Area of Learning: SCIENCE — Science for Citizens

BIG IDEAS

- Science informs our decisions and impacts our daily lives.
- Science has everyday uses and safety implications in the workplace.
- Science helps explain how natural changes and human choices affect global systems.

Learning Standards

### Curricular Competencies

**Students are expected to be able to do the following:**

**Questioning and predicting**
- Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest
- Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world
- **Formulate multiple hypotheses** and predict multiple outcomes

**Planning and conducting**
- Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)
- Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods
- Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data
- Apply the concepts of accuracy and precision to experimental procedures and data:
  - significant figures
  - uncertainty
  - scientific notation

### Content

**Students are expected to know the following:**

**Personal/Home Science**
- health science:
  - nutrition and lifestyle
  - allergies and sensitivities
  - medications and supplements
  - non-Western health practices, including First Peoples health and healing practices
- **safe use and storage of household chemicals**
- home technologies:
  - home automation and safety alarms
  - home appliances
  - home electrics
- **science literacy and informed decision making:**
  - pseudo-science versus science

**Local/Workplace Science**
- waste recycling and disposal:
  - industrial and workplace
  - recycling processes
  - transfer stations and landfills
  - impacts of personal choices
### Curricular Competencies

#### Processing and analyzing data and information
- Experience and interpret the local environment
- Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information
- Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies
- Construct, analyze, and interpret graphs, models, and/or diagrams
- Use knowledge of scientific concepts to draw conclusions that are consistent with evidence
- **Analyze cause-and-effect relationships**

#### Evaluating
- Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions
- Describe specific ways to improve their investigation methods and the quality of the data
- Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled
- Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources
- Consider the changes in knowledge over time as tools and technologies have developed
- Connect scientific explorations to careers in science
- Exercise a healthy, informed skepticism, and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources
- Consider social, ethical, and environmental implications of the findings from their own and others’ investigations
- Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems
- **Assess risks** in the context of personal safety and social responsibility

#### Content
- chemicals commonly found in the workplace or in industrial products:
  - chemical safety, including disposal methods
  - current WHMIS and other standards
  - components of mixtures
  - classes of hazardous chemicals
- combustive and explosive materials:
  - combustible mixtures
  - explosive potential
  - safety
- forensic science:
  - methodologies and technologies
  - forensic techniques and protocols
  - impact of advances in technology

### Global Science
- **extreme weather events:**
  - causes and impacts
  - weather and climate change
- disaster preparedness:
  - natural and human-influenced events
  - survival needs
- agriculture practices and processes:
  - chemicals used in agriculture
  - environmental impacts
  - impacts of personal choices
### Curricular Competencies

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<tr>
<th>Applying and innovating</th>
<th>Content</th>
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<tr>
<td>• <strong>Contribute to care for self, others, community</strong>, and world through individual or</td>
<td>• <strong>energy generation</strong> and needs:</td>
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<td>collaborative approaches</td>
<td>– production</td>
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<td>• Co-operatively design projects with local and/or global connections and applications</td>
<td>– economics</td>
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<td>• Contribute to finding solutions to problems at a local and/or global level through</td>
<td>– environmental impacts</td>
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<td>• <strong>Implement multiple strategies to solve problems in real-life, applied, and</strong></td>
<td>• <strong>sustainability of resources</strong>:</td>
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<td><strong>conceptual situations</strong></td>
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<td>• Consider the role of scientists in innovation</td>
<td>– First Peoples worldview and sustainability</td>
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<td>– <strong>product life cycles</strong></td>
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<td>Communicating</td>
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<td>• Formulate physical or mental theoretical models to describe a phenomenon</td>
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<td>• <strong>Communicate scientific ideas, information, and perhaps a suggested course of action,</strong></td>
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<td>for a specific purpose and audience, constructing evidence-based arguments and using</td>
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<td>appropriate scientific language, conventions, and representations</td>
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<td>• Express and reflect on a variety of experiences, perspectives, and worldviews through</td>
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### Big Ideas – Elaborations

**Science informs our decisions and impacts our daily lives.**

*Sample opportunities to support student inquiry:*
- How do the substances you take into or use on your body affect your health?
- What are some potential dangers to be aware of when storing chemicals in your home?
- How do home technologies function to contribute to our health and safety?
- Why is science literacy important?

**Science has everyday uses and safety implications in the workplace.**

*Sample opportunities to support student inquiry:*
- What types of safety precautions should be considered in the workplace?
- How can industrial waste materials be dealt with responsibly?
- How do catalytic converters in cars convert harmful pollutants from combustion into less harmful emissions?
- How has science helped to solve crimes?

**Science helps explain how natural changes and human choices affect global systems.**

*Sample opportunities to support student inquiry:*
- How do your actions affect the world around you?
- What is the life cycle of a cell phone?
- How do local changes affect global weather?

### Curricular Competencies – Elaborations

**Sample opportunities to support student inquiry:**

**Questioning and predicting:**
- **Formulate multiple hypotheses:** What are some possible drug interactions and their negative effects?

**Processing and analyzing data and information:**
- **First Peoples perspectives:** Describe a First Peoples healing practice and how it is understood to support healing.
- **Analyze cause-and-effect relationships:** What advice could you give someone who wishes to make changes to improve their nutrition and lifestyle?
### Curricular Competencies – Elaborations

#### Evaluating:
- **Investigation:** May address questions such as:
  - How does an electrostatic precipitator assist in improving air quality?
  - What kind of remediation is necessary after a chemical spill?
  - What are the differences between recyclable and non-recyclable plastics?
- **Assess risks:**
  - Is it safe to eat GMO foods?
  - How can you use lock-out protection when changing a light fixture?

#### Applying and innovating:
- **Contribute to care for self, others, community:**
  - How can you help set up a disaster preparedness relief site in your community?
  - What would you include in an emergency survival kit?
- **Implement multiple strategies to solve problems in real-life, applied, and conceptual situations:**
  - Design safe storage plans for chemicals found in the home (including flammable and poisonous materials).

#### Communicating:
- **Communicate scientific ideas, information, and perhaps a suggested course of action.** For example:
  - How could you share what you have learned about safe storage of household chemicals with others (e.g., poster, video, public service announcement)?
  - What needs must be met to survive after an earthquake?
  - What kinds of resources are needed to create your cell phone?
  - How do smoke detectors use alpha radiation to keep you safe?

### Content – Elaborations

#### Personal/Home Science
- **nutrition and lifestyle:** fats, protein, carbohydrates in the diet, fad diets compared to balanced diets, exercise
- **allergies and sensitivities:** gluten intolerance, celiac disease, lactose intolerance, sulphites, other allergens, what to do in case of anaphylaxis
- **medications:** prescription and non-prescription drugs, safety in drug interactions, potential overdose (e.g., acetaminophen), addiction risks, safe storage and disposal
- **supplements:** vitamins, protein supplements, minerals
- **safe use:** harmful combinations (e.g., bleach and ammonia), gasoline, propane
household chemicals: poisons in the home (including cleaning products), chemical hazards for children and pets in the home and garden

home automation and safety alarms: carbon monoxide detector, smoke alarms, and burglar alarms as part of home automation; apps for scheduling lights and sprinklers

home appliances: heat pumps, water heaters, air conditioning and refrigerators, microwave ovens

home electrics: electrical wiring and circuits, circuit overload protection, electrical adaptors (e.g., travel); personal protection from electricity (e.g., lock-out procedure, working near power lines)

science literacy: judging validity of evidence from a variety of sources (e.g., journals, magazines, news, Internet)

pseudo-science: misleading scientific claims related to products (e.g., hair-growth products, magnetic bracelets, anti-aging cosmetics)

Local/Workplace Science

recycling: recycling of materials (e.g., chairs made from pop bottles, tires made into playground surfacing); classes of waste (e.g., plastic classification system)

industrial and workplace: e-waste, paper, organics

transfer stations and landfills: limitations of recycling

other: physical, health, and environmental hazards

components of mixtures:
  – proportion
  – concentration
  – identification (e.g., chromatography, spectrometry, flame test)

classes of hazardous chemicals: oxidants and solvents, acids and bases

methodologies:
  – steps to preserve and document a crime scene
  – procedures for collection and packaging of evidence (i.e., chain of custody)

technologies: technologies that could be used to gather and analyze evidence at a crime scene (e.g., fingerprint lifting, blood detection, blood typing, DNA extraction, gel electrophoresis, hair/fibre analysis, drug identification through chromatography, mass spectrometry, spectroscopy)

forensic techniques and protocols:
  – identification of forensic techniques used to solve crimes
  – proper lab techniques to identify unknown substances
  – application of forensic techniques and principles to solve a simulated crime

impact of advances in technology:
  – differences between current forensic techniques and those available in a historical crime (e.g., Jack the Ripper)
  – the use of databases for suspect or victim identification (e.g., fingerprints, tattoos, DNA)
Global Science

- **extreme weather events:**
  - hurricanes, tornadoes, drought, flooding
  - evidence, including oral narratives, about extreme weather
- **natural:** earthquake, tsunami, hurricane, avalanches, rock slides
- **human-influenced:** nuclear reactors, oil spills, mining accidents, transportation accidents
- **survival needs:** basic (water, food, shelter), communication, economic, medical, transportation
- **practices and processes:** hydroponics, food crops, feed crops, fuel crops, animal husbandry, new technologies
- **energy generation:** various ways of generating electricity (e.g., hydro, coal)
- **production:** renewable versus non-renewable resources; alternative technologies
- **economics:** energy sources (e.g., coal transportation); global electricity markets (e.g., buying and selling of excess electricity)
- **resources:** Earth has limited resources (e.g., aluminum, rare metals, copper, fossil fuels)
- **product life cycles:** clothing, electronic devices