# BIG IDEAS

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|---|---|---|
| **Scientific processes and knowledge** inform our decisions and impact our daily lives. | Scientific knowledge can be used to develop procedures, techniques, and technologies that have implications for **places of employment**. | Scientific understanding enables humans to **respond and adapt to changes** locally and globally. |

## Learning Standards

| Curricular Competencies | Content |
|---|---|
| *Students are expected to be able to do the following:*<br><br>**Questioning and predicting**<br>• Demonstrate a sustained intellectual curiosity about a scientific topic or problem of personal, local, or global interest<br>• Make observations aimed at identifying their own questions, including increasingly abstract ones, about the natural world<br>• Formulate multiple hypotheses and predict multiple outcomes<br><br>**Planning and conducting**<br>• Collaboratively and individually plan, select, and use appropriate investigation methods, including field work and lab experiments, to collect reliable data (qualitative and quantitative)<br>• Assess risks and address ethical, cultural, and/or environmental issues associated with their proposed methods<br>• Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data<br>• Apply the concepts of accuracy and precision to experimental procedures and data:<br>– significant figures<br>– uncertainty<br>– scientific notation<br><br>**Processing and analyzing data and information**<br>• Use local knowledge to experience and interpret the local environment | *Students are expected to know the following:*<br><br>• **evidence-based decision making** through science<br>• **personal and public health practices**, including First Peoples traditional health and healing practices<br>• impact of **technologies**<br>• **personal safety** and awareness<br>• **workplace safety**<br>• **certifications**<br>• **practical applications of science** in the workplace<br>• **impacts of technology** in the workplace<br>• **applications of materials science**<br>• **beneficial scientific innovations**<br>• **natural hazards and responses**<br>• human impact on Earth's systems:<br>– **natural resources**<br>– **effects of climate change**<br>• **actions and decisions** affecting the local and global environment, including those of First Peoples |

  

## Learning Standards (continued)

| Curricular Competencies | Content |
|---|---|
| • Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information<br>• Seek and analyze patterns, trends, and connections in data, including describing relationships between variables, performing calculations, and identifying inconsistencies<br>• Construct, analyze, and interpret graphs, models, and/or diagrams<br>• Use knowledge of scientific concepts to draw conclusions that are consistent with evidence<br>• Analyze cause-and-effect relationships<br>**Evaluating**<br>• Evaluate their methods and experimental conditions, including identifying sources of error or uncertainty, confounding variables, and possible alternative explanations and conclusions<br>• Describe specific ways to improve their investigation methods and the quality of their data<br>• Evaluate the validity and limitations of a model or analogy in relation to the phenomenon modelled<br>• Demonstrate an awareness of assumptions, question information given, and identify bias in their own work and in primary and secondary sources<br>• Consider the changes in knowledge over time as tools and technologies have developed<br>• Connect scientific explorations to careers in science<br>• Exercise a healthy, informed skepticism and use scientific knowledge and findings to form their own investigations to evaluate claims in primary and secondary sources<br>• Consider social, ethical, and environmental implications of the findings from their own and others' investigations<br>• Critically analyze the validity of information in primary and secondary sources and evaluate the approaches used to solve problems<br>• Assess risks in the context of personal safety and social responsibility | |

  

## Learning Standards (continued)

| Curricular Competencies | Content |
|---|---|
| **Applying and innovating**<br>• Contribute to care for self, others, community, and world through individual or collaborative approaches<br>• Co-operatively design projects with local and/or global connections and applications<br>• Contribute to finding solutions to problems at a local and/or global level through inquiry<br>• Implement multiple strategies to solve problems in real-life, applied, and conceptual situations<br>• Consider the role of scientists in innovation<br>**Communicating**<br>• Formulate physical or mental theoretical models to describe a phenomenon<br>• Communicate scientific ideas and information, and perhaps a suggested course of action, for a specific purpose and audience, constructing evidence-based arguments and using appropriate scientific language, conventions, and representations<br>• Express and reflect on a variety of experiences, perspectives, and worldviews through **place** | |

## Big Ideas – Elaborations

- **Scientific processes and knowledge:**
  *Sample questions to support inquiry with students:*
  - How do the substances you ingest 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 contribute to our health and safety?
  - Why is scientific literacy important?
- **places of employment:**
  *Sample questions to support inquiry with students:*
  - What types of safety precautions are associated with employment?
  - How can industrial waste materials be dealt with responsibly?
  - How do catalytic converters reduce air-borne pollutants?
  - How can science help to solve crimes?
- **respond and adapt to changes:**
  *Sample questions to support inquiry with students:*
  - How do your actions affect the world around you?
  - What are the causes of forest fires or flooding in the province?
  - How do local actions affect global weather?

- **Questioning and predicting:**

  *Sample opportunities to support student inquiry:*
  - What are the scientifically valid key points about allergies in a print or online article?
  - What are some personal or public health issues that affect you or your family (e.g., food sensitivities, drug interactions, diabetes)?
  - What kinds of resources are needed to design and create your cell phone?
  - How do smoke detectors use alpha radiation to keep you safe?
  - How have advancements in technologies affected your present or future employment?
  - What are some of the chemical reactions that are important in society?
  - What factors influence the frequency of forest fires? Predict several scenarios of how changes in these factors might affect the frequency.
  - What are the purposes of using admixtures in concrete?
  - How are temperature and colour linked to the process of hardening metals?
- **Planning and conducting:**

  *Sample opportunities to support student inquiry:*
  - How would you design an experiment to test the effects of various concentrations of caffeine on heart rate in *Daphnia* (water fleas)? Can your conclusions be applied to other organisms? If so, are there any limitations?
  - Devise a hypothetical experiment to test the claims in a scientific article about allergies.
  - Design an experiment to test foods for various nutrients (e.g., proteins, carbohydrates).
  - How would you design an experiment to test the heat conduction or insulation properties of objects or materials (e.g., heat exchangers, R values of building materials, thermoses)?
  - How would you design an experiment to test glue strength in wet or dry environments on face, edge, or end grains (tangential, transverse, radial) of wood?
  - Design an experiment to test the effectiveness of baking soda and different types and concentrations of vinegar in producing $CO_2$. What risks are associated with gas production in an enclosed space?
  - Design an experiment to investigate how components of the fire triangle contribute to combustion.
  - Discuss ethical issues related to the use of living things in experiments, considering related safety precautions.
  - Design a procedure to test the accuracy of instruments such as blood pressure monitors or smoke alarms. Discuss the importance of measurements being accurate (i.e., close to a given standard or known value).
- **Processing and analyzing data and information:**

  *Sample opportunities to support student inquiry:*
  - Construct a graph, table, or model to illustrate data from food packaging (e.g., nutrients, ingredients, price).
  - In what ways are data related to forest fire frequency analyzed, interpreted, and communicated?
  - Use scientific evidence about the benefits and risks associated with genetically modified organisms (GMO) to support your conclusions on genetically modified vegetables.

  

  - Describe a First Peoples traditional healing practice and how it is understood to support healing.
  - What data support a particular vaccination rate to provide herd immunity?
  - What seismic activity occurs before an earthquake?
  - How is blood pressure affected before, during, and after exercise?
- **Evaluating:**
  *Sample opportunities to support student inquiry:*
  - Evaluate the costs and benefits of recyclable and non-recyclable plastics.
  - How do data collected about the complete energy cycle for electric vehicles impact your willingness to operate an electric car?
  - Analyze data and evaluate the risks involved in consuming genetically modified foods.
  - What kind of remediation is necessary after an oil or chemical spill?
  - What could be some social, ethical, and environmental implications of rising sea level to B.C. coastal communities, including First Peoples?
- **Applying and innovating:**
  *Sample opportunities to support student inquiry:*
  - How can you help set up a disaster preparedness relief site in your community?
  - What would you include in a workplace emergency survival kit?
  - Design safe storage plans for chemicals found in the home, including flammable and poisonous materials.
  - Design a residential subdivision plot plan that uses solar photovoltaic (PV) modules for its energy needs.
- **Communicating:**
  *Sample opportunities to support student inquiry:*
  - What advice would you give someone who wishes to make changes to improve their nutrition and lifestyle?
  - How could you share what you have learned about safe storage of household chemicals with others (e.g., poster, video, public service announcement)?
  - How will you communicate to your co-workers how to survive after an earthquake?
  - Use social media to communicate how a particular action impacts climate change.
- **place:** Place is any environment, locality, or context with which people interact to learn, create memory, reflect on history, connect with culture, and establish identity. The connection between people and place is foundational to First Peoples perspectives.

## Content – Elaborations

- **evidence-based decision making:**
  - scientific literacy
  - judging the validity of evidence from a variety of media sources (e.g., peer-reviewed journals, magazines, news, Internet)
  - scientific laws, theories, hypotheses
  - misleading scientific claims related to products (e.g., dietary supplements, hair-growth products, magnetic bracelets, anti-aging cosmetics)
- **personal and public health practices:**
  - nutrition and lifestyle choices
  - allergies and sensitivities
  - medications and supplements
  - vaccination programs
  - pre-natal care
  - First Peoples traditional medicines
  - antibiotics
  - outdoor activities (e.g., hypothermia, heat stroke, UV protection)
- **technologies:**
  - transportation technologies (e.g., electric and self-driving vehicles)
  - health technologies (e.g., insulin pump, blood pressure monitor)
  - media (e.g., smart home, gaming, computer, cell phone)
- **personal safety:**
  - safe use of chemicals (e.g., bleach, antifreeze, propane)
  - electrical hazards (e.g., wiring and circuits, circuit overload protection, travel adaptors)
  - personal protection from electricity (e.g., working near power lines)
  - interactions of medications
  - safety alarms (e.g., smoke, carbon monoxide)
- **workplace safety:**
  - purpose and role of WorkSafeBC
  - chemicals found in the workplace or in industrial products, including disposal methods (e.g., paint, art supplies, solvents, esthetic supplies, herbicides and insecticides, cleaners, chlorine, carbon dioxide in confined space)
  - electricity (e.g., Ground Fault Interrupter [GFI] switches, lockout procedures)
  - oil and gas production, transport, and use
  - fire

## Content – Elaborations

- **certifications**: BC FOODSAFE and responsible disposal, current WHMIS (Workplace Hazardous Materials Information System), MSDS (Material Safety Data Sheet) and other standards, CPR, first-aid, scuba certification, pesticide applications, apprenticeships, Red Seal Program, first responders
- **practical applications of science:** circuits and electronics, hydraulic systems, fluid dynamics, pressure, torque/moment structures, dilution, fractional distillation, forensics, computer system analyses
- **impacts of technology:**
  - robotics and automation
  - heating and cooling systems (e.g., heat pumps, water heaters, air conditioners, refrigerators)
  - electromagnetic spectrum (e.g., microwaves, cell towers, radio waves, X-rays)
  - communications
  - forensics
  - medical
  - transportation
- **applications of materials science:**
  - metallurgy:
    - austenite and martensite crystalline lattice structures/hardening metals
    - tempering colour in ferrous and non-ferrous metals/alloys
    - stress–strain graphical analysis (yield point, ultimate strength, breaking point)
  - welding:
    - carburizing, neutralizing, and oxidizing flames in gas welding
    - inert gas in MIG and TIG welding (e.g., argon, $CO_2$)
    - electrode classification in arc welding
  - carpentry, construction, and joinery:
    - structures and codes
    - concrete admixtures (e.g., air entrained, water reducers, retarders, accelerators)
    - glue technology (e.g., epoxies, polyurethanes, cyanoacrylates, polyvinyl acetate [PVA], construction adhesives, contact cements, urea-resorcinol resins), monomers, polymers
    - tangential, radial, and transverse wood grains
  - power mechanics:
    - hydraulic systems
    - pressure
    - quantitative analysis (e.g., horsepower and torque area under the curve, top dead center [TDC], static compression)

  

  - plumbing and gas fitting:
    - hydronic systems (thermodynamics: convection, conduction, and radiation)
    - gas-fired systems (specific heat, specific gravity)
    - pressure systems (Boyle's law, Charles' law, combined gas law, Bernoulli's principle)
  - electrical and computing:
    - circuits and electronics (Ohm's law, Kirchhoff's law)
    - integrated circuits
    - solar photovoltaic (PV) modules
  - forensics and criminology
  - hairstyling and aesthetics:
    - hygiene, sanitation, and disinfection practices
    - chemical waving and relaxing
    - hair colouring
  - petroleum and industrial:
    - fractional distillation
    - dilution
- **beneficial scientific innovations:**
  - food security (e.g., production, distribution)
  - water treatment and technologies
  - societal safety (e.g., infrastructure, transportation)
  - energy security
- **natural hazards and responses:**
  - geologic events (e.g., earthquake, tsunami, avalanche, land/rock/mudslide)
  - weather events: causes and effects (e.g., flooding, wildfire, hurricane, tornado, flooding, drought)
  - disaster preparedness: survival needs, home and workplace planning and response, industrial accidents (e.g., nuclear plant accident, train derailment, oil spill)
- **natural resources:** including availability (e.g., food, water, energy, minerals) and responsible development and use
- **effects of climate change:**
  - impact on food production
  - impact on climate (e.g., desertification, changing range of plants and animals)
  - impact on weather
  - sea level rise (e.g., infrastructure changes in coastal communities)
  - ocean acidification

## Content – Elaborations

- **actions and decisions:**
  - ethical, cultural, social, economic, environmental, and political implications
  - waste recycling and disposal including limitations of recycling
  - agriculture/aquaculture practices and processes (e.g., hydroponics, food crops, feed crops, fuel crops, animal husbandry, fish farms, new technologies, use of chemicals, environmental impacts)
  - energy generation, use, and efficiency (e.g., production, economics, environmental impacts)
  - sustainability of resources (e.g., impacts of personal choices, product life cycles)

  