superhero Element Project	Students will research an element and apply creative problem solving to design a superhero that embodies their element's chemical and physical properties.	K, I, C, A	7
Unit 2 Conversation	Students will discuss various questions from unit 2 with the course instructor. This is also an opportunity for students to ask questions before the midterm exam.	K, I, C, A	3.5
Midterm Exam	Students will complete a proctored two hour midterm exam based on units 1 and 2.	K,I,C,A	7
Midpoint of the course			
Unit 3 Nuclear Power and Implications Project	Students will look at the technology behind nuclear power as well as its social, environmental, and economic implications.	K,I,C,A	7
Unit 3 Energy Usage Elevator Pitch	Students will create their own one minute speech about solving common energy usage issues.	K,I,C,A	3.5
Unit 3 Arctic Energy Design Project	Students will engage in the design of a greenhouse for the arctic to promote food security.	K,I,C,A	7
Unit 4 Humans and Technology in Space	Students will research Canada's contributions to space exploration and analyze human impacts of space travel.	K,I,C,A	7
Unit 4 Conversation	Students will discuss various questions from unit 4 with the course instructor. This is also an opportunity for students to ask questions before the final exam.	K,I,C,A	3.5
Unit 4 Space Research that Helps Our Everyday Life	Students will research space scientific discovery spin-offs and technology transfer that benefit the public and every day life.	K,I,C,A	7

FINAL EVALUATIONS (30%):

Evaluation Item	Description	Category	Weight
Final Project	Students will evaluate the Canadian tar sands in terms of its scientific and engineering innovation and social and environmental impact, performing inquiry and conducting research in relation to all four units.	SUM	15
Final Exam	Students will complete this proctored two hour exam that addresses all four units in the course.	SUM	15

	Weight
Course Work	**70**
Knowledge/Understanding	17.5
Thinking/Inquiry	17.5
Communication	17.5
Application	17.5
Final	**30**
Exam	20
Culminating Project	10

AFL/AAL/AOL Tracking sheet:

Unit 1: Sustainable Ecosystems and Climate Change (Biology)

AAL	AFL	AOL
Food Chains, Food Webs, and Energy Pyramid	Your Ecosystem	Boreal Forest Research Study
Gizmo Food Chain and Population Worksheet	Population Dynamics	Climate Change Elevator Pitch
Gizmo Photosynthesis Lab Worksheet	Gizmo Nitrogen Cycle STEM Case	Wildlife Crossing Environmental Assessment

Unit 2: Nature of Matter (Chemistry)

AAL	AFL	AOL
Gizmo Phase Changes Worksheet	Gizmo Density Lab Worksheet	Superhero Element Project
Physics vs. Chemical Properties and Changes	Bohr-Rutherford Diagrams	End of Unit 2 Conversation
Elements and Atoms	Exploring the Periodic Table	Midterm Test
Classifying Matter	Compounds and Molecules	

Unit 3: Characteristics and Applications of Electricity (Physics)

AAL	AFL	AOL
Introduction to Electricity	Charging an Object	Nuclear Power and Social-Environmental-Economic Implications Project
Current, Voltage and Resistance	Circuit Diagrams	Energy Usage Elevator Pitch
Gizmo Household Energy Usage Worksheet	Gizmo Circuits Lab Worksheet	Arctic Energy Design Project

Unit 4: Space Exploration (Earth and Space Science)

AAL	AFL	AOL
Introduction to Astronomy	Gizmo H-R Diagram Worksheet	Humans and Technology in Space
Planetary Database	Space Motion and Distance	End of Unit 4 Conversation
Celestial Objects in Our Solar System	Gizmo Big Bang Worksheet	Space Research that Helps Our Everyday Life

Unit 5: Cumulative Assessments

AAL	AFL	AOL
		Final Project
		Final Exam

CONSIDERATION FOR PROGRAM PLANNING

PLANNING 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 percent 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 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 parents, teachers, administration and external educational assessment reports. 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.
- ***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 writing tasks.
- ❑ Allow students to report verbally to a scribe (teacher/ student) who can help in note taking.
- ❑ Permit students a range of options for reading and writing tasks.
- ❑ Where an activity requires reading, provide it in advance.
- ❑ Provide opportunities for enrichment.