

**Main Criteria:** Forward Education  
**Secondary Criteria:** Ontario Curriculum  
**Subjects:** Mathematics, Science, Technology Education  
**Grades:** 11, 12, Key Stage 4

## Forward Education

Autonomous Electric Vehicles of the Future

Ontario Curriculum

Mathematics

Grade 12 - Adopted: 2007

**STRAND / COURSE** **Advanced Functions, Grade 12: University Preparation (MHF4U)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MHF4U. D.</b>	<b>Characteristics of Functions</b>
<b>STAGE / SKILLS</b>	<b>MHF4U. D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>MHF4U. D.3.</b>	<b>Using Function Models to Solve Problems: By the end of this course, students will:</b>

EXPECTATION MHF4U.D.3.3. Solve problems, using a variety of tools and strategies, including problems arising from real-world applications, by reasoning with functions and by applying concepts and procedures involving functions (e.g., by constructing a function model from data, using the model to determine mathematical results, and interpreting and communicating the results within the context of the problem)

**STRAND / COURSE** **Calculus and Vectors, Grade 12: University Preparation (MCV4U)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MCV4U. B.</b>	<b>Derivatives and their Applications</b>
<b>STAGE / SKILLS</b>	<b>MCV4U. B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>MCV4U. B.2.</b>	<b>Solving Problems Using Mathematical Models and Derivatives: By the end of this course, students will:</b>

EXPECTATION MCV4U.B.2.4. Solve optimization problems involving polynomial, simple rational, and exponential functions drawn from a variety of applications, including those arising from real-world situations

**STRAND / COURSE** **Calculus and Vectors, Grade 12: University Preparation (MCV4U)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MCV4U. C.</b>	<b>Geometry and Algebra of Vectors</b>
<b>STAGE / SKILLS</b>	<b>MCV4U. C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION MCV4U.C.3. Distinguish between the geometric representations of a single linear equation or a system of two linear equations in two-space and three-space, and determine different geometric configurations of lines and planes in three-space;

**STRAND / COURSE** **Mathematics of Data Management, Grade 12: University Preparation (MDM4U)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MDM4U. E.</b>	<b>Culminating Data Management Investigation</b>
<b>STAGE / SKILLS</b>	<b>MDM4U. E.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>MDM4U. E.2.</b>	<b>Presenting and Critiquing the Culminating Investigation: By the end of this course, students will:</b>
EXPECTATION	MDM4U. E.2.4.	Critique the mathematical work of others in a constructive manner

**STRAND / COURSE** **Mathematics for College Technology, Grade 12: College Preparation (MCT4C)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MCT4C. B.</b>	<b>Polynomial Functions</b>
<b>STAGE / SKILLS</b>	<b>MCT4C. B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>MCT4C. B.3.</b>	<b>Solving Problems Involving Polynomial Equations: By the end of this course, students will:</b>
EXPECTATION	MCT4C.B .3.6.	Determine the value of a variable of degree no higher than three, using a formula drawn from an application, by first substituting known values and then solving for the variable, and by first isolating the variable and then substituting known values

**STRAND / COURSE** **Foundations for College Mathematics, Grade 12: College Preparation (MAP4C)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MAP4C. A.</b>	<b>Mathematical Models</b>
<b>STAGE / SKILLS</b>	<b>MAP4C. A.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>MAP4C. A.3.</b>	<b>Make connections between formulas and linear, quadratic, and exponential relations, solve problems using formulas arising from real-world applications, and describe applications of mathematical modelling in various occupations.</b>

**STRAND / COURSE** **Foundations for College Mathematics, Grade 12: College Preparation (MAP4C)**

<b>STRAND / OVERALL EXPECTATION</b>	<b>MAP4C. A.</b>	<b>Mathematical Models</b>
<b>STAGE / SKILLS</b>	<b>MAP4C. A.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>MAP4C. A.2.</b>	<b>Modelling Graphically: By the end of this course, students will:</b>
EXPECTATION	MAP4C. A.2.6.	Recognize that a linear model corresponds to a constant increase or decrease over equal intervals and that an exponential model corresponds to a constant percentage increase or decrease over equal intervals, select a model (i.e., linear, quadratic, exponential) to represent the relationship between numerical data graphically and algebraically, using a variety of tools (e.g., graphing technology) and strategies (e.g., finite differences, regression), and solve related problems

**STRAND / COURSE**

**Foundations for College Mathematics, Grade 12: College Preparation (MAP4C)**

<b>STRAND / OVERALL EXPECTATION</b>	MAP4C.A.	Mathematical Models
<b>STAGE / SKILLS</b>	MAP4C.A.SE.	Specific Expectations
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	MAP4C.A.3.	Modelling Algebraically: By the end of this course, students will:

EXPECTATION MAP4C.A.3.2. Determine the value of a variable of degree no higher than three, using a formula drawn from an application, by first substituting known values and then solving for the variable, and by first isolating the variable and then substituting known values

Ontario Curriculum  
 Science  
 Grade 11 - Adopted: 2008

**STRAND / COURSE**

**ON.SBI3U Biology, Grade 11 University Preparation SBI3U**

<b>STRAND / OVERALL EXPECTATION</b>	SBI3U.B.	Diversity of Living Things
<b>STAGE / SKILLS</b>	SBI3U.B.OE.	Overall Expectations: By the end of this course, students will:

SUB-ORGANIZER / SPECIFIC EXPECTATION SBI3U.B1. Analyse the effects of various human activities on the diversity of living things;

**STRAND / COURSE**

**ON.SBI3U Biology, Grade 11 University Preparation SBI3U**

<b>STRAND / OVERALL EXPECTATION</b>	SBI3U.B.	Diversity of Living Things
<b>STAGE / SKILLS</b>	SBI3U.B.SE.	Specific Expectations
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	SBI3U.B.1.	Relating Science to Technology, Society, and the Environment: By the end of this course, students will:

EXPECTATION SBI3U.B1.2. Analyse the impact that climate change might have on the diversity of living things (e.g., rising temperatures can result in habitat loss or expansion; changing rainfall levels can cause drought or flooding of habitats) [AI, C]

**STRAND / COURSE**

**ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	SCH3U.B.	Matter, Chemical Trends, and Chemical Bonding
<b>STAGE / SKILLS</b>	SCH3U.B.OE.	Overall Expectations: By the end of this course, students will:

SUB-ORGANIZER / SPECIFIC EXPECTATION	SCH3U.B 1.	Analyse the properties of commonly used chemical substances and their effects on human health and the environment, and propose ways to lessen their impact;
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**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.C.</b>	<b>Chemical Reactions</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SCH3U.C 1.	Analyse chemical reactions used in a variety of applications, and assess their impact on society and the environment;
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SCH3U.C 3.	Demonstrate an understanding of the different types of chemical reactions.
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**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.C.</b>	<b>Chemical Reactions</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.C.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH3U.C1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION	SCH3U.C 1.1.	Analyse, on the basis of research, chemical reactions used in various industrial processes (e.g., pulp and paper production, mining, chemical manufacturing) that can have an impact on the health and safety of local populations [IP, PR, AI, C]
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EXPECTATION	SCH3U.C 1.2.	Assess the effectiveness of some applications of chemical reactions that are used to address social and environmental needs and problems [AI, C]
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**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.C.</b>	<b>Chemical Reactions</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.C.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH3U.C2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION	SCH3U.C 2.2.	Write balanced chemical equations to represent synthesis, decomposition, single displacement, double displacement, and combustion reactions, using the IUPAC nomenclature system [PR, AI, C]
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**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.C.</b>	<b>Chemical Reactions</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.C.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH3U.C3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION      SCH3U.C 3.2. Explain the difference between a complete combustion reaction and an incomplete combustion reaction (e.g., complete and incomplete combustion of hydrocarbon fuels)

**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.D.</b>	<b>Quantities in Chemical Reactions</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.D.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION      SCH3U.D 1. Analyse processes in the home, the workplace, and the environmental sector that use chemical quantities and calculations, and assess the importance of quantitative accuracy in industrial chemical processes;

**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.D.</b>	<b>Quantities in Chemical Reactions</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH3U.D1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION      SCH3U.D 1.1. Analyse processes in the home, the workplace, and the environmental sector that involve the use of chemical quantities and calculations (e.g., mixing household cleaning solutions, calculating chemotherapy doses, monitoring pollen counts) [AI, C]

EXPECTATION      SCH3U.D 1.2. Assess, on the basis of research, the importance of quantitative accuracy in industrial chemical processes and the potential impact on the environment if quantitative accuracy is not observed [IP, PR, AI, C]

**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.F.</b>	<b>Gases and Atmospheric Chemistry</b>
<b>STAGE / SKILLS</b>	<b>SCH3U.F.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SCH3U.F.1.	Analyse the cumulative effects of human activities and technologies on air quality, and describe some Canadian initiatives to reduce air pollution, including ways to reduce their own carbon footprint;
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**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.F.</b>	<b>Gases and Atmospheric Chemistry</b>
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<b>STAGE / SKILLS</b>	<b>SCH3U.F.SE.</b>	<b>Specific Expectations</b>
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<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH3U.F1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
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EXPECTATION	SCH3U.F.1.1.	Analyse the effects on air quality of some technologies and human activities (e.g., smelting; driving gas-powered vehicles), including their own activities, and propose actions to reduce their personal carbon footprint [AI, C]
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EXPECTATION	SCH3U.F.1.2.	Assess air quality conditions for a given Canadian location, using Environment Canada's Air Quality Health Index, and report on some Canadian initiatives to improve air quality and reduce greenhouse gases (e.g., Ontario's Drive Clean program to control vehicle emissions) [AI, C]
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**STRAND / COURSE**      **ON.SCH3 Chemistry, Grade 11 University Preparation SCH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH3U.F.</b>	<b>Gases and Atmospheric Chemistry</b>
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<b>STAGE / SKILLS</b>	<b>SCH3U.F.SE.</b>	<b>Specific Expectations</b>
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<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH3U.F3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>
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EXPECTATION	SCH3U.F.3.1.	Identify the major and minor chemical components of Earth's atmosphere
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.B.</b>	<b>Scientific Solutions to Contemporary Environmental Challenges</b>
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<b>STAGE / SKILLS</b>	<b>SVN3M.B.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.B.1.	Analyse social and economic issues related to an environmental challenge, and how societal needs influence scientific endeavours related to the environment;
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.B.3.	Demonstrate an understanding of major contemporary environmental challenges and how we acquire knowledge about them.
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M M.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.B.</b>	<b>Scientific Solutions to Contemporary Environmental Challenges</b>
<b>STAGE / SKILLS</b>	<b>SVN3M.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3M.B1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
EXPECTATION	SVN3M.B 1.1.	Analyse, on the basis of research, social and economic issues related to a particular environmental challenge (e.g., overfishing, deforestation, acid rain, melting of the polar ice cap) and to efforts to address it [IP, PR, AI, C]
EXPECTATION	SVN3M.B 1.2.	Analyse ways in which societal needs or demands have influenced scientific endeavours related to the environment (e.g., the development of drought- and pest-resistant crops to address the rising global need for food; research into alternative energy sources in response to demands to address the impact on climate change of burning fossil fuels) [AI, C]

**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M M.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.B.</b>	<b>Scientific Solutions to Contemporary Environmental Challenges</b>
<b>STAGE / SKILLS</b>	<b>SVN3M.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3M.B2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>
EXPECTATION	SVN3M.B 2.1.	Use appropriate terminology related to the application of scientific knowledge and procedures to environmental issues, including, but not limited to: fact, inference, paradigm, objectivity, and causality [C]

**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M M.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.B.</b>	<b>Scientific Solutions to Contemporary Environmental Challenges</b>
<b>STAGE / SKILLS</b>	<b>SVN3M.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3M.B3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>
EXPECTATION	SVN3M.B 3.1.	Identify some major contemporary environmental challenges (e.g., global warming, acid precipitation), and explain their causes (e.g., deforestation, carbon and sulfur emissions) and effects (e.g., desertification, the creation of environmental refugees, the destruction of aquatic and terrestrial habitats)
EXPECTATION	SVN3M.B 3.2.	Describe how scientists use a variety of processes (e.g., environmental impact assessments, environmental scans) to solve problems and answer questions related to the environment
EXPECTATION	SVN3M.B 3.3.	Explain how new evidence affects scientific knowledge about the environment and leads to modifications of theory and/or shifts in paradigms (e.g., the impact of evidence of the effects of carbon dioxide emissions on theories of global warming)

EXPECTATION	SVN3M.B 3.4.	Explain how an environmental challenge has led to advances in science or technology (e.g., scrubbers on smokestacks to decrease sulfur dioxide emissions, hybrid cars)
EXPECTATION	SVN3M.B 3.5.	Describe a variety of human activities that have led to environmental problems (e.g., burning fossil fuels for transportation or power generation; waste disposal) and/or contributed to their solution (e.g., the development of renewable sources of energy; programs to reduce, reuse, and recycle)

**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.C.</b>	<b>Human Health and the Environment</b>
<b>STAGE / SKILLS</b>	<b>SVN3M.C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.C 1.	Analyse initiatives, both governmental and non-governmental, that are intended to reduce the impact of environmental factors on human health;
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.C 2.	Investigate environmental factors that can affect human health, and analyse related data;
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.C 3.	Demonstrate an understanding of various environmental factors that can affect human health, and explain how the impact of these factors can be reduced.
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.F.</b>	<b>Conservation of Energy</b>
<b>STAGE / SKILLS</b>	<b>SVN3M.F.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.F 1.	Assess the impact on society and the environment of the use of various renewable and non-renewable energy sources, and propose a plan to reduce energy consumption;
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3M.F 3.	Demonstrate an understanding of energy production, consumption, and conservation with respect to a variety of renewable and non-renewable sources.
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.F.</b>	<b>Conservation of Energy</b>
<b>STAGE / SKILLS</b>	<b>SVN3M.F.SE.</b>	<b>Specific Expectations</b>



<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3M.F1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
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EXPECTATION	SVN3M.F1.1.	Evaluate the impact on the environment of renewable and non-renewable energy sources, and propose an environmentally friendly solution to reduce non-renewable energy consumption (e.g., a plan for broader use of hybrid cars or solar panels) [AI, C]
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EXPECTATION	SVN3M.F1.2.	Assess the costs and benefits to society of the use of renewable and non-renewable energy sources, using a variety of criteria (e.g., associated health concerns, reliability, ability to meet demand, start-up and production costs) [AI, C]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.F.</b>	<b>Conservation of Energy</b>
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<b>STAGE / SKILLS</b>	<b>SVN3M.F.SE.</b>	<b>Specific Expectations</b>
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<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3M.F2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>
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EXPECTATION	SVN3M.F2.4.	Design and construct a working model of a device that uses an alternative energy source (e.g., a wind generator, a solar-powered car, a "fan boat") [IP, PR]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 University/College Preparation SVN3M**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3M.F.</b>	<b>Conservation of Energy</b>
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<b>STAGE / SKILLS</b>	<b>SVN3M.F.SE.</b>	<b>Specific Expectations</b>
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<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3M.F3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>
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EXPECTATION	SVN3M.F3.1.	Explain the historical significance of a variety of energy sources (e.g., whale oil, coal), and describe their long-term impact on the environment
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EXPECTATION	SVN3M.F3.3.	Explain the basic principles and characteristics of various types of renewable (e.g., tidal, geothermal, solar, wind) and non-renewable (e.g., coal, oil, gas) energy production and their impact on the environment
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EXPECTATION	SVN3M.F3.4.	Describe methods of energy production and conservation intended to reduce greenhouse gas emissions (e.g., energy production methods at the Prince Edward Island Wind-Hydrogen Village; charging higher prices for energy used during peak hours)
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.B.</b>	<b>Human Impact on the Environment</b>
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<b>STAGE / SKILLS</b>	<b>SVN3E.B.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E.B 1.	Analyse selected current environmental problems in terms of the role human activities have played in creating or perpetuating them, and propose possible solutions to one such problem;
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SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E.B 3.	Demonstrate an understanding of some of the ways in which human activities affect the environment and how the impact of those activities is measured and monitored.
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.B.</b>	<b>Human Impact on the Environment</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3E.B1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION	SVN3E.B 1.1.	Propose possible solutions, on the basis of research, to a current practical environmental problem that is caused, directly or indirectly, by human activities [IP, PR, AI, C]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.B.</b>	<b>Human Impact on the Environment</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3E.B2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION	SVN3E.B 2.1.	Use appropriate terminology relating to the environmental impact of human activity, including, but not limited to: carbon footprint, carbon neutral, biodegradable, biodiversity, carrying capacity, sustainability, and invasive and native species [C]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.B.</b>	<b>Human Impact on the Environment</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3E.B3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION	SVN3E.B 3.4.	Explain the concept of a "carbon footprint" and how it is used to measure the impact on the environment of a range of human activities
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EXPECTATION	SVN3E.B 3.5.	Explain the effects of human activity on an aquatic or terrestrial ecosystem (e.g., the impact of fertilizer run-off, acid precipitation, or an oil spill on an aquatic ecosystem)
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**

<b>STRAND / OVERALL EXPECTATION</b>	SVN3E. C.	<b>Human Health and the Environment</b>
<b>STAGE / SKILLS</b>	SVN3E. C.OE.	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E.C 3.	Demonstrate an understanding of the ways in which environmental factors can affect human health and how their impact can be reduced.
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**

<b>STRAND / OVERALL EXPECTATION</b>	SVN3E. C.	<b>Human Health and the Environment</b>
<b>STAGE / SKILLS</b>	SVN3E. C.SE.	<b>Specific Expectations</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E. C2.	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>
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EXPECTATION	SVN3E.C 2.1.	Use appropriate vocabulary related to human health and the environment, including, but not limited to: smog, environmental contaminants, pathogens, inhalation, ingestion, and absorption [C]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**

<b>STRAND / OVERALL EXPECTATION</b>	SVN3E. D.	<b>Energy Conservation</b>
<b>STAGE / SKILLS</b>	SVN3E. D.OE.	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E.D 1.	Evaluate initiatives and technological innovations related to energy consumption and conservation, and assess their impact on personal lifestyles, social attitudes, and the environment;
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**

<b>STRAND / OVERALL EXPECTATION</b>	SVN3E. D.	<b>Energy Conservation</b>
<b>STAGE / SKILLS</b>	SVN3E. D.SE.	<b>Specific Expectations</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E. D1.	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
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EXPECTATION	SVN3E.D 1.2.	Evaluate, on the basis of research, some of the advantages or disadvantages of technological innovations that contribute to the production of renewable energy and/or aid in conservation (e.g., bio-oil, biodiesel, wind turbines, improved insulation, programmable thermostats) [IP, PR, AI, C]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**  
E.

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.D.</b>	<b>Energy Conservation</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3E.D2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION	SVN3E.D 2.1.	Use appropriate terminology related to energy conservation and consumption, including, but not limited to: conventional source, alternative source, efficiency, watt, kilowatt-hour [kWh], joule, BTU, gas meter, electric meter, thermostat, and EnerGuide [C]
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EXPECTATION	SVN3E.D 2.4.	Conduct a risk-benefit analysis of different types of electricity generation (e.g., fossil fuel, hydro, nuclear, wind, and/or solar power) [PR, AI]
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**  
E.

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.D.</b>	<b>Energy Conservation</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3E.D3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION	SVN3E.D 3.1.	Explain the basic principles and characteristics of various types of power generation from nonrenewable sources (e.g., coal, oil, natural gas, nuclear) and renewable sources (e.g., hydroelectric, tidal, geothermal, solar, wind, hydrogen fuel cells)
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EXPECTATION	SVN3E.D 3.2.	Compare and contrast renewable and nonrenewable energy sources, using criteria such as availability, cost, and environmental impact (e.g., compare a fossil fuel and geothermal energy, using a graphic organizer)
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**  
E.

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.E</b>	<b>Natural Resource Science and Management</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.E.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SVN3E.E 2.	Investigate methods scientists use to classify and monitor natural resources, and conduct investigations using those methods;
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**STRAND / COURSE**      **ON.SVN3 Environmental Science, Grade 11 Workplace Preparation SVN3E**  
E.

<b>STRAND / OVERALL EXPECTATION</b>	<b>SVN3E.E</b>	<b>Natural Resource Science and Management</b>
<b>STAGE / SKILLS</b>	<b>SVN3E.E.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SVN3E.E 3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>
<b>EXPECTATION</b>	<b>SVN3E.E 3.1.</b>	<b>Describe the main types of natural resources found in Canada (e.g., forests, minerals, fisheries, wildlife, water, fossil fuels)</b>

**STRAND / COURSE**      **ON.SPH3 Physics, Grade 11 University Preparation SPH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH3U.A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SPH3U.A.OE.</b>	<b>Overall Expectations: Throughout this course, students will:</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH3U.A 1.</b>	<b>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);</b>

**STRAND / COURSE**      **ON.SPH3 Physics, Grade 11 University Preparation SPH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH3U.A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SPH3U.A.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH3U.A1.</b>	<b>Scientific Investigation Skills: Throughout this course, students will:</b>
<b>EXPECTATION</b>	<b>SPH3U.A 1.11.</b>	<b>Communicating [C]: Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)</b>

**STRAND / COURSE**      **ON.SPH3 Physics, Grade 11 University Preparation SPH3U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH3U.D.</b>	<b>Energy and Society</b>
<b>STAGE / SKILLS</b>	<b>SPH3U.D.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH3U.D 1.</b>	<b>Analyse technologies that apply principles of and concepts related to energy transformations, and assess the technologies' social and environmental impact;</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SPH3U.D Investigate energy transformations and the law of conservation of energy, and solve related problems;  
2.

**STRAND / COURSE** ON.SPH3 Physics, Grade 11 University Preparation SPH3U

<b>STRAND / OVERALL EXPECTATION</b>	SPH3U.F	Electricity and Magnetism
<b>STAGE / SKILLS</b>	SPH3U.F.OE.	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SPH3U.F Analyse the social, economic, and environmental impact of electrical energy production and technologies related to electromagnetism, and propose ways to improve the sustainability of electrical energy production;  
1.

**STRAND / COURSE** ON.SPH3 Physics, Grade 11 University Preparation SPH3U

<b>STRAND / OVERALL EXPECTATION</b>	SPH3U.F	Electricity and Magnetism
<b>STAGE / SKILLS</b>	SPH3U.F.SE.	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	SPH3U.F.3.	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION SPH3U.F.3.4. Explain Ohm's law, Kirchhoff's laws, Oersted's principle, the motor principle, Faraday's law, and Lenz's law in relation to electricity and magnetism

EXPECTATION SPH3U.F.3.5. Describe the production and interaction of magnetic fields, using diagrams and the principles of electromagnetism (e.g., Oersted's principle, the motor principle, Faraday's law, Lenz's law)

EXPECTATION SPH3U.F.3.6. Explain the operation of an electric motor and a generator, including the roles of their respective components

**Ontario Curriculum  
Science  
Grade 12 - Adopted: 2008**

**STRAND / COURSE** ON.SPH4 Physics, Grade 12 University Preparation SPH4U

<b>STRAND / OVERALL EXPECTATION</b>	SPH4U.A.	Scientific Investigation Skills and Career Exploration
<b>STAGE / SKILLS</b>	SPH4U.A.OE.	<b>Overall Expectations: Throughout this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SPH4U.A.1. 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);

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 University Preparation SPH4U U.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4U. A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SPH4U. A.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4U. A1.</b>	<b>Scientific Investigation Skills: Throughout this course, students will:</b>

EXPECTATION      SPH4U.A 1.11.      Communicating [C]: Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 University Preparation SPH4U U.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4U. B.</b>	<b>Dynamics</b>
<b>STAGE / SKILLS</b>	<b>SPH4U. B.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION      SPH4U.B 1.      Analyse technological devices that apply the principles of the dynamics of motion, and assess the technologies' social and environmental impact;

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 University Preparation SPH4U U.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4U. C.</b>	<b>Energy and Momentum</b>
<b>STAGE / SKILLS</b>	<b>SPH4U. C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION      SPH4U.C 1.      Analyse, and propose ways to improve, technologies or procedures that apply principles related to energy and momentum, and assess the social and environmental impact of these technologies or procedures;

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C C.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C. A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SPH4C. A.OE.</b>	<b>Overall Expectations: Throughout this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION      SPH4C.A 1.      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);

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C C.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.A.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.A1.</b>	<b>Scientific Investigation Skills: Throughout this course, students will:</b>
EXPECTATION	SPH4C.A 1.11.	Communicating [C]: Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.B.</b>	<b>Motion and Its Applications</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.B.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.B 1.</b>	Analyse selected technologies that are used to move objects or track their motion, and evaluate their impact on society and the environment, including their contribution to scientific knowledge;

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.B.</b>	<b>Motion and Its Applications</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.B.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.B1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
EXPECTATION	SPH4C.B 1.1.	Analyse the design and uses of a transportation technology (e.g., snowmobiles, automobiles, motorized personal water craft), and evaluate its social and environmental impact, including the impact on risk behaviour and accident rates [A], [C]

**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.D.</b>	<b>Electricity and Magnetism</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.D2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>
EXPECTATION	SPH4C.D 2.1.	Use appropriate terminology related to electricity and magnetism, including, but not limited to: direct current, alternating current, electrical potential difference, resistance, power, energy, permanent magnet, electromagnet, magnetic field, motor principle, and electric motor [C]



EXPECTATION	SPH4C.D 2.7.	Construct, or deconstruct and explain the components of, a basic electric device (e.g., a DC motor, a water-level detector) [PR, C]
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**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.D.</b>	<b>Electricity and Magnetism</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.D3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION	SPH4C.D 3.8.	State the motor principle, and use the right-hand rule to explain the direction of the force experienced by a conductor
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EXPECTATION	SPH4C.D 3.9.	Explain, using diagrams, the components and operation of a DC electric motor
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EXPECTATION	SPH4C.D 3.10.	Compare and contrast direct current and alternating current (AC) in qualitative terms (e.g., the difference between DC and AC motors), and describe situations in which each is used
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**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.E.</b>	<b>Energy Transformations</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.E.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.E1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION	SPH4C.E 1.1.	Analyse an energy-transformation technology (e.g., wind turbines, refrigerators, telephones, steam engines, coal-fired electrical plants), and evaluate its impact on society and the environment [AI, C]
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EXPECTATION	SPH4C.E 1.2.	Propose a course of practical action to improve the sustainability of an energy-transformation technology (e.g., solar panels, internal combustion engines, fuel cells, air conditioners) [PR, AI, C]
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**STRAND / COURSE**      **ON.SPH4 Physics, Grade 12 College Preparation SPH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SPH4C.E.</b>	<b>Energy Transformations</b>
<b>STAGE / SKILLS</b>	<b>SPH4C.E.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SPH4C.E3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION	SPH4C.E 3.3.	Describe, with the aid of diagrams, the operation of selected energy-transformation technologies (e.g., wind turbines, photoelectric cells, heat engines)
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EXPECTATION	SPH4C.E 3.5.	Describe a variety of renewable and nonrenewable sources of energy (e.g., solar energy, fossil fuels, hydroelectric energy, energy generated from biomass), and identify the strengths and weaknesses of each
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**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 University/College Preparation SNC4M**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4M. A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SNC4M. A.OE.</b>	<b>Overall Expectations: Throughout this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SNC4M. 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);
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**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 University/College Preparation SNC4M**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4M. A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SNC4M. A.SE.</b>	<b>Specific Expectations</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SNC4M. A1.	<b>Scientific Investigation Skills: Throughout this course, students will:</b>
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EXPECTATION	SNC4M. A1.2.	Initiating and Planning [IP]: Select appropriate instruments (e.g., respirometer, titration apparatus) and materials (e.g., prepared slides, Petri dishes, food samples), and identify appropriate methods, techniques, and procedures, for each inquiry
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EXPECTATION	SNC4M. A1.11.	Communicating [C]: Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)
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**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 Workplace Preparation SNC4E**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4E. A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SNC4E. A.OE.</b>	<b>Overall Expectations: Throughout this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SNC4E.A 1.	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);
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**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 Workplace Preparation SNC4E**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4E. A.</b>	<b>Scientific Investigation Skills and Career Exploration</b>
<b>STAGE / SKILLS</b>	<b>SNC4E. A.SE.</b>	<b>Specific Expectations</b>

<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SNC4E.A1.</b>	<b>Scientific Investigation Skills: Throughout this course, students will:</b>
EXPECTATION	SNC4E.A 1.2.	Initiating and Planning [IP]: Select appropriate instruments (e.g., a decibel meter, spot plates, glassware, thermometers) and materials (e.g., a heat lamp, agar plates, circuit boards), and identify appropriate methods, techniques, and procedures, for each inquiry
EXPECTATION	SNC4E.A 1.5.	Performing and Recording [PR]: Conduct inquiries, controlling relevant variables, adapting or extending procedures as required, and using appropriate materials and equipment safely, accurately, and effectively, to collect observations and data
EXPECTATION	SNC4E.A 1.11.	Communicating [C]: Communicate ideas, plans, procedures, results, and conclusions orally, in writing, and/or in electronic presentations, using appropriate language and a variety of formats (e.g., data tables, laboratory reports, presentations, debates, simulations, models)

**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 Workplace Preparation SNC4E.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4E.C.</b>	<b>Chemicals in Consumer Products</b>
<b>STAGE / SKILLS</b>	<b>SNC4E.C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION      SNC4E.C 1.      Analyse chemical products used in the home and workplace, and issues related to their safe and environmentally responsible use and disposal;

SUB-ORGANIZER / SPECIFIC EXPECTATION      SNC4E.C 2.      Investigate chemical properties of, and chemical reactions used to produce, various consumer products;

SUB-ORGANIZER / SPECIFIC EXPECTATION      SNC4E.C 3.      Demonstrate an understanding of chemical reactions, and of properties of chemicals used in common household and workplace products.

**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 Workplace Preparation SNC4E.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4E.C.</b>	<b>Chemicals in Consumer Products</b>
<b>STAGE / SKILLS</b>	<b>SNC4E.C.SE.</b>	<b>Specific Expectations</b>

**SUB-ORGANIZER / SPECIFIC EXPECTATION**      **SNC4E.C1.**      **Relating Science to Technology, Society, and the Environment: By the end of this course, students will:**

EXPECTATION      SNC4E.C 1.1.      Analyse, on the basis of research, a chemical product used in a particular profession or in the home (e.g., pool chemicals, chlorine bleach, hair dye), and prepare guidelines for safe and responsible use of the product [IP, PR, AI, C]

EXPECTATION      SNC4E.C 1.2.      Assess the environmental consequences of improper disposal of chemical products commonly used in the home (e.g., pouring paint down the drain; dumping batteries in garbage destined for landfill sites) [AI, C]

EXPECTATION	SNC4E.C 1.3.	Evaluate the appropriateness of current disposal practices in their home, at school, or in the community, with particular reference to the disposal of chemical waste [AI, C]
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**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 Workplace Preparation SNC4E**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4E.C.</b>	<b>Chemicals in Consumer Products</b>
<b>STAGE / SKILLS</b>	<b>SNC4E.C.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SNC4E.C2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION	SNC4E.C 2.6.	Investigate a variety of consumer products within a given category (e.g., shampoo, window cleaner, disinfectant), focusing on products claiming to be environmentally friendly, and analyse them with respect to selected factors (e.g., cost, effectiveness, impact on the environment) [PR, AI, C]
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**STRAND / COURSE**      **ON.SNC4 Science, Grade 12 Workplace Preparation SNC4E**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SNC4E.E.</b>	<b>Electricity at Home and Work</b>
<b>STAGE / SKILLS</b>	<b>SNC4E.E.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SNC4E.E2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION	SNC4E.E 2.3.	Build a simple electrical device or circuit (e.g., a loudspeaker, an electric motor, a D-cell, a circuit containing a 40W lightbulb and a dimmer switch), following a clear set of instructions and diagrams, and using appropriate tools safely [PR]
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**STRAND / COURSE**      **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.B.</b>	<b>Organic Chemistry</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.B.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION	SCH4U.B 1.	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;
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**STRAND / COURSE**      **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.B.</b>	<b>Organic Chemistry</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.B.SE.</b>	<b>Specific Expectations</b>

<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4U.B1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
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EXPECTATION SCH4U.B 1.1. Assess the impact on human health, society, and the environment of organic compounds used in everyday life (e.g., polymers, nutritional supplements, food additives, pharmaceuticals, pesticides) [A1, C]

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.C.</b>	<b>Structure and Properties of Matter</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4U.C 1. 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;

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.C.</b>	<b>Structure and Properties of Matter</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.C.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4U.C1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION SCH4U.C 1.1. Assess the benefits to society of technologies that are based on the principles of atomic and molecular structures (e.g., magnetic resonance imaging [MRI], infrared spectroscopy, X-ray crystallography, nuclear energy, medical applications of spectroscopy and mass spectrometry) [A1, C]

EXPECTATION SCH4U.C 1.2. Evaluate the benefits to society, and the impact on the environment, of specialized materials that have been created on the basis of scientific research into the structure of matter and chemical bonding (e.g., bulletproof fabric, nanotechnologies, superconductors, instant adhesives) [A1, C]

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.D.</b>	<b>Energy Changes and Rates of Reaction</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.D.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4U.D 2. Investigate and analyse energy changes and rates of reaction in physical and chemical processes, and solve related problems;

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4U.D 3. Demonstrate an understanding of energy changes and rates of reaction.

**STRAND / COURSE**      **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.D.</b>	<b>Energy Changes and Rates of Reaction</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4U.D1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION      SCH4U.D.1.1. Analyse some conventional and alternative energy technologies (e.g., fossil fuel-burning power plants, hydro-powered generators, solar panels, wind turbines, fuel cells), and evaluate them in terms of their efficiency and impact on the environment [AI, C]

**STRAND / COURSE**      **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.D.</b>	<b>Energy Changes and Rates of Reaction</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4U.D2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION      SCH4U.D.2.2. Write thermochemical equations, expressing the energy change as a change in H value or as a heat term in the equation [AI, C]

**STRAND / COURSE**      **ON.SCH4 Chemistry, Grade 12 University Preparation SCH4U**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4U.D.</b>	<b>Energy Changes and Rates of Reaction</b>
<b>STAGE / SKILLS</b>	<b>SCH4U.D.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4U.D3.</b>	<b>Understanding Basic Concepts: By the end of this course, students will:</b>

EXPECTATION      SCH4U.D.3.1. Compare the energy changes resulting from physical change (e.g., boiling water), chemical reactions (e.g., bleaching a stain), and nuclear reactions (e.g., fission, fusion), in terms of whether energy is released or absorbed

EXPECTATION      SCH4U.D.3.2. Compare the energy change from a reaction in which bonds are formed to one in which bonds are broken, and explain these changes in terms of endothermic and exothermic reactions

**STRAND / COURSE**      **ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.B.</b>	<b>Matter and Qualitative Analysis</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.B.SE.</b>	<b>Specific Expectations</b>

<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4C.B1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>
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EXPECTATION SCH4C.B 1.1. Evaluate the risks and benefits to the environment of some commonly used chemical substances (e.g., substances used in fireworks, fire extinguishers, "green" cleaning products) [A], [C]

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.C.</b>	<b>Organic Chemistry</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.C.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4C.C1. Evaluate the impact on society, human health, and the environment of products made using organic compounds;

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4C.C2. Investigate the physical and chemical properties of organic compounds, and analyse some common organic chemical reactions;

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.C.</b>	<b>Organic Chemistry</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.C.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4C.C2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION SCH4C.C2.6. Conduct an inquiry to identify some of the products of the combustion of a hydrocarbon and an alcohol [PR], [A]

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.E.</b>	<b>Chemical Calculations</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.E.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4C.E2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION SCH4C.E2.7. Use qualitative observations of a chemical reaction to identify the chemical changes, presence of limiting reagents, and the products occurring in a chemical reaction (e.g., aluminum reacting with copper(II) chloride solution, steel wool reacting with oxygen) [PR], [A]

**STRAND / COURSE** **ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C.**

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.F.</b>	<b>Chemistry in the Environment</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.F.OE.</b>	<b>Overall Expectations: By the end of this course, students will:</b>

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4C.F.1. Evaluate the importance of government regulations, scientific analyses, and individual actions in improving air and water quality, and propose a personal plan of action to support these efforts;

SUB-ORGANIZER / SPECIFIC EXPECTATION SCH4C.F.3. Demonstrate an understanding of chemical reactions that occur in the environment as a result of both natural processes and human activities.

**STRAND / COURSE** ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.F.</b>	<b>Chemistry in the Environment</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.F.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4C.F1.</b>	<b>Relating Science to Technology, Society, and the Environment: By the end of this course, students will:</b>

EXPECTATION SCH4C.F.1.1. Evaluate, on the basis of research, the effectiveness of government initiatives or regulations (e.g., the Great Lakes Action Plan), and the actions of individuals (e.g., use of public transportation), intended to improve air and water quality, and propose a personal action plan to support these efforts [IP, PR, AI, C]

EXPECTATION SCH4C.F.1.2. Evaluate the importance of quantitative chemical analysis in assessing air and water quality (e.g., the use of Environment Canada's Air Quality Index to determine when smog advisories need to be issued; systems to monitor the quality of drinking water), and explain how these analyses contribute to environmental awareness and responsibility [AI, C]

**STRAND / COURSE** ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.F.</b>	<b>Chemistry in the Environment</b>
<b>STAGE / SKILLS</b>	<b>SCH4C.F.SE.</b>	<b>Specific Expectations</b>
<b>SUB-ORGANIZER / SPECIFIC EXPECTATION</b>	<b>SCH4C.F2.</b>	<b>Developing Skills of Investigation and Communication: By the end of this course, students will:</b>

EXPECTATION SCH4C.F.2.1. Use appropriate terminology related to chemical analysis and chemistry in the environment, including, but not limited to: ozone, hard water, titration, pH, ppm, and ppb [C]

**STRAND / COURSE** ON.SCH4 Chemistry, Grade 12 College Preparation SCH4C

<b>STRAND / OVERALL EXPECTATION</b>	<b>SCH4C.F.</b>	<b>Chemistry in the Environment</b>
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STAGE / SKILLS	SCH4C.F.SE.	Specific Expectations
SUB-ORGANIZER / SPECIFIC EXPECTATION	SCH4C.F3.	Understanding Basic Concepts: By the end of this course, students will:

EXPECTATION    SCH4C.F 3.2. Identify gases and particulates that are commonly found in the atmosphere, and explain how they affect air quality (e.g., greenhouse gases, tropospheric and stratospheric ozone, carbon monoxide, chlorofluorocarbons, soot)