Alberta High School Environmental Curriculum Links

Science 14

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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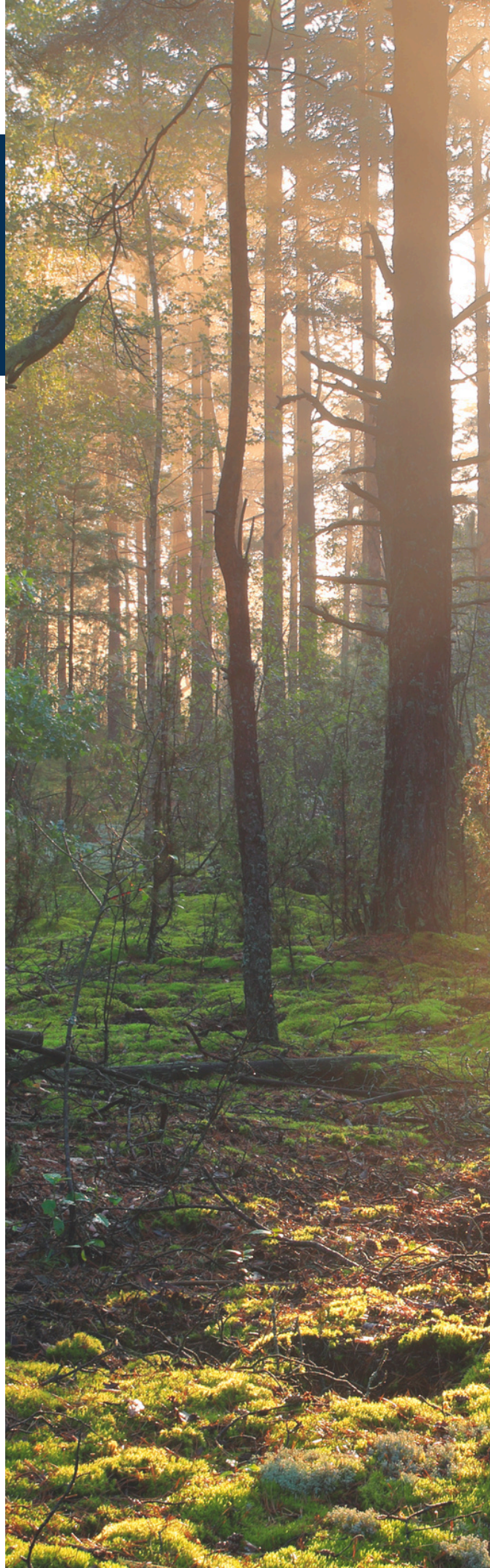

SCIENCE 14

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UNIT A

Investigating Properties of Matter

UNIT B

Understanding Energy Transfer Technologies

UNIT C

Investigating Matter and Energy in Living Systems

UNIT D

Investigating Matter and Energy in the Environment

SCIENCE 14: UNIT A

Investigating Properties of Matter

Links to Nature & Place

1. How does the improper disposal of household chemicals contribute to environmental pollution?
    a. Discuss safe disposal methods and their importance in protecting the environment.
2. How is used household water treated before it re-enters the environment?
3. Golf courses often use a significant amount of water and fertilizers to maintain their courses. What impact does this have on the environment?
    a. Think about a golf course in your community and its proximity to nature (e.g., rivers, streams, parks, wetlands, etc.). What specific impacts does it have on the environment in your community?
4. What is the pH for a local healthy water source?
    a. How does it compare to healthy water sources in other environments?
    b. Why might different water sources have different pH's but still be considered healthy?
5. Discuss the environmental challenges associated with using and disposing of non-biodegradable materials. What are some sustainable alternatives and practices to reduce waste and pollution?
    a. What places exist in your community to help you reduce waste and pollution?

SCIENCE 14: UNIT A

Investigating Properties of Matter

Links to Indigenous Knowledge Systems & Perspectives

1. How have human-shaped environments (golf courses, ski hills, manicured lawns etc.) impacted local biodiversity?
2. What are natural forms of packaging? How/ are these methods still in use today? How do humans manage waste disposal?
3. Is it helpful to disrupt/ speed up decomposition cycles through the elements, bacteria, enzymes, etc.? Why or why not?

Climate Related Questions for Exploration

1. What impact does the production of household products (e.g., cleaners) have on the environment?
    a. What are the risks and benefits of household products (e.g. cleaners) being sold in concentrated versions?
    b. How long can household products and their packaging take to decompose in a landfill?
    c. What are some alternatives to plastic packaging? Are these appropriate for all household products? Why or why not?
2. How do the properties of gases like carbon dioxide (CO_2) and methane (CH_4) contribute to the greenhouse effect and global warming?
3. Discuss the chemical properties of common pollutants, such as sulfur dioxide (SO_2) and nitrogen oxides (NO_x), and their role in the formation of acid rain. How does acid rain impact ecosystems and water sources?

SCIENCE 14: UNIT A

Investigating Properties of Matter

Resources & Activities

1. How to safely dispose of cleaning chemicals. Look up the policies and instructions from your municipality.
    a. Example: City of Calgary
2. Interactive Periodic Table
3. Test the pH of different household product's activity.
    a. pH Simulator

SCIENCE 14: UNIT B

Understanding Energy Transfer Technologies

Links to Nature & Place

1. Where does Alberta's thermal and electrical energy come from?
    a. What are the potential risks and benefits associated with each method?
2. Where does thermal energy originate in nature?
    a. How do organisms adapt to time with low thermal energy?
    b. How do organisms adapt to times of high thermal energy?
3. How does the climate where you live compare to a coastal city like Vancouver or Halifax?
    a. How does sea breeze vs land breeze impact climate?
    b. How do heating and insulation systems differ between your community and a coastal community? Why?
4. How can your home, school, and/or community become more energy efficient?
    a. What are some practical ways individuals and communities can conserve energy?

Links to Indigenous Knowledge Systems & Perspectives

1. What are all the energy sources that humans use in Alberta? What energy sources are used by plants, animals, rocks, and stars? Which are the most common and why?
2. What energy sources have Indigenous Peoples used before and after colonization? How has this changed? How has this remained the same?
3. What machines and technologies were used before colonization? What current technologies have been inspired by these technologies?

SCIENCE 14: UNIT B

Understanding Energy Transfer Technologies

Climate Related Questions for Exploration

1. What are the environmental impacts of using non-renewable energy sources such as coal, oil, and natural gas for electricity generation?
    a. Discuss the implications for air quality, water resources, and climate change.
2. Compare the benefits and challenges of renewable energy sources such as solar, wind, hydro, and geothermal. How can these technologies help reduce greenhouse gas emissions and mitigate climate change?
3. Why is thermal energy conservation important for combating climate change?
4. How does improving energy efficiency in homes, industries, and transportation contribute to reducing environmental impact and combating climate change?
    a. Provide examples of energy-efficient technologies and practices.

Resources & Activities

1. Environment Canada Sea Surface Temperature
2. Inside Education Classroom Programs
3. Natural Resources Canada Energy Efficiency
4. Renewable Energy Backgrounder

SCIENCE 14: UNIT C

Investigating Matter and Energy in Living Systems

Links to Nature & Place

1. What impacts do different diets, such as vegetarian, pescetarian, and omnivorous, have on human health?
    a. What social influences are present when it comes to diet?
    b. What impacts do different diets have on the environment?
2. How is light energy used in different Alberta ecosystems such as grasslands, boreal forests, lake ecosystems, etc.?
3. How are rates of photosynthesis impacted when different plants are in different light conditions?
4. Compare the functioning of a cell to the functioning of your local environment or community.

Links to Indigenous Knowledge Systems & Perspectives

1. What foods do Indigenous Peoples eat that are connected to their homelands? What influenced their diet, and how is this reflected today?
    a. What if we ate food that relates to the land of our Ancestors? How might your allergies/intolerances reflect this idea?
2. Investigate different Indigenous and Land-based medicine and their effects on health, wellness, and disease. How have pharmaceutical companies taken, re-branded, and commodified these medicines?
3. How can practices be modified to be more sustainable and connected with the teachings of The Land?

SCIENCE 14: UNIT C

Investigating Matter and Energy in Living Systems

Climate Related Questions for Exploration

1. Examine how climate change affects our health and the functioning of our organ systems.
    a. How does climate change impact human bodies?
    b. How does climate change impact our health?
    c. How does climate change impact specific organ systems?
2. How can we adapt to changing environmental conditions that affect our health and wellbeing?
3. How can sustainable actions impact our health?
4. How does the process of photosynthesis in plants impact the levels of carbon dioxide in the atmosphere? Discuss the role of photosynthesis in mitigating climate change.

Resources & Activities

1. Alberta Capital Airshed Air Quality Educational Materials
2. Benefits of Nature
3. Bio-Art Activity
4. Forest Bathing and Forest Bathing Activity
    a. Measure your heart rate before and after being in nature and compare.
5. Microscope Activity: Nature's Hidden Wonders
6. Relational Science & Ancestral Science Podcast

SCIENCE 14: UNIT D

Investigating Matter and Energy in the Environment

Links to Nature & Place

1. Trace the flow of energy in a local ecosystem by building a food chain or food web.
2. Where are water, carbon, and nitrogen stored in your local environment?
    a. Where is matter stored in an environment different from your local one (e.g. coastal, desert, etc.).
3. What biodegradable materials are used in your local community?
    a. Why is biodegradability an important consideration for matter and energy cycling?
4. Discuss the environmental benefits of alternative transportation methods, such as electric vehicles, public transit, and cycling.
    a. What are the main sources of transportation in your community? What are their impacts on the environment?
    b. What is your community doing to provide or encourage alternative transportation methods?

Links to Indigenous Knowledge Systems & Perspectives

1. How have settlers disrupted the natural energy cycle on Turtle Island/ Canada?
2. Across Indigenous knowledge systems, there is no “biotic” or “abiotic” category. How can this help with climate change and environmental awareness and connection?
3. How does agriculture contribute to climate change? What methods, technologies, or knowledge exist to reduce the effects?

SCIENCE 14: UNIT D

Investigating Matter and Energy in the Environment

Climate Related Questions for Exploration

1. How has human activity caused climate change through its impact on the cycling of matter, specifically the carbon and nitrogen cycles?
2. What is the Anthropocene? (resource linked below)
3. What responsibility do humans have to mitigate climate change?
4. How does population growth affect climate change?
    a. Explain how various factors influence the size of a population (e.g. immigration and emigration, birth and death rates, food supply, disease, climate change, etc.)

Resources & Activities

1. Anthropocene Education Program
2. Canadian Geographic Climate Change Educator Resources
3. Climate.gov: The Essential Principles of Climate Literacy
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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