

Lesson # 4: Setting the Stage

Topic:	Human Impacts: The Good, Bad and Innovative
Science 14 Program of Studies outcome(s): Science, Technology and Society (STS) and Knowledge	<p>Students will:</p> <ol style="list-style-type: none"> 1. Describe how the flow of matter in the biosphere is cyclical along characteristic pathways and can be disrupted by human activity <ul style="list-style-type: none"> • assess the costs and benefits of technological developments that produce materials the ecosystem cannot recycle (<i>e.g., disposable plastics, heavy metals</i>) • assess the impact of modern agricultural technology on the natural pathways of recycling matter • explain how biodegradable materials reduce the impact of human-made products on the environment • https://education.alberta.ca/media/3069383/pos_science_14_24.pdf • http://leaf-republic.com/media/
Skills	<p>Initiating and Planning:</p> <p>Ask questions about relationships between and among observable variables and plan investigations to address those questions</p> <ul style="list-style-type: none"> • Identify questions to investigate arising from practical problems and issues • Define questions and problems to facilitate investigation <p>Performing and Recording:</p> <p>Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data</p> <ul style="list-style-type: none"> • Organize data, using a format that is appropriate to the task or experiment • Use tools, technology and apparatus safely <p>Analyzing and Interpreting</p> <p>Analyze qualitative and quantitative data, and develop and assess possible explanations</p> <ul style="list-style-type: none"> • Identify new questions and problems that arise from what was learned <p>Communication and Teamwork</p> <p>Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results</p> <ul style="list-style-type: none"> • Communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means • Evaluate individual and group processes used in planning, problem solving, decision making and completing a task

Attitudes	Most of the Attitude Outcomes stated in the Program of Studies are included into each of the <i>Wading in for Water</i> lessons. This includes; Interest in Science, Mutual Respect, Scientific Inquiry, Collaboration, Stewardship, and Safety. Please refer to the specific outcomes · https://education.alberta.ca/media/3069383/pos_science_14_24.pdf
Planning ahead	Have the groups organized ahead of time for the jigsaw activity Sign out mobile laptops/tablets in advance. Have one/two computer(s) available for each group.
Type of lesson	Discussion Jigsaw NOTE: Student Sheet for Jigsaw found here
Word Wall	Listed in Appendix A

Getting Started

Topic opener “hooks”	Intro/ Hook ideas: Oregon man urinates in the drinking water reservoir. Video (time: 1:17): http://www.usatoday.com/story/news/nation/2014/04/17/water-reservoir-urination/7814581/ <ul style="list-style-type: none"> • Should they have drained the reservoir? • Where is our community’s drinking water reservoir? How is it protected?
Lesson Sketch	<ul style="list-style-type: none"> • Discussion: <ul style="list-style-type: none"> ○ What is technology? What is the purpose of technology? Give some examples of technology you used so far today. Examples: coffee maker, hair dryer, bus/car, cell phone. Describe some pros and cons to this technology. What parts of this technology cannot be recycled or reused? Heavy metals, plastics, other? Depending on your community, even if something has a symbol that shows it is recyclable with the Mobius Loop symbol, but it may not be able to be processed due to cost or convenience in many communities, so it still ends up in the landfill. Teacher Resource: http://www.davidsuzuki.org/publications/downloads/2010/plasticsbynumber.pdf ○ Look up your community, and try a few items for the closest location for recycling them. https://callcentre.emergeknowledge.com/search/drop_down/alberta?jurisdiction_material=1445&location_method=area&place=11132&address=&distance=&commit=Search ○ But what does it become? Teacher resource: https://www.edmonton.ca/programs_services/garbage_waste/recycling-what-does-it-become.aspx ○ Regarding renewable and non-renewable resources: Define. Brainstorm some local examples of each. ○ What are some of the local industries around your community? Forestry, agriculture, oil & gas, etc. ○ What are our local industry concerns when it comes to renewable/non-renewable resources? How do we find out what is being done? Who is in charge of this? Should we even care?

	<ul style="list-style-type: none">○ Pollution. Can it be undone? Timeline? Pros and cons of society recycling.○ What is consumerism? If matter cycles, where does material end up that can/cannot be recycled? Is it okay for material to build up in one place, while being depleted of resources someplace else thousands of km away? Length of time (long/short cycling of carbon). What about plastic? If time permits, Water Brothers episode: Plastic Ocean, may be viewed (28 minutes): http://thewaterbrothers.ca/plastic-ocean/• Discussion: What are some consumer products that “bug” you? You know it would be difficult to stop using, but know that they add to the problem of garbage/pollution/ waste? Possible answers: Plastic straws, plastic forks, and plastic six-pack holders. Keeping these items in mind, now let’s think outside of the box: What about biodegradable materials? What does this mean? How can individual citizens and/or industry improve their technology to minimize waste? Examples:<ul style="list-style-type: none">○ Six-pack holder in the oceans. Pros/cons? Video (time 1:52): https://www.youtube.com/watch?v=-YG9gUJMGyW○ Edible spoons. Pros/cons? Video (time 3:42): https://www.youtube.com/watch?v=r4Cc5zmy0eY○ Edible cups video (time, less than 1 minute): https://www.loliware.com/○ Biodegradable leaf plates video (time 1:59): http://leaf-republic.com/media/○ Water without the bottles: http://www.skippingrockslab.com/○ How can we prevent harm when developing new technology? Discuss the design process (see a discussion of Design Thinking here)• Unfolding Innovation: There is a way to reduce or reuse of some materials such as paper towels in a different way. Depending on the method, this can reduce waste, and operate in either a carbon neutral or carbon negative capacity for an organization. This technology is called Gasification. Are there any negative impacts from this type of innovation?<ul style="list-style-type: none">○ How it works Video (time 4:52): https://www.youtube.com/watch?v=cjyAR7EkZlC&feature=youtu.be○ Commercial for a local Calgary company employing this technology Video (time 5:01): https://www.youtube.com/watch?v=ZisQHpYLyac&feature=youtu.be○ An article looking at the Alberta Governments interest in this technology: http://www.cbc.ca/news/canada/calgary/plasma-gasification-alberta-proposal-1.3373979• Jigsaw activity: What is industry doing to improve water recovery? (see attached worksheet found here)<ul style="list-style-type: none">○ Oilsands○ SAGD○ Farming (cattle & grain)○ Forestry○ City/town use○ Tourism
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Closing ideas	<p>Wabamun Lake is a provincial park, and adjacent to the lake is the Sundance Power Station that operates the Highvale Coal Mine and Power Plant. This is Western Canada's largest coal-fired electrical generating station. Warm water is deposited into the lake after it has been cleaned, but does the temperature of the water have any long term effects?</p> <ul style="list-style-type: none">• Teacher resource: http://www.transalta.com/facilities/plants-operation/sundance/ and http://www.transalta.com/facilities/mines-operation/highvale-mine/• To show how it is highly monitored by the government see the following (search the word "temperature" for specific info): https://extranet.gov.ab.ca/env/infocentre/info/library/6138.pdf <p>Possible discussion starters:</p> <ul style="list-style-type: none">• Different organisms might prefer different temperatures. How would that change the entire food web?• Would the warmer lake water freeze in the winter? What is the potential impact?• How might the coal mine and power plant have positive and negative effects on the environment? Are there other considerations to take into account such as: political, economic, social? <p>**Note: Consider the role that industry, community partners, environmental organizations, local and provincial governments, and others may play when engaging students in a balanced discussion about water in your community. There are both challenges and good news stories to share regarding each stakeholder's social responsibility and the ways in which emerging technologies and innovative thinking may contribute to managing and caring for our water and other natural resources.</p>
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