Alberta High School Environmental Curriculum Links

Science 10

Developed by the
Alberta Council for Environmental Education

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ACEE Alberta Council for Environmental Education
ADVANCING ENVIRONMENTAL EDUCATION IN ALBERTA

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INTRODUCTION & BACKGROUND

The purpose of these documents is to empower Alberta educators to integrate environmental and climate education into their classrooms. Each subject area is enriched with guiding questions that align with the Alberta curriculum, creating meaningful connections to nature and place-based learning, Indigenous knowledge systems and perspectives, and climate change across all units. Additionally, these documents offer related resources and activities with links that educators can use to gain further knowledge and incorporate into their lessons.

The curriculum link documents were carefully developed in collaboration with practicing teachers and an Indigenous consultant to ensure they are both practical and culturally responsive. These educators brought their classroom experience and insights to the project, helping to shape content that is directly applicable and impactful for students. The inclusion of an Indigenous consultant ensured that Indigenous knowledge systems and perspectives were thoughtfully and accurately integrated, providing a well-rounded and respectful approach to environmental and climate education. This collaborative process resulted in resources that are both relevant and enriching for educators across Alberta.

For additional resources and support, educators are encouraged to explore the ACEE Resources Hub.

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A NOTE FOR LINKS TO INDIGENOUS KNOWLEDGE SYSTEMS AND PERSPECTIVES

CREATED IN COLLABORATION WITH KORI CZUY, PHD.
INDIGENOUS/RELATIONAL SCIENCE CONSULTANT

The suggestions made and the activities recommended have been reviewed and considered with deep conversation, relationality, time, and respect. Kori recognizes that educators are required to introduce, include, and expand upon Indigenous Knowledges in addition to global ones, but also acknowledges the challenges of introducing these concepts in a good way. Both within this guide and in teaching practice, Kori recommends the following:

- First focus on the knowledges of the Land you are teaching on and relate the topics/subject to those lands.
- This also allows for local connections to more easily be created. All knowledges are connected to a Land, and originate from humans being in deep relationship with those Lands.
- All Indigenous knowledges should be cited both orally and written. Reference the Knowledge Keeper/Elder as well as which land they are connected with.
- This ensures relationality and allows for continued connections to that Land. This type of citation, although it seems strange at first when speaking it, also allows for authenticity of knowledge and protocols.
- When possible, teach about concepts in context, outdoors. Make the learning tangible and inquiry based, experiencing phenomena in real-time when possible. This is essential to grounding learners to a greater understanding of place.
- Example: can you contextualize where water is sourced from by visiting the main source, or a feeder source?

Across the curriculum, there is language around commodification, extraction, and a lack of reciprocity and connection with the natural world. This continues to reinforce the idea that everything on Earth that is not human is for humans to use without consequence, rather than a gift that must be acknowledged. Some suggested alternate terms are as follows:

- Conservation --> finding balance
- Solutions --> responses to
- Preserving/ preservation --> balance of the natural world
- Preservation is nearly impossible to achieve in the natural world, like conservation
- Exist --> thrive
- New species --> non-native or human-introduced
- Protect --> sustain
- Products/ resources --> gifts
- Produced --> harvested
- Emulating --> learning
- Invented --> created or originated for people (especially if the “invention” was influenced from plant or animal knowledge)

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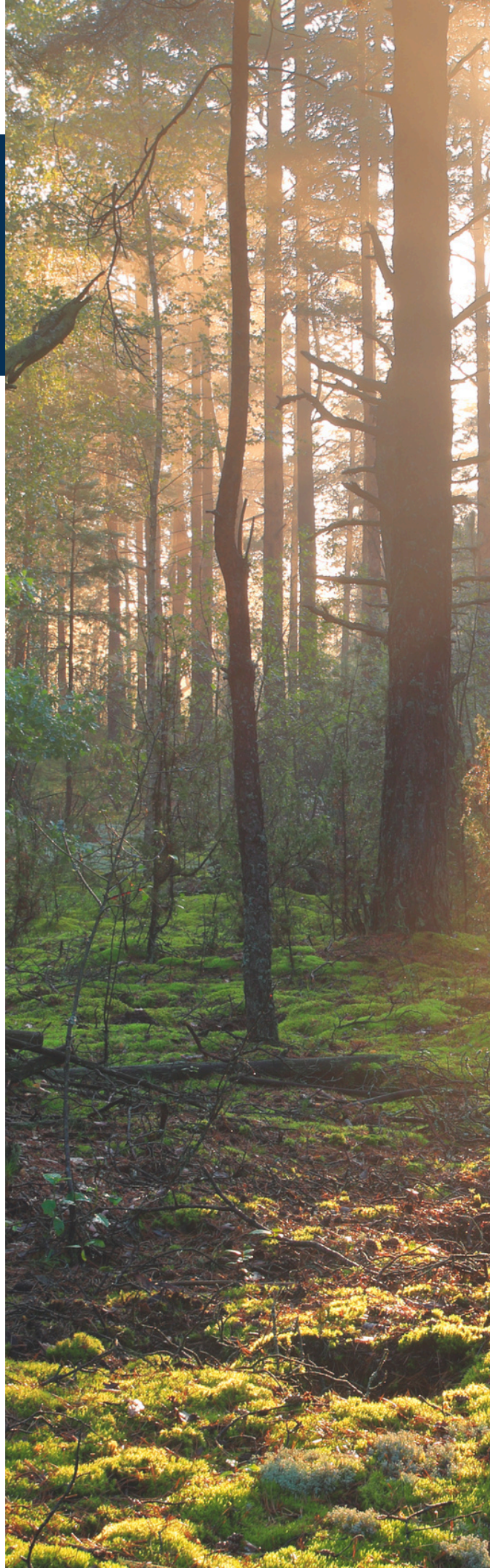

SCIENCE 10

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UNIT A

Energy and Matter in Chemical Change

UNIT B

Energy Flow in Technological Systems

UNIT C

Cycling of Matter in Living Systems

UNIT D

Energy Flow in Global Systems

SCIENCE 10: UNIT A

Energy and Matter in Chemical Change

Links to Nature & Place

1. What type of chemical reaction is at the basis of photosynthesis and cellular respiration?
2. Explain the chemical reaction involved in the combustion of fossil fuels like bitumen.
    a. Discuss the environmental implications of this reaction, including the release of carbon dioxide and other pollutants.
3. Compare and contrast the combustion reactions happening in cellular respiration to the combustion of fossil fuels.
4. How does the principle of conservation of mass apply to industrial processes like treating tailings ponds?
    a. How can understanding mass balance help in creating better ways to manage and protect the environment?
5. Describe an exothermic reaction and an endothermic reaction that occur in nature or industrial processes.
    a. How do these reactions impact the environment?

SCIENCE 10: UNIT A

Energy and Matter in Chemical Change

Links to Indigenous Knowledge Systems & Perspectives

1. How might conversation with students shift if we think of “change” as “cycles”? This aids in thinking about the full life cycle of every transformation, and the intersections of processes, rather than the “end point” of a process.
2. How does the source of water connect to water cycles, including the water cycle inside of beings? How is water essential to the composition of people and animals?
3. How have Indigenous Peoples survived through their deep relationships with the Land and Cosmos?
4. Why are Indigenous People most effected by climate change, water pollution, rising oceans, flooding, thawing permafrost, etc.? How can Indigenous People help with solutions to climate change?
5. What are people from Indigenous communities saying about air or water quality? How have they seen changes in themselves, the land, the animals, and the trees? How have these changes been communicated through relationships or in creative ways?

SCIENCE 10: UNIT A

Energy and Matter in Chemical Change

Climate Related Questions for Exploration

1. What gases are considered greenhouse gases and why?
    a. What greenhouse gas emissions targets has the global community set?
    b. How does an understanding of chemical processes support the development of these targets?
2. What is the chemical process that explains ocean acidification?
    a. Does acidification affect freshwater systems?
    b. What is the impact of acidification in Alberta?
3. What is your community doing to monitor and improve air quality?

Resources & Activities

1. Caring for Our Watersheds
2. E-Waste: A Resource? Lesson Plan
3. How might the defrost of permafrost impact communities across the globe?
    a. PBS: Is Permafrost the Climate Tipping Point of No Return?
    b. Climate Institute: The Impact of Permafrost Thaw on Northern Indigenous Communities
4. Inside Education Classroom Programs
5. Interactive Periodic Table
6. Activity suggestion from Dr. Nicole Redvers (Dene): Think of the water you drink and how that water creates you. Follow the pathway this water takes to your house (or does not take if you do not have access to regular clean water, if so, what are the barriers?).
    a. Ancestral Science Podcast: Planetary Health Through Berries, Land and Water with Dr. Nicole Redvers

SCIENCE 10: UNIT B

Energy Flow in Technological Systems

Links to Nature & Place

1. How is energy used in your community?
    a. How is energy used and transformed in the natural community?
2. How are different forms of energy produced and how is the energy distributed to humans?
    a. What energy conversions are involved?
3. What are the implications for your community of the first and second laws of thermodynamics for energy use and energy conservation?
    a. How do these laws apply to energy conversions in the food chain of natural ecosystems?
    b. How do they apply to our food systems?
4. How does the extraction and use of fossil fuels impact natural ecosystems. Include the effects on wildlife, water sources, air quality, and soil quality.

Links to Indigenous Knowledge Systems & Perspectives

1. How do other animals and plants change energy states to help them survive?
2. Who has access to diverse types of energy? Why or why not? What are the barriers to people accessing renewable energy sources?
3. What does net-zero or living in balance mean?

SCIENCE 10: UNIT B

Energy Flow in Technological Systems

Climate Related Questions for Exploration

1. What are the environmental impacts, including greenhouse gas emissions, associated with different forms of energy use?
2. How has efficiency been considered in renewable and non-renewable energy systems?
    a. Should there be a limit imposed on expected efficiency levels?
3. Compare and contrast the sources of energy in Alberta.
    a. How is the energy stored?
    b. How is the energy transformed into what humans use?
    c. What are the consequences of the release of that energy?
    d. How efficient is the release and capture of that energy?
    e. How does this compare to historical forms of energy used in Alberta?
4. What technologies exist for households and industries to improve efficiency and sustainability in energy conversion and use?
    a. Compare the environmental impacts of renewable energy sources (such as solar, wind, and hydroelectric) with non-renewable energy sources (such as coal, oil, and natural gas). Consider factors like pollution, resource depletion, and habitat disruption.
5. Consider the technology you use (not just digital technology).
    a. Which technologies are efficient?
    b. Which technologies are inefficient?
    c. How did you make this evaluation?
    d. What improvements could you suggest?
6. Should technological improvements be the only path towards improving efficiency in our energy systems?

SCIENCE 10: UNIT B

Energy Flow in Technological Systems

Resources & Activities

1. Inside Education Classroom Programs
2. Renewable Energy Backgrounder
3. The Way We Green: Classroom Conversations
4. Video: TED Ed - Can 100% renewable energy power the world?

SCIENCE 10: UNIT C

Cycling of Matter in Living Systems

Links to Nature & Place

1. How do the plants in your community use specialized cells and processes to function?
    a. Compare the specialized cells found in grass, flowers, and trees in your community. How are the cells different? Why are they different?
2. How do plant cells and animal cells differ, and what are the similarities in their structures and functions?
    a. What are the similarities and differences in how plant and animal cells respond to environmental stress?
3. How do the plants in an alpine meadow in Jasper National Park differ from those in southern Alberta's badlands?
    a. How do the conditions in which they live impact their function?
4. How do environmental factors enhance or impede the function of organelles within cells?
    a. Consider aspects such as temperature, pH levels, nutrient availability, and exposure to toxins, and discuss their potential effects on organelle performance and overall cellular health.

SCIENCE 10: UNIT C

Cycling of Matter in Living Systems

Links to Indigenous Knowledge Systems & Perspectives

1. What is some Indigenous knowledge of plants and their medicines/ gifts? How has this knowledge been appropriated and/or commodified?
2. How might an Indigenous worldview/ relationship to the natural world, including the Land and Cosmos, help humans more deeply understand the impacts of the changing climate?
3. How do Indigenous stories, songs, and complex knowledge systems help humans have a more relational connection with nature, the Land, and the Cosmos?

Climate Related Questions for Exploration

1. What role do plants play in countering climate change?
    a. Discuss the importance of native plants compared to non-native plants, and the impact of monoculture (the cultivation of a single crop) versus native biodiversity on carbon sequestration (the process of capturing and storing carbon).
    b. How do these factors influence the effectiveness of plants as carbon sinks in mitigating climate change?
2. In terms of structure and function, how can the cell system be compared to larger-scale systems such as ecosystems or the planetary system?
3. Discuss the importance of soil health in carbon sequestration.
    a. How can sustainable agricultural practices enhance the carbon storage capacity of soils and help mitigate climate change?
    b. What are the potential environmental consequences of the use of synthetic fertilizers in agriculture

SCIENCE 10: UNIT C

Cycling of Matter in Living Systems

Resources & Activities

1. Garden Projects
2. Inside Education Classroom Programs
3. Video: Plant vs. Animal Cells (0:00-7:00min)

SCIENCE 10: UNIT D

Energy Flow in Global Systems

Links to Nature & Place

1. Describe the impacts of climate change on your local community.
    a. How has it impacted the people, wildlife, and plants?
    b. How has it impacted community design and structure?
2. How do the effects of climate change in your community compare to others in the province, the country, or the world?
3. Why does climate change affect people and places differently and disproportionately?
4. What biome(s) is present in your community, province, or country?
    a. How have they changed over time?
5. What technologies could be used to make your school, house, or community more energy efficient and reduce your environmental impact?

Links to Indigenous Knowledge Systems & Perspectives

1. What are the natural energy systems?
2. How have Indigenous Peoples adapted to past changes in Earth's climate? How are the changes different now?
3. How have Indigenous Peoples's knowledge and perspectives contributed to our understanding of climate change and better understanding to thereby reduce the impacts of human activity?
4. Indigenous People say, "only take what you need," which connects to the idea of "The Honorable Harvest". How does this relate to climate change and industrialization?
5. How is the human activity of taking more than what is needed and not giving back causing climate change?

SCIENCE 10: UNIT D

Energy Flow in Global Systems

Climate Related Questions for Exploration

1. What are the relationships between solar energy, global energy transfer processes, climate, and biomes?
    a. How will climate affect these relationships?
2. What evidence suggests our climate may be changing more rapidly than living species can adapt?
    a. What are some species' responses to rapid climate change?
3. How can we reduce our impact on the biosphere and local and global climate?

Resources & Activities

1. Canadian Geographic Climate Change Educator Resources
2. Climate.gov: The Essential Principles of Climate Literacy
3. Design Our Climate Simulation
4. NASA Climate Change: Vital Signs of the Planet
5. Protect Our Winters: Hot Planet Cool Athletes
6. The Way We Green: Classroom Conversations

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GET SUPPORT FROM ACEE

ACEE is committed to supporting teachers across Alberta by developing curriculum links between climate, sustainability, and our environment to the AB Programs of Study.

The ACEE team has specialized professional development offerings to enhance your classroom teaching experience. All workshops can be adapted to your location, desired length, and goals.

In addition to our workshops, the ACEE team offers personalized consultation services to help you integrate curriculum linked environmental education into your programs or classrooms.

To learn more:
abcee.org

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