

# Science 8

*Renewed Curriculum At a Glance*

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# Background

An important and universal goal of science education is to equip learners with an understanding of the roles that science and technology play in society. The Nova Scotia science curriculum aims to develop learners' Scientific Literacy and their ability to problem solve and apply the principles of scientific inquiry to real-world situations and familiar problems. In so doing, learners will develop skills and competencies. Additionally, Science 8 seeks to develop scientific literacy through designing and building for technological innovation, writing for scientific communication and data analysis.

Learners in grade 8 will have opportunities to design scientific inquiries, evaluate evidence, use evidence for argumentation and use technology to solve problems. They will explore fundamental concepts of the Nature of Science such as:

- Scientific Reasoning
- Patterns
- Cause and Effect
- Systems and Models
- Energy and Matter
- Structure and Function
- Change and Stability
- Stewardship and Sustainability
- Similarity and Diversity

Learning in Context:

The nature of science asks learners to question the phenomena of the world around them, then test those questions in controlled environments. Themes create authentic purpose for learning and facilitate cross curricular, project-based learning opportunities. Learners will see the context for what they are learning which will improve transfer of skills and knowledge. It is important that learners view themselves as scientists and as an integral part of the learning process. Teaching through themes is one way to make the learning meaningful for all learners. Each of the themes in Science 8 provide opportunities for learners to engage with inquiry based learning in a hands-on way that is crucial to science literacy and the development of critical thinking skills.

Science 8 Themes:

- Healthy Cells, Healthy Systems - Learners explore concepts related to keeping their bodies healthy. They will learn about cell structures and functions in relation to various medical disorders. Learners will employ case study methodologies.
- Climate Change - Learners will explore concepts related to heat and the kinetic molecular theory in relation to climate change and the greenhouse effect. They will examine the role of humans in climate change as well as potential solutions for adaptation and mitigation.
- Hydraulics and Pneumatics - Learners will explore concepts related to the properties of fluids and fluid dynamics as they are applied in hydraulic and pneumatic systems.

Learners will explore mechanical advantage provided by these systems and they will use the design process to create a hydraulic or pneumatic system to solve a problem.

## Learners will **analyse** how the characteristics of cells relate to the needs of organisms.

### Healthy Cells, Healthy Systems

#### Rationale

Studying the concepts of cell specialization and the structures needed for specialization leads to understanding how individual cells and systems are related. A comparison of various cell types will lead to an understanding of the survival needs of various organisms. Through the use of microscopes, learners will explore how advances in technology relate to new discoveries in science.

#### Competencies

- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Analyse** the structures and functions of cells in organisms (COM/CI/CT)
- **Compare** animal and plant cells (COM/CT/TF)
- **Analyse** characteristics of specialized cells in relation to their function in the system (COM/PCD/CT/TF)
- **Investigate** how cells work together in systems (PCD/CT/TF)
- **Investigate** the needs of cells and systems (PCD/CT/TF)

### Concepts (and Guiding Questions)

#### Interdependence of cell systems

- How do the needs of organisms relate to the needs of their cells?
- How do cells work together?
- How are cell and system function related?

#### Plant and Animal cells

- How can data collected from a microscope be represented?
- How do plant and animal cells compare?

#### Cellular Organelles

- How do cells meet the needs of plants?
- How do cells meet the needs of animals?

#### Cell specialization

- How do cell organelles and cellular structure relate to their specialized functions?
- Why don't we digest our own stomach?

### Skills

#### Analyse

Gather and select appropriate information; determine accuracy, validity, and relevance of the information; identify perspectives, communicate findings.

#### Compare

Make observations; identify similarities and differences; identify relationships and offer an interpretation; communicate the findings.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships, recognize represented perspectives and communicate findings.

## Learners will **evaluate** ways to maintain and factors that disrupt cell and system health.

### Healthy Cells, Healthy Systems

#### Rationale

An evaluation of cell and system health provides an opportunity for learners to explore cell and body system disorders in depth through case studies. In learning about ways to maintain a healthy body, including related technologies and careers, learners will examine personally relevant contexts.

#### Competencies

- Citizenship (CZ)
- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Investigate** disruptions and disorders that affect cell and system health (CI/CT/PCD/TF)
- **Evaluate** the impact of disruptions and disorders on cell/system health. (COM/PCD/CT/TF)
- **Investigate** technologies and careers that address cell/system health. (PCD/TF)
- **Evaluate** ways to maintain health from a number of perspectives, including Mi'kmaw (CZ/COM/PCD/CI/CT/TF)

### Concepts (and Guiding Questions)

#### Cell/system disorders

- How do cells/systems “malfunction”?
- How can you determine the difference between a disorder and a disruption?
- How do health professionals use case studies to learn about cell and system disorders?

#### Maintaining Health

- How can we maintain cell and system health?
- How do Mi'kmaw perspectives enrich the understanding of maintaining health?

#### Health-related Technology

- How do technologies help us maintain cell/system health?
- How do technologies help us learn about cell/system health?

### Skills

#### Evaluate

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships, recognize represented perspectives and communicate findings.

## Learners will **create** a model that demonstrates the principles of kinetic molecular theory.

### Climate Change

#### Rationale

In order to understand large scale concepts such as climate change, or small-scale concepts like kinetic molecular theory, it is often useful to produce models that demonstrate these concepts more concretely. The relationship between particle theory, heat transmission and absorption are best explored with hands on application. This outcome extends the analysis of particle theory that began in grade 7. The focus in this theme is on the movement of particles and heat as it relates to climate change.

#### Competencies

- Citizenship (CZ)
- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Investigate** heat as it relates to the kinetic molecular theory (CI/CT/TF)
- **Evaluate** conducting and insulating materials (COM/CT/TF)
- **Investigate** heat transference (CT/TF)
- **Analyse** heat absorption in the context of the greenhouse effect (CZ/COM/PCD/CT/TF)

### Concepts (and Guiding Questions)

#### Kinetic Molecular Theory

- How does the kinetic molecular theory allow for an understanding of heat and temperature?
- How do the notions of hot and cold relate to the kinetic molecular theory?
- How does the kinetic molecular theory relate to states of matter?

#### Greenhouse effect and heat absorption

- How does the greenhouse effect work?
- How does kinetic molecular theory relate to the greenhouse effect?

#### Heat Transfer

- How does kinetic molecular theory relate to heat transfer?
- How does heat transfer impact our daily lives?

#### Heat Capacity of materials

- Why do some materials take longer to heat up/cool off?
- Which materials are best for insulating?

### Skills

#### Create

Develop an idea; communicate a representation for a process and/or a product; produce a product; modify as necessary; evaluate results and/or modifications.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships, recognize represented perspectives and communicate findings.

**Evaluate**

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.

**Analyse**

Gather and select appropriate information; determine accuracy, validity, and relevance of the information; identify perspectives, communicate findings.



## Learners will **evaluate** oceanographic and other evidence of climate change inclusive of a Mi'kmaw perspective.

### Climate Change

#### Rationale

The ocean is a primary source of evidence for measuring the health of our environment. The Mi'kmaw people have long used observational evidence to inform decision making. Evaluation of evidence for climate change will allow learners to make informed decisions about their role in climate change. Additionally, this evaluation will allow learners to discover career opportunities in ocean science and marine industry.

#### Competencies

- Citizenship (CZ)
- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Investigate** the impact of climate change on biological organisms (CZ/COM/PCD/CT)
- **Evaluate** oceanographic data for evidence of climate change (COM/PCD/CI/CT/TF)
- **Measure** climatic indicators using probeware. (CT/TF)
- **Analyse** the impact of climate change on various communities, including Mi'kmaw. (CZ/COM/CT)

### Concepts (and Guiding Questions)

#### Indicators of Climate Change

- How can evidence be used to determine that the earth's climate is changing?
- How can we measure climate change?
- How can ocean careers contribute to a better understanding of climate change?

#### Community impacts

- How has climate change affected various communities?
- How will climate change affect communities in the future?

#### Biological Impacts

- How does climate change impact various living organisms?
- How do organisms respond to climate change?

#### Oceanographic Evidence

- How does climate change affect oceans?
- How can oceanographic data be used to determine changes to earth's climate?
- How does climate change impact coastlines?

### Skills

#### Evaluate

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships, recognize represented perspectives and communicate findings.

**Evaluate**

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.

**Analyse**

Gather and select appropriate information; determine accuracy, validity, and relevance of the information; identify perspectives, communicate findings.

## Learners will **evaluate** the impact of human activity on climate change.

### Climate Change

#### Rationale

The increase of carbon in the atmosphere is the reason climate change is happening and much of that carbon comes from energy production. By studying both renewable and non-renewable energies, learners will be able to evaluate the positive and negative impacts of human activity on the environment.

#### Competencies

- Citizenship (CZ)
- Communication (COM)
- Critical Thinking (CT)
- Technological Fluency (TF)

#### Indicators

- **Analyse** the causes of climate change (CZ/COM/CT/TF)
- **Evaluate** the environmental impacts of various sources of energy (CZ/COM/CT/TF)
- **Analyse** how climate change is being expedited (CZ/COM/CT/TF)

### Concepts (and Guiding Questions)

#### Causes of climate change

- How are human activities linked to climate change?
- How is the impact of humans on climate change measured?

#### Sources of energy

- How do we get energy?
- How can the environmental impacts of various forms of energy production be determined?

#### Enhanced Greenhouse Effect

- How do humans impact the greenhouse effect?
- How is energy production related to climate change?

### Skills

#### Evaluate

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.

#### Analyse

Gather and select appropriate information; determine accuracy, validity, and relevance of the information; identify perspectives, communicate findings.

## Learners will formulate a plan to mitigate or adapt to the effects of climate change.

### Climate Change

#### Rationale

This outcome is the consolidation and application of the other outcomes within this theme. Formulating a plan to mitigate or adapt to climate change will allow learners to apply what they have learned about heat energy, human impact and climate-based careers in an authentic way. Evaluating the climate change plans of others will provide opportunities for learners to explore possible implications of their actions.

#### Competencies

- Citizenship (CZ)
- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Investigate** strategies to promote paradigm shift and increase environmental awareness
- **Investigate** climate change solutions inclusive of a Mi'kmaw perspective (CZ/CI/CT)
- **Evaluate** the environmental impact of green technologies (CZ/COM/PCD/CT/TF)
- **Evaluate** the implications of potential climate change solutions (CZ/COM/PCD/CI/CT)

### Concepts (and Guiding Questions)

#### Climate change solutions

- How will humans need to change the way they live in response to changing climate?
- How do certain careers help to mitigate or adapt to the effects of climate change?

#### Environmental Paradigm shift

- How is environmental awareness changing?
- How can we as individuals impact perceptions of environmental issues?

#### Green Technology

- How can technology help us adapt to a changing climate?
- How can climate change solutions pose other problems?

### Skills

#### Formulate

Identify a topic of interest; brainstorm ideas; choose, prioritize, and refine ideas; evaluate choices.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships; recognize represented perspectives and communicate findings.

#### Evaluate

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.



## Learners will test the effects of changes in temperature and pressure on the properties of fluids.

### Hydraulic and Pneumatic Systems

#### Rationale

The properties of fluids should be explored by developing procedures for testing, a significant step in understanding the importance of controlling variables. To best understand fluid dynamics, learners should also test factors that affect fluid properties in a hands-on way. This approach is particularly useful for investigating viscosity which is a new concept to most learners.

#### Competencies

- Communication (COM)
- Critical Thinking (CT)
- Technological Fluency (TF)

#### Indicators

- **Investigate** the properties of fluids (CT/TF)
- **Test** factors that affect fluid properties (CT, CI, COMM)
- **Analyse** the relationships between temperature, volume, pressure, compressibility, viscosity, and density (COM/CT/TF)
- **Measure** temperature and pressure with probeware (TF)

### Concepts (and Guiding Questions)

#### Properties of Fluids

- How is air a fluid?
- How do the properties of viscosity, density, compressibility and pressure relate?

#### Factors that affect fluid properties

- How can the relationship between temperature and pressure be tested?
- How can the viscosity of a fluid be changed?

#### Experimental Design

- How can variables be controlled when conducting a test?
- How does a graphical representation assist in the analysis of data?

### Skills

#### Test

Formulate a testable question and a reasonable hypothesis; identify dependent and independent variables; identify variables to intentionally control; design an experiment; execute the steps; collect and record evidence; conduct data analysis; develop conclusions based on evidence; communicate findings and possible limitations.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships; recognize represented perspectives and communicate findings.

#### Analyse

Gather and select appropriate information; determine accuracy, validity, and relevance of the information; identify perspectives, communicate findings.

## Learners will compare mechanical advantage provided by hydraulic and pneumatic systems.

### Hydraulic and Pneumatic Systems

#### Rationale

To understand how hydraulic and pneumatic systems create mechanical advantage, learners need to understand the properties of compressibility and force and how these forces are transferred. Learning how and where hydraulic and pneumatic systems are used is also important in giving authentic context to the learner.

#### Competencies

- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Investigate** devices that use hydraulics and pneumatics (PCD/CI/TF)
- **Compare** hydraulic and pneumatic systems (COM/CT/TF)
- **Investigate** how mechanical advantage is created in hydraulic and pneumatic devices (CI/CT/ TF)

### Concepts (and Guiding Questions)

#### Hydraulic and pneumatic devices

- How are hydraulics and pneumatics used in various tools and technologies?
- How are hydraulics and pneumatics applied to innovations made locally and globally?

#### Hydraulic and pneumatic systems

- How do hydraulic and pneumatic systems compare?
- How can pressure be used to accomplish tasks?
- How are hydraulics and pneumatics used in various careers?

#### Mechanical Advantage

- How do hydraulic and pneumatic systems provide mechanical advantage?
- How can the mechanical advantage generated by hydraulic/pneumatic systems be modified?
- How does surface area and/or size of tubing affect mechanical advantage?

### Skills

#### Compare

Make observations; identify similarities and differences; identify relationships and offer an interpretation; communicate the findings.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships, recognize represented perspectives and communicate findings.

## Learners will construct a device that utilizes hydraulics or pneumatics.

### Hydraulic and Pneumatic Systems

#### Rationale

This outcome is the consolidation and application of the other outcomes within this theme.

Constructing a hydraulic or pneumatic device will allow learners to apply what they have learned about the properties of fluids and mechanical advantage in an authentic way. Evaluating the efficiency and effectiveness of devices constructed by others will provide learners with an opportunity to iterate their designs.

#### Competencies

- Citizenship (CZ)
- Communication (COM)
- Creativity and Innovation (CI)
- Critical Thinking (CT)
- Personal Career Development (PCD)
- Technological Fluency (TF)

#### Indicators

- **Investigate** problems that may be solved with hydraulics or pneumatics. (CI/CT/PCD/TF)
- **Apply** the properties of fluids in building a device (CI/TF)
- **Evaluate** devices for efficiency and effectiveness (COM/PCD/CT/TF)
- **Implement** a design for a hydraulic or pneumatic device (CI/CT/TF)

### Concepts (and Guiding Questions)

#### Applications of hydraulics and pneumatics

- How can I solve a problem using hydraulics and pneumatics?
- In what situations would I choose a hydraulic system? A pneumatic system?

#### Applying the properties of fluids

- How can our knowledge of properties of fluids help us in the construction of a hydraulic or a pneumatic device?
- How do hot and cold temperatures affect the functioning of my device?

#### Efficiency and effectiveness

- How can I determine the efficiency of my device?
- How can devices be altered to improve their effectiveness?

### Skills

#### Construct

Identify a purpose; brainstorm ideas; gather and select information to support a plan; identify and choose options within the plan; offer reasons to support choices; build a model; test and revise, modify as necessary; evaluate the results at each stage of the process; consider alternative options.

#### Investigate

Ask and revise questions; locate several relevant and dependable details to support an answer; organize and compare details; identify relationships, recognize represented perspectives and communicate findings.

#### Apply

Carry out, use or complete a procedure/ technique.

#### Evaluate

Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.



## Implement

**Select** - Locate several relevant and dependable details to support an answer

**Plan** – FORMULATE Identify a topic of interest; brainstorm ideas; choose, prioritize, and refine ideas; evaluate choices. Devise a process to solve the problem. Execute the steps, modifying as necessary.

**Evaluate** - Review processes and results from an inquiry; consider and communicate varying perspectives and alternative solutions; identify potential new problems and/or issues; justify decisions and/or findings.

**Apply** - Carry out, use or complete a procedure/technique.