



Grade 5

Conservation of Energy & Resources

Mini-Unit on Batteries

Overview

This mini unit was developed to be a part of your Grade 5 science unit on the **Conservation of Energy and Resources**. It was envisioned as a continuous flow of lessons. However you may feel free to pick and choose or rearrange the lessons in any order to suit the needs of your classroom. Every effort was made to cite any external sources referenced. If I have missed any please let me know and I will make every effort to rectify the problem.

Written and compiled by: Tyler Fraipont
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Lesson #1 - Introduction

Ontario Curriculum connections:

Science:

Conservation of Energy and Resources:

The Big Ideas

1. Choices about using energy and resources have both immediate and long-term impacts.
2. Conservation (reducing our use of energy and resources) is one way of reducing the impacts of using energy and resources.

Specific Expectations

- 1.1 - **analyze** the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts.
- 1.2 - **evaluate** the effects of various technologies on energy consumption.
- 2.4 - **use** appropriate science and technology vocabulary in oral and written communication
- 2.5 - **use** a variety of forms (e.g., oral, written, graphic, multimedia) to communicate with different audiences and for a variety of purposes.

Language:

Oral Communication:

- 2.1 - **identify** a variety of purposes for speaking.
- 2.3 - **communicate** orally in a clear, coherent manner, presenting ideas, opinions, and information in a readily understandable form.
- 2.5 - **identify** some vocal effects, including tone, pace, pitch, volume, and a variety of sound effects, and **use** them appropriately and with sensitivity towards cultural differences to help **communicate** their meaning.

Media Literacy:

- 1.1 - **identify** the purpose and audience for a variety of media texts
- 1.5 - **identify** whose point of view is presented or reflected in a media text, **ask questions** to identify missing or alternative points of view, and, where appropriate, **suggest** how a more balanced view might be represented.
- 3.1 - **describe** in detail the topic, purpose, and audience for media texts they plan to create.
- 3.2 - **identify** an appropriate form to suit the specific purpose and audience for a media text they plan to create, and **explain** why it is an appropriate choice.
- 3.3 - **identify** conventions and techniques appropriate to the form chosen for a media text they plan to create, and **explain** how they will use the conventions and techniques to help communicate their message.

Activation:

- With your partner brainstorm all of the items you use in your house that use batteries.
- Share your ideas with the class as a whole.
- In the whole group, discuss any novel ideas of items that came up. Can they think of any other items in the world at large that use batteries.
- Ask the kids to think about how amazing it is that we were able to invent a small, portable power supply that we can take with us.



Activity:

What do you think the effects of the battery have been on our society? How have humans and their behaviour changed due to the widespread use of batteries?

Use your list of items from the first part of the lesson to help you make your conjectures.

Use your ideas to create a 1-3 minute commercial (skit) for a battery company to try and sell even more batteries to people.

Consolidation:

Questions for consolidating the students understanding

- Why do you think people in our society like batteries?
- How have batteries helped our society to grow and advance?
- Why do you think that companies would want the public to use more batteries?
- Is it a good thing to use more batteries? Why or why not?



Lesson #2 Battery Research

Ontario Curriculum connections:

Science:

Conservation of Energy and Resources:

The Big Ideas

1. Energy sources are either renewable or non-renewable
2. Choices about using energy and resources have both immediate and long-term impacts
3. Conservation (reducing our use of energy and resources) is one way of reducing the impacts of using energy and resources.

Specific Expectations

- 1.1 - **analyze** the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts.
- 1.2 - **evaluate** the effects of various technologies on energy consumption.
- 2.2 **use** scientific inquiry/research skills to **investigate** issues related to energy and resource conservation
- 3.2 - **identify** renewable and non-renewable sources of energy.

Language:

Reading:

- 1.1 - **read** a variety of texts from diverse cultures, including literary texts, graphic texts, and informational texts.
- 1.2 - **identify** a variety of purposes for reading and **choose** reading materials appropriate for those purposes.

Writing:

- 1.3 - **gather** information to support ideas for writing, using a variety of strategies and a range of print and electronic resources.

Activation:

- Ask the students to think about the previous lesson.
- Have some students recount/share their ideas about how batteries have helped our society to grow and advance.
- Split students into small groups and ask them if they can think of any negative consequences of batteries. Allow think and discussion time.
- Bring the small groups back together and record their ideas on chart paper.
- If the idea of waste does not come up, try to guide their thinking using questioning, as this idea will be central to the Learning for the lesson. Possible questions: How many batteries do you think you go through in your house in a year? What do you think happens to all off the batteries once they run out of power? Are they safe to just through into the garbage?

Activity:

This activity may take a few periods to complete, or may be assigned as a home task.



What goes into a battery?

Alone or with a partner use the internet to research the different types of batteries and the natural resources used to make them.

Complete worksheet (**Appendix 5.1**)

Consolidation:

When the research is complete discuss the students findings and ask what they think can be done with the materials, especially the dangerous materials that are found in batteries.

Discuss recycling options. Ask if they know whether batteries should be thrown in the garbage or recycled? Does your municipality collect batteries to be recycled, or are there private collection programs. What can you do to get your municipality to more directly support battery recycling?



Lesson #3 Battery Ingredients Sustainability

Ontario Curriculum connections:

Science:

Conservation of Energy and Resources:

The Big Ideas

1. Energy sources are either renewable or non-renewable
2. Choices about using energy and resources have both immediate and long-term impacts
3. Conservation (reducing our use of energy and resources) is one way of reducing the impacts of using energy and resources.

Specific Expectations

1.1 - **analyze** the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts.

1.2 - **evaluate** the effects of various technologies on energy consumption.

Language:

Reading:

1.4 - **demonstrate** understanding of a variety of texts by **summarizing** important ideas and citing supporting details.

1.5 - **use** stated and implied ideas in texts to **make** inferences and **construct** meaning.

1.6 - **extend** understanding of texts by **connecting** the ideas in them to their own knowledge, experience, and insights, to other familiar texts, and to the world around them.

1.8 - **make judgements** and **draw conclusions** about the ideas and information in texts and **cite** stated or implied evidence from the text to support their views .

Activation:

- On a piece of chart paper ask student to recall any of the different ingredients they can remember from their research in Lesson #2. If they cannot, allow them to refer back to their research.
- Are there any ingredients that they are familiar with? Which ones do they have questions about?
- Where do they think these ingredients come from? If no answers are forthcoming make some connections to the game Minecraft. If there are still no answers lead them to the idea of mining these products from the Earth
- Discuss how some of the elements are toxic to all life, but still important to the products we use

Most common elements:

zinc, steel, plastic, manganese, lithium, mercury, graphite, potassium, nickel, cadmium, lead

<u>Toxic</u>	<u>Non-Toxic</u>
Mercury	Potassium



Lead	Plastic
Cadmium	Graphite
Manganese	Nickel
Zinc	Steel
Lithium	

Activity:

Watch the video after the whole group discussion and complete the What's One Can?

<https://www.youtube.com/watch?v=P9UjmOHC300>

Worksheet (**Appendix 5.2**)

Can be completed individually or in small groups depending on student abilities.

Consolidation:

Come back to the whole group and discuss students answers.

Key Ideas:

- The Earth only has a finite amount of resources
- We can save energy when we recycle
- We help maintain a more healthy environment when we recycle
- We don't use up our landfill sites as quickly
- We create local jobs

Resources used and additional optional videos

<https://www.conserve-energy-future.com/benefits-of-recycling.php>

What's One Can?

<https://www.youtube.com/watch?v=P9UjmOHC300>

RMC Process

https://www.snotr.com/video/17525/How_Do_Your_Old_Batteries_Help_Grow_Corn

Saving Little Pieces of our Earth

<https://www.youtube.com/watch?v=pMUuxPOgqTk>



Lesson #4 Persuasive letter

Ontario Curriculum connections:

Science:

Conservation of Energy and Resources:

The Big Ideas

1. Choices about using energy and resources have both immediate and long-term impacts.

Specific Expectations

1.1 - **analyze** the long-term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts.

1.2 - **evaluate** the effects of various technologies on energy consumption.

2.4 - **use** appropriate science and technology vocabulary in oral and written communication

2.5 - **use** a variety of forms to communicate with different audiences and for a variety of purposes.

Language:

Writing:

1.1 - **identify** the topic, purpose, and audience for a variety of writing forms.

1.2 - **generate** ideas about a potential topic and **identify** those most appropriate for the purpose.

1.5 - **identify** and order main ideas and supporting details and **group** them into units that could be used to develop several linked paragraphs, **using** a variety of strategies.

2.1 - **write** longer and more complex texts **using** a variety of forms.

2.2 - **establish** an appropriate voice in their writing, with a focus on modifying language and tone to suit different circumstances or audiences.

2.8 - **produce** revised, draft pieces of writing to meet identified criteria based on the expectations related to content, organization, style, and use of conventions

Activation:

Student questions:

- Think about what your family does with batteries after they die.
- Do you think that it is safe to just throw them into the garbage or regular recycling?
- Does anyone know where they can take their discharged batteries?
- Why do you think it may be important to dispose of or recycle batteries properly?
- Who do you think is/should be responsible for making sure that batteries get recycled?

Activity:

Students will write a persuasive letter using all of the information that they have learned so far in this Mini-Unit. They may choose to write it too whom ever they see fit: the **Premier**, the **Head of their Regional Council**, their **Mayor**, their **Principal**, or even their **parents**.



Write a persuasive letter using everything that you have learned. A graphic organizer (**Appendix 5.3**) has been included for you, or you can use whichever one you prefer from your own sources.

Consolidation:

Possible ideas for discussion during the planning stage or for after the letters are complete.

- Share some of your reasons for recycling and evidence with your peers.
- Are there any arguments that you can think of **against** battery recycling that you could rebut?



Lesson # 5 Data Analysis

Ontario Curriculum connections:

Science:

Conservation of Energy and Resources:

The Big Ideas

1. Conservation (reducing our use of energy and resources) is one way of reducing the impacts of using energy and resources.

Math:

Data Management and Probability

Overall Expectations

By the end of Grade 5, students will read, describe, and interpret primary data and secondary data presented in charts and graphs, including broken-line graphs.

Specific Expectations

- **read, interpret, and draw conclusions** from primary data and from secondary data , presented in charts, tables, and graphs.
- **compare** similarities and differences between two related sets of data, using a variety of strategies.

Activation:

- Remind students of all of the information they have learned about batteries over the last couple of days.
- Tell them that they are now going to have to use that knowledge to help them interpret some data on the sale and collection of batteries for recycling in Canada.

Activity:

Students will get a copy of the graph (**Appendix 5.4**)

Possible question to help students interpret the graph:

- What is this graph telling you?
- What information is important?
- Why are there 2 bars for each battery type?
- Why do you think some batteries have higher values on the graph?
- Why do you think Alkaline have the most?
- Why do you think Zinc Air Button and Lithium Ion batteries are so low on the graph?
- Are there any values that seem odd or wrong to you on this graph?
- Why are the Zinc Carbon values strange?
- What could some possible explanations be for the Zinc Carbon values?
- Is this a good scale to use for this graph? Why/why not?
- What would be a better scale?



If you wish, have the students draw the graph again with a scale that they think would represent the data better.

Consolidation:

Post student graphs with different scales and discuss how the different scales can affect the appearance of the data. Which scales do you think represent the data in the best, most honest way? Why?



What Goes Into a Battery?

Define a Primary Cell: _____

Types of Primary Cells and what they are made of:

Type of battery cell	Ingredients



Define a Secondary Cell: _____

Types of Secondary Cells and what they are made of:

Type of battery cell	Ingredients

What are the most common ingredients in batteries?: _____

Which ones are dangerous to humans and/or the environment? _____

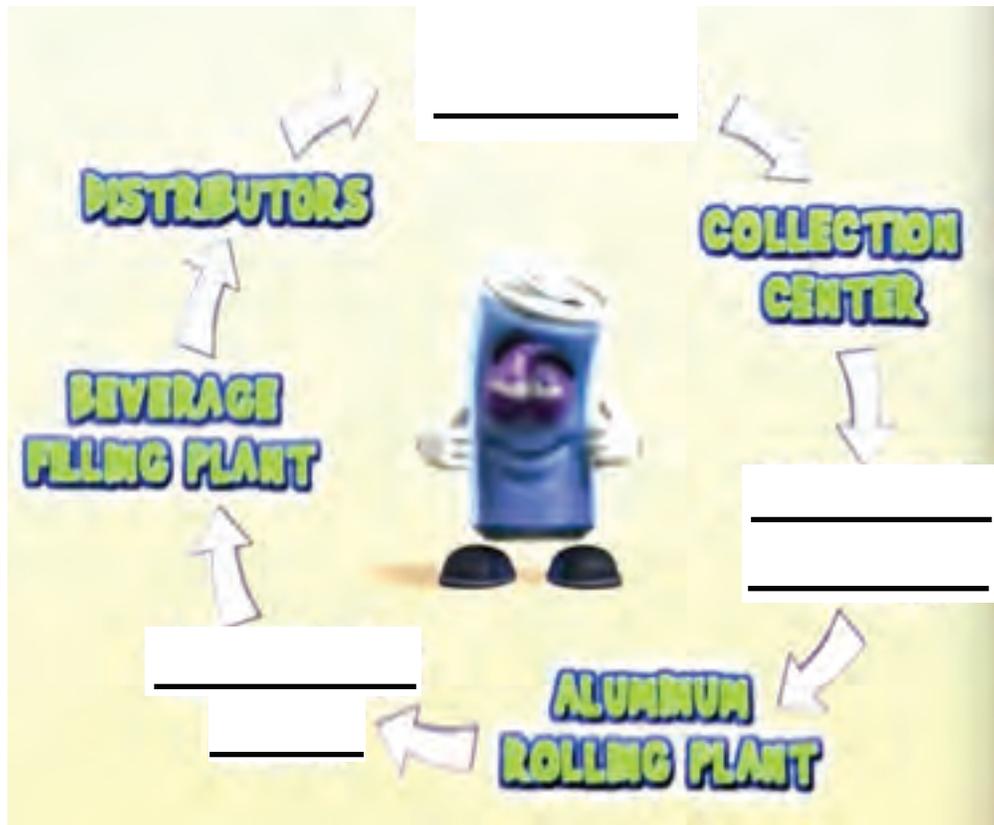


What's One Can?

About how much garbage does the average person generate each day?

Why is recycling important? _____

Label the missing parts of the Life Cycle of an aluminum can/



Read the following paragraphs from www.benefits-of-recycling.com.

Recycling metals is especially effective because they can be recycled almost indefinitely, thereby making them extremely friendly to the environment. Metals are different from polymer plastics in that their properties can be restored fully whatever physical or chemical form they are in, although sometimes the process is costly and difficult.

The success of recovered metal markets is dependent upon the cost of retrieving and processing. These are the metals most commonly recycled and are highly valued.

Aluminum -the production of aluminum from the raw ore needs large quantities of energy. The process to free aluminum from alumina, which is the raw ore, is quite complex. Recycling aluminum uses only 5 percent of the energy and produces only 5 percent of CO₂ emissions when compared to with production of virgin metal.

This also reduces the amount of waste going to the landfill. A recycled aluminum can save enough energy to run a television set for three hours. Recycling 1kg of aluminum saves up to 6kg of bauxite, 4kg of chemical products and 14 kWh of electricity.

Steel -is also derived from an ore that has to be mined from non-renewable resources of the Earth. Iron ore is common and is quite plentiful but in that form it is usually combined with oxygen or other elements like sulphur or carbon. Large amounts of energy are again needed to produce the pig iron from the ore.

Over 11 million tons of iron and steel scrap are produced each year, of this amount 70 percent is recovered. Of the remaining quantity 2/3 is land filled. Each ton of steel recycled can save 1.5 tons of iron ore, 0.5 tons of coal, 40 % of the water used in production, 75 % of the energy needed to make steel from the raw material, 1.28 tons of solid waste, reduction in air emission 86 %, and reduction of water pollution by 76 %.



Persuasive Letter Planner



Paragraph #1 - Introduction

- > Attention-grabbing beginning -
- > Description of issue -
- > Opinion Statement -

Paragraph #2

Reason #1 -

Evidence to support
(details and examples)

-
-
-
-
-
-
-
-

Paragraph #3

Reason #2 -

Evidence to support
(details and examples)

-
-
-
-
-
-
-
-

Paragraph #4

Reason #3 -

Evidence to support
(details and examples)

-
-
-
-
-
-
-
-

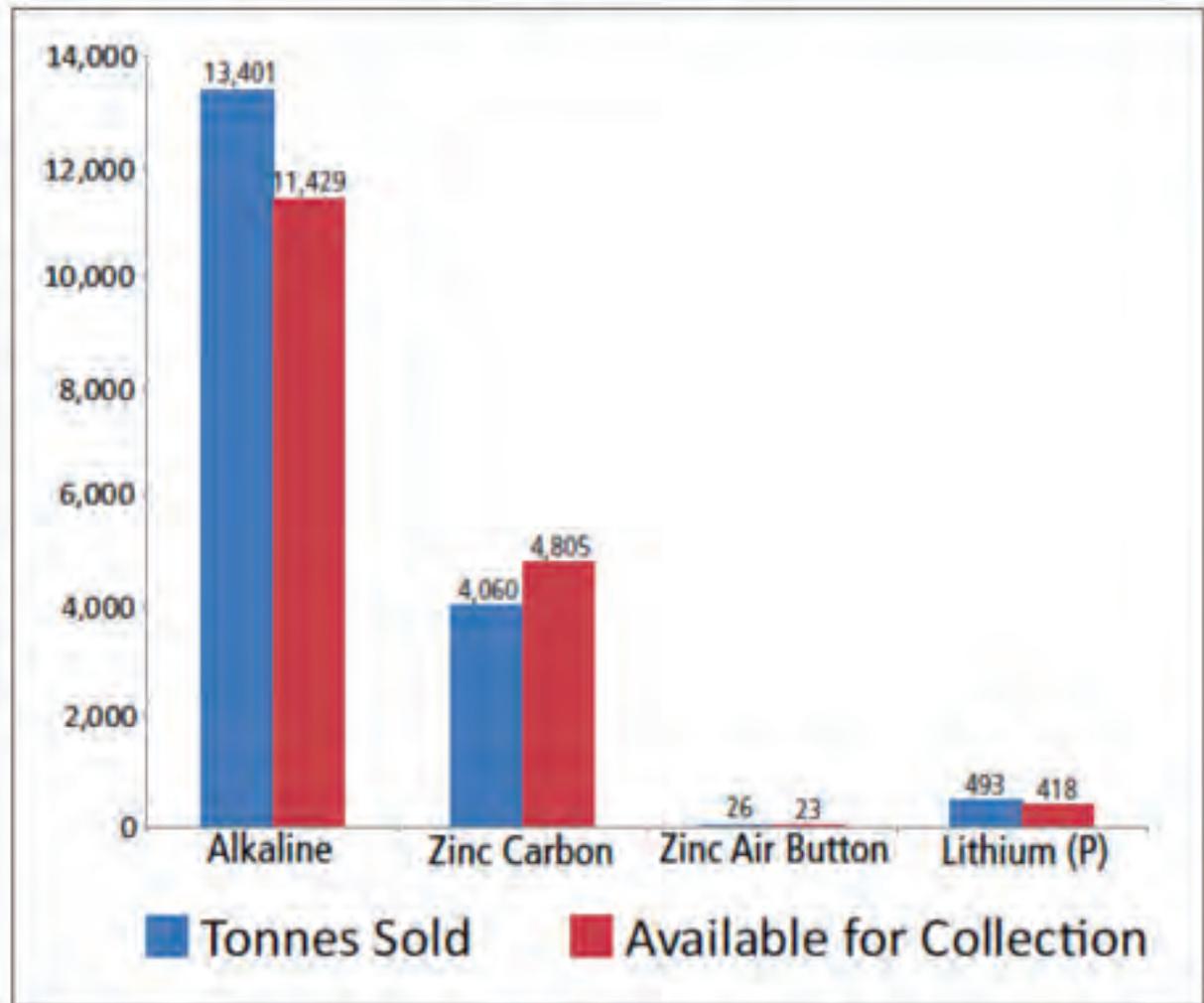
- Can you include a rebuttal?

Paragraph #5 - Conclusion

- > Restate opinion -
- > Summarize 3 reasons -
- > Call to action or closing statement -



Figure 3: Estimated tonnes of primary batteries sold and available for collection in Canada, 2011



Source: Benchmark Battery Recycling in Canada, CM Consulting, 2012



Persuasive Letter Rubric

CATEGORY	4 - Above Standards	3 - Meets Standards	2 - Approaching Standards	1 - Below Standards	Score
Position Statement	The position statement provides a clear, strong statement of the author's position on the topic.	The position statement provides a clear statement of the author's position on the topic.	A position statement is present, but does not make the author's position clear.	There is no position statement.	
Support for Position	Includes 3 or more pieces of evidence (facts, statistics, examples, real-life experiences) that support the position statement. The writer anticipates the reader's concerns, biases or arguments and has provided at least 1 counter-argument.	Includes 3 or more pieces of evidence (facts, statistics, examples, real-life experiences) that support the position statement.	Includes 2 pieces of evidence (facts, statistics, examples, real-life experiences) that support the position statement.	Includes 1 or fewer pieces of evidence (facts, statistics, examples, real-life experiences).	
Evidence and Examples	All of the evidence and examples are specific, relevant and explanations are given that show how each piece of evidence supports the author's position.	Most of the evidence and examples are specific, relevant and explanations are given that show how each piece of evidence supports the author's position.	At least one of the pieces of evidence and examples is relevant and has an explanation that shows how that piece of evidence supports the author's position.	Evidence and examples are NOT relevant AND/OR are not explained.	
Closing paragraph	The conclusion is strong and leaves the reader solidly understanding the writer's position. Effective restatement of the position statement begins the closing paragraph.	The conclusion is recognizable. The author's position is restated within the first two sentences of the closing paragraph.	The author's position is restated within the closing paragraph, but not near the beginning.	There is no conclusion - the paper just ends.	
Sentence Structure	All sentences are well-constructed with varied structure.	Most sentences are well-constructed and there is some varied sentence structure in the essay.	Most sentences are well-constructed, but there is no variation in structure.	Most sentences are not well-constructed or varied.	
Grammar & Spelling	Author makes no errors in grammar or spelling that distract the reader from the content.	Author makes 1-2 errors in grammar or spelling that distract the reader from the content.	Author makes 3-4 errors in grammar or spelling that distract the reader from the content.	Author makes more than 4 errors in grammar or spelling that distract the reader from the content.	
Audience	Demonstrates a clear understanding of the potential reader and uses appropriate vocabulary and arguments. Anticipates reader's questions and provides thorough answers appropriate for that audience.	Demonstrates a general understanding of the potential reader and uses vocabulary and arguments appropriate for that audience.	Demonstrates some understanding of the potential reader and uses arguments appropriate for that audience.	It is not clear who the author is writing for.	



Battery Recycling Quiz

Answer all of the questions using the knowledge you have gained from the questions and activities in the last few lessons in class.

1. Make a chart showing the Pros and Cons of batteries and their uses.

Pros	Cons



2. Define the following terms.

Primary cell: _____

Secondary Cell: _____

3. Considering the research you did on the ingredients of a battery, explain why it is or is not important to recycle batteries.



