

Science 9

Overarching Question: What lessons can we learn from science and math that can help us live mino bimaadiziwin?

Overarching Challenge: Use Indigenous knowledge and western knowledge to develop a guide that includes helpful advice for living mino bimaadiziwin. (For example, communicate five important tips/lessons in the format of your choice.)

Lesson Question: Is metal always better?

Lesson Challenge: Decide which type of material is best for making a canoe.

Lesson Summary: In this lesson, you will decide whether metal or non-metal is best for four different types of canoes.

Big Idea: Understanding the unique physical and chemical properties of metals and non-metals can help us make decisions on how to best use them.



Lesson Question: Is metal always better?

Lesson Challenge: Decide which type of material is best for making a canoe.

Start Your Thinking

Canoes are a significant part of both Indigenous and non-Indigenous history in Canada. An Indigenous invention, canoes are an elegant feat of engineering. They are lightweight, can be designed to fit different environments, and can travel great distances. Early European settlers quickly saw how canoes could be a tool for exploration and colonization. Over the years, colonization caused many Indigenous peoples to lose the art of canoe making and paddling.



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Today, canoes are an icon for many Canadians. For many Indigenous people, canoes have become a “symbol and tool of sovereignty, resurgence, and resilience” (NWT Recreation & Parks Association 2021) as they rediscover the traditional arts of canoe making and paddling on traditional canoe routes, such as the Kitchi Siipi.

In this lesson, you will look at different materials and decide which is best for making a canoe. Historically, Indigenous people commonly made canoes/boats out of different materials.

For example, the Indigenous Peoples of the North traditionally used the following materials:

Birch Bark

Birch bark canoes were used for transportation, most commonly down the Yukon River. The men would cut strips of birch bark in the spring and the women would gather spruce roots to sew them together. The canoes were long and narrow and light for portaging.

Sealskin

The sealskin qayaq was used by the Inuit for transportation across the Arctic. Qayaqs were light to carry and moved silently through the water. They were used to hunt seals and beluga whales.

Moose Skin

Every part of the moose had a purpose, including the hides for boat building. The boats were used to paddle downstream because they were too heavy to paddle upstream. When the boats reached their destination, the skins were removed and used for other purposes.

Hollowed Trees

The dugout canoe was made from hollowed cedar, spruce, and cottonwood trees. These types of canoes could endure long trips through oceans and rapid rivers. They were used to travel for trade and for visiting relatives.

Sources: “The Canoe: A Symbol of Resilience, Resurgence, and Nationhood for Indigenous Peoples.” NWT Recreation & Parks Association. June 26, 2021. <https://www.nwtrpa.org/post/canoe-a-symbol-of-resilience-resurgence-and-nationhood>

“History of Boats.” Yukon First Nations Culture & Tourism Association. <https://www.yfnct.ca/can150-boats#spruce>

Lesson Question: Is metal always better?

Today, canoes are made from a variety of materials, such as metals, plastics, and wood. You will learn more about these materials in later parts of this lesson.

Let's begin our thinking by considering different uses for a canoe:

- hunting and fishing trips
- camping trips
- harvesting wild rice
- paddling on a river

Think about how some types of materials may suit a canoe activity better than other types of materials.

What do you think is the best material to use for a canoe for each different activity?



Canoe Activity	Best Material for a Canoe	Reason for Your Thinking
Hunting and fishing	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	
Camping trips	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	
Harvesting wild rice	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	
Paddling on a river	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	

Lesson Question: Is metal always better?**Think About the Lesson Challenge**

In this lesson, you will decide whether metal or non-metal is best for four different types of canoes.

Before moving on to the next part of the lesson, let's pause and think about any prior experiences you have had with canoes, or you can talk to someone you know who has experience with canoes. What was the canoe used for? What material was it made of? Do you have or know any stories about canoes? Record your answers in the chart below.



Prior Knowledge, Experiences, and Stories	Observations and Learnings from the Experiences and Stories

Lesson Question: Is metal always better?

Grow Your Thinking

The most common materials used to build canoes, both historically and today, all have different chemical and physical properties.

Before moving on to the next part of the lesson, review the following background information about the different properties of these materials. How do you think understanding the unique properties of these materials may help you decide which material is best? Write your thoughts in the “My Initial Thoughts” column.

Material	Background Information	My Initial Thoughts
Metal	<ul style="list-style-type: none"> The most common metal used to build canoes is aluminum. Properties of aluminum: non-toxic, malleable (bendable), lightweight, good electrical conductor, non-corrosive (doesn't rust), durable, recyclable 	
Plastic	<ul style="list-style-type: none"> Fibreglass and Kevlar are common manufactured plastics used to build canoes. Properties of fibreglass and Kevlar: high strength and toughness, electrical insulator, lightweight, chemically stable, less expensive, recyclable (some), easily repaired 	
Wood and bark	<ul style="list-style-type: none"> The most common materials used are cedar and birch bark. Properties of cedar: lightweight, thermal (heat) insulator, hygroscopic (absorbs moisture), recyclable, durable, more expensive than birch bark Properties of birch bark: lightweight, waterproof, smooth, hard, recyclable, durable, fragile but easily repaired 	
Animal hide	<ul style="list-style-type: none"> Moose skin and sealskin are commonly used to build canoes. Properties of moose skin and sealskin: very durable, expensive, heavier than bark 	

Lesson Question: Is metal always better?

What properties do you think are important to consider when picking the best material for a canoe?

When deciding between different options, it is helpful to consider criteria. Think back to the initial decision you made on page 3 about which type of material was best for each canoe activity. Perhaps you thought about taking the canoe on long trips with rough waters and wanted a canoe that is durable. You may have thought about how you were going to carry the canoe, making weight important. If protecting the environment is a priority for you, then sustainability might also be a factor to consider. And if you wondered if you could afford the canoe, cost might also be important.

You can use criteria to help you determine the best material to use to make a canoe:

Criteria for the best material:

- cost: How affordable is this material?
- durability: Will the material last over time? Will it stand up to use without getting damaged?
- weight: How heavy is this material?
- sustainability: What is the environmental impact of this material? Consider the raw material, production, and disposal.

In the table on page 7, use what you know about the properties of each material and the criteria to rate each material. Place an X on each scale to rate the material for each criterion. Explain your thinking.

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Canoe Material	Rating	Reason for Your Rating
Metal	<p>●—————● Not cost-effective Highly cost-effective</p> <p>●—————● Low durability High durability</p> <p>●—————● Very heavy Very light</p> <p>●—————● Not very sustainable Very sustainable</p>	
Plastic	<p>●—————● Not cost-effective Highly cost-effective</p> <p>●—————● Low durability High durability</p> <p>●—————● Very heavy Very light</p> <p>●—————● Not very sustainable Very sustainable</p>	
Wood and bark	<p>●—————● Not cost-effective Highly cost-effective</p> <p>●—————● Low durability High durability</p> <p>●—————● Very heavy Very light</p> <p>●—————● Not very sustainable Very sustainable</p>	
Animal hide	<p>●—————● Not cost-effective Highly cost-effective</p> <p>●—————● Low durability High durability</p> <p>●—————● Very heavy Very light</p> <p>●—————● Not very sustainable Very sustainable</p>	

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Now, based on your ratings, decide which material you now think would be best for each canoe activity.



Canoe Activity	Best Material for a Canoe	Reason for Your Thinking
Hunting and fishing	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	
Camping trips	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	
Harvesting wild rice	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	
Paddling on a river	<input type="checkbox"/> Metal <input type="checkbox"/> Plastic <input type="checkbox"/> Wood and bark <input type="checkbox"/> Animal hide	

Lesson Question: Is metal always better?**Practise the Thinking**

Let's practise what you have learned by applying the criteria to two everyday items. Place an X on each scale to rate the material for each criterion. Use the information about the properties for each material to support your ratings. Which material is best for each item: metal or non-metal?

Item #1: Water Bottle

Background information:

- Properties of stainless steel: durable, recyclable, more expensive, heavier than plastic
- Properties of plastic: lightweight, chemically stable, less expensive, recyclable

Water Bottle Material	Rating	Reason for Your Rating
Metal (stainless steel)	<p>●—————● Not cost-effective Highly cost-effective</p> <p>●—————● Low durability High durability</p> <p>●—————● Very heavy Very light</p> <p>●—————● Not very sustainable Very sustainable</p>	
Non-metal (plastic)	<p>●—————● Not cost-effective Highly cost-effective</p> <p>●—————● Low durability High durability</p> <p>●—————● Very heavy Very light</p> <p>●—————● Not very sustainable Very sustainable</p>	
Which material is better? (Include evidence to support your decision)		

Lesson Question: Is metal always better?



Item #2: Fence

Background information:

- Properties of aluminum: lightweight, long lasting, recyclable, more expensive
- Properties of wood: less durable, recyclable, less expensive, heavier

Fence Material	Rating	Reason for Your Rating
Metal (aluminum)	<p>●—————●</p> <p>Not cost-effective Highly cost-effective</p> <p>●—————●</p> <p>Low durability High durability</p> <p>●—————●</p> <p>Very heavy Very light</p> <p>●—————●</p> <p>Not very sustainable Very sustainable</p>	
Non-metal (wood)	<p>●—————●</p> <p>Not cost-effective Highly cost-effective</p> <p>●—————●</p> <p>Low durability High durability</p> <p>●—————●</p> <p>Very heavy Very light</p> <p>●—————●</p> <p>Not very sustainable Very sustainable</p>	
Which material is better? (Include evidence to support your decision)		

Lesson Question: Is metal always better?



Reflect on Your Thinking

Think About the Lesson Challenge

In this lesson, you've practised applying criteria to help you determine the best material for objects.

On pages 3 and 8, you decided which material would be best for four different canoe activities. Did your responses change? Why or why not? Record your responses in the chart below.



Canoe Activity	Best Material for a Canoe	My Thinking Did/Did Not Change Because...
Hunting and fishing	<p>I originally thought the best material was...</p> <p>I now think the best material is...</p>	
Camping trips	<p>I originally thought the best material was...</p> <p>I now think the best material is...</p>	
Harvesting wild rice	<p>I originally thought the best material was...</p> <p>I now think the best material is...</p>	
Paddling on a river	<p>I originally thought the best material was...</p> <p>I now think the best material is...</p>	

Lesson Question: Is metal always better?**Think About the Overarching Challenge**

If you completed the launch lesson (it was the one with the title “What lessons can we learn from science and math that can help us live mino bimaadiziwin?”), you probably started a Thoughtbook. In this Thoughtbook, you began thinking about ways to respond to the challenge: **Begin creating helpful advice for living mino bimaadiziwin.**

What have you learned in this lesson that could help you live mino bimaadiziwin?

After you’ve finished the science lessons, you’ll use what you’ve learned to respond to that challenge. You can use the format of your choice—a song, a traditional art form, photographs, a poem, whatever you think would be best—to describe the actions we can take to live in a good way with the land.

Revisit your Thoughtbook now, and think about what you’ve learned in this lesson:

- What actions would you add to your Thoughtbook?
- Would you change any of the ideas that you already have in your Thoughtbook?

If you haven’t already started a Thoughtbook, you can answer these questions on page 14.

Lesson Question: Is metal always better?

My Thoughtbook: What lessons can we learn from science and math that can help us live mino bimaadiziwin?



Use words, symbols, or pictures to describe three pieces of helpful advice that we can learn from science and math that could help us live mino bimaadiziwin.