Grade 9 Science Curriculum Links to Sustainability Education and Action

Topic A: Biological Diversity

What is biological diversity, and by what processes do diverse living things pass on their characteristics to future generations?

Links to Place and Nature

- What different natural ecosystems exist in our area?
- What are the main biotic and abiotic components of these ecosystems?
- How does biodiversity differ among these ecosystems?
- How do humans use, interact with, and impact these ecosystems?
- How do our local ecosystems provide services for humans?
- What can we do to ensure the health of our local ecosystems?
- What kind of biodiversity exists in the schoolyard, neighbourhood, nearby natural area, or local ecosystems?
- What can we do to protect the biological diversity of local ecosystems?
- What species are considered 'at risk' in my area and why?

Links to Indigenous Perspectives

- How do Indigenous peoples in my area view their relationship with Mother Earth and other living beings?
- Why was biological diversity important to Indigenous peoples?
- How did Indigenous peoples help maintain biological diversity?

Links to Climate Change

- How does climate change affect our local ecosystems (e.g. forests, grasslands, wetlands)?
- How does climate change affect the viability of species at risk?
- What can we do to minimize the effects of climate change on our natural systems and on biodiversity?
- How can we help our ecosystems be more resilient in the face of climate change?

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Topic A: Biological Diversity (cont'd)

What is biological diversity, and by what processes do diverse living things pass on their characteristics to future generations?

Links to City of Calgary Environmental and Climate Strategies

- **Climate Resilience Strategy (2):** Climate change is impacting our ecosystems. Due to climate change we are experiencing, and will continue to experience (p.65-72):
  - More snow in winter
  - Less rain in summer
  - More heat waves
  - Increased average annual temperature
  - More intense summer storms
  - Multi-year drought
  - Increase in pests, diseases, and invasive species due to changes in seasonality
  - Spring will arrive earlier, Summer will last longer, Fall will arrive later, and Winter will be shorter.
- This will have impacts on the lifecycles of plants and species in nature that depend on each other, for example birds migration patterns being altered, and pollinators emerging before plants are ready to be pollinated (see pages 66 and 67 of the Climate Resilience Strategy for more detail). There are actions that we can take to help plants and animals adapt to the impacts of climate change, such as plant natural vegetation to benefit plants and animals (p. 85), and plant local plant species that do well in Calgary's environment and are resilient to climate change.
- **The City of Calgary's Nature Explorations programs (4)** provide environmental education and nature experience for students in preschool to Grade 12.
- **Our BiodiverCity: Calgary's 10-year biodiversity strategic plan (6):** Our BiodiverCity aims to provide a framework for City staff to foster more resilient, biologically diverse open space and neighbourhoods that support positive outcomes for Calgarians, visitors, wildlife and plant communities. Additionally, the introductory sections provide information about biodiversity and are meant for everyone, to engage people with nature and biodiversity in the context of our city ("In brief" section).
- For more information about supporting biodiversity in Calgary, please visit **Calgary's Biodiversity (5).**

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Topic B: Matter and Chemical Change

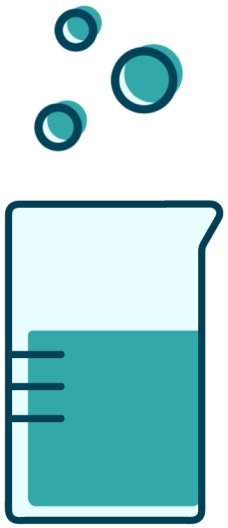
What are the properties of materials, and what happens to them during chemical change? What evidence do we have of chemical change; and what ideas, theories or models help us explain that evidence?

Links to Place and Nature

- What are examples of chemical changes in my home? In the natural environment (e.g. rock weathering)?
- What evidence exists for these changes?

Links to Indigenous Perspectives

- What chemical changes or reactions were important to Indigenous peoples in my area?
- How were they either beneficial or detrimental?



Links to Climate Change

- How does global warming contribute to chemical changes in our environment?
- What is the nature of these changes and how are they beneficial or detrimental to humans? To other life forms?

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Topic C: Environmental Chemistry

What substances do we find in local and global environments? What role do they play, and how do changes in their concentration and distribution affect living things?

Links to Place and Nature

- What chemical substances are beneficial or harmful to the environment? Why?
- What chemical reactions are involved in important environmental processes like weathering of rocks? Acid rain? Forest fires? Photosynthesis?
- What chemicals are responsible for air pollution in my area? Water pollution in my area?

Links to Indigenous Perspectives

- What chemical compounds have adverse effects on Indigenous communities peoples in my area?
- Where do these harmful chemicals come from?
- How are Indigenous communities affected by harmful substances?
- Why have Indigenous peoples traditionally valued a healthy environment?
- How does a healthy environment fit into the notions of interrelatedness, stewardship, and reciprocity?

Links to Climate Change

- What chemical reaction is involved in the burning of fossil fuels, including the internal combustion engine?
- What is the primary by-product of fossil fuel combustion?
- How can carbon dioxide be both beneficial and harmful to life on Earth?
- How does climate change lead to ocean acidification? How does this in turn impact coral reefs?
- What are the primary greenhouse gases and how are they produced and emitted into the atmosphere?
- How do these gases compare in terms of overall contributors to climate change, and why?
- Why does solving the climate crisis require becoming 'net carbon zero" by 2050 (i.e. why is it necessary to eliminate our net greenhouse gas emissions rather than just reduce them)?

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Topic D: Electrical Principles and Technologies

How do we obtain and use electrical energy? What scientific principles are involved? What approaches can we use in selecting, developing and using energy-consuming devices that are efficient and effective in their energy use?

Links to Place and Nature

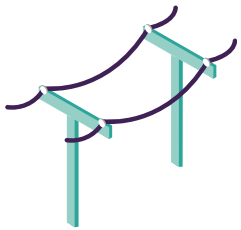
- What forms of electricity were used in my area prior to the availability of electricity?
- What are the major uses of electricity in my home or school?
- What are other major uses of electricity in my community or area?
- Where does the electricity used in my school and home come from?
- How is it produced, and how is it distributed?
- How has electricity generation evolved in Alberta over the past two decades?
- What are the impacts of electricity production, transmission, and use?

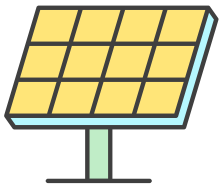
Links to Indigenous Perspectives

- What sources of energy did Indigenous peoples use traditionally prior to electricity?
- How do many remote Indigenous communities in Alberta and Canada meet their electricity needs?
- How is this different from urban centres and less isolated communities in Alberta?
- What particular issues do remote communities face with regards to electricity?

Links to Climate Change

- How can electricity production and use contribute to climate change?
- What can we do to reduce greenhouse gas emissions related to electricity use?





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Topic D: Electrical Principles and Technologies (cont'd)

How do we obtain and use electrical energy? What scientific principles are involved? What approaches can we use in selecting, developing and using energy-consuming devices that are efficient and effective in their energy use?

Links to City of Calgary Environmental and Climate Strategies

- **Climate Resilience Strategy (2):** Natural gas and electricity used in Calgary's residential, commercial, and institutional buildings make up almost 65% of total GHG emissions generated in our community (p.33). Additionally, emissions associated with transporting people and goods account for one third of Calgary's emissions (p.40).
  - **Climate Mitigation Action Plan (2), Program 1: Energy Performance Standards in New and Existing Buildings (p. 34-35):** Energy performance standards refer to the minimum energy performance requirements that are regulated for new and existing buildings. Actions with this Program include supporting the development of new building codes and investigating and enable new incentives and financing mechanisms for improved energy performance.
  - **Climate Mitigation Action Plan (2), Program 2: Energy Consumption Information (p.36-37):** Many people are unaware of how much energy their everyday activities require. By making energy consumption information more readily available and easily understood, we help provide the tools to make better decisions about how energy is used in specific buildings, and we also allow better comparisons between buildings.
  - **Climate Mitigation Action Plan (2), Program 3: Renewable and Low-Carbon Energy Systems (p.38-39):** On-site renewable energy systems and district energy systems are important strategies to transition away from fossil fuels. Actions within this Program relate to enabling the implementation of onsite renewable and low-carbon energy systems, and to supporting community ownership of renewable energy generation.
  - **Climate Mitigation Action Plan (2), Program 4: Electric and Low-Emissions Vehicles (p.41-42):** It is important that we reduce the impacts of remaining cars, buses, and trucks through cleaner vehicles and fuels. Actions within this Program relate to supporting and enabling the uptake of electric vehicles, and to supporting and enabling the uptake of low emissions vehicles in commercial fleets.
- **Electric Vehicle Strategy (3):** The EV Strategy was developed as part of the Climate Resilience Program, since it represents one of the greatest opportunities to reduce greenhouse gas emissions from transportation (p.19). Visit the Electric Vehicle Strategy to learn more about its objectives

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Topic E: Space Exploration

How have humans attained a presence in space? What technologies have been developed and on what scientific ideas are they based? How has the development of these technologies contributed to the exploration, use and understanding of space and to benefits on Earth?

Links to Place and Nature

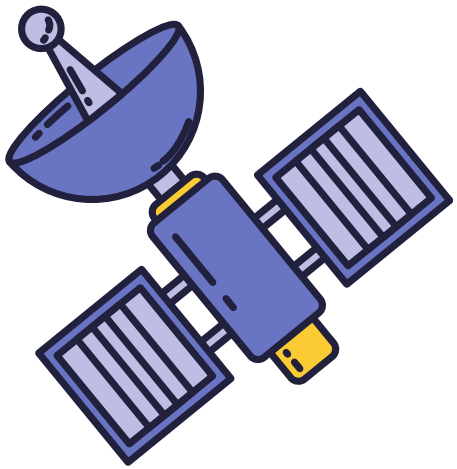
- How has space exploration helped us gain a better understanding of Earth as our home and the interconnectedness of its systems?

Links to Climate Change

- What is unique about Planet Earth that allows life to thrive here?
- How do global warming and climate change affect the earth's systems?
- How do global warming and climate change threaten the Earth's ability to sustain Life on Earth, including humans?

Links to Indigenous Perspectives

- See **Learn Alberta grade 9 sample lesson plan (1)** for this unit.
- How do Indigenous peoples peoples view their connection to the cosmos? What is the significance of this connection?
- What is 'two-eyed' seeing and how can it help us make sense of the world around us?



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