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: What is the safest way to store chemicals at home?

Lesson Challenge: Develop three tips for safely storing chemicals at home.

Lesson Summary: In this lesson, you will learn about the physical and chemical properties of household chemical products and how understanding these can help us determine how to store them safely. You will use this knowledge and understanding to create tips for safely storing chemicals at home.

Big Idea: Investigating and describing the physical and chemical properties of common household products can help us determine how to safely store them.

Lesson Question: What is the safest way to store chemicals at home?

Lesson Challenge: Develop three tips for safely storing chemicals at home.

Start Your Thinking

Many chemicals are used and stored in and around a home. These chemicals include household products such as cleaning liquids and powders, polishes, drain cleaners, paint and paint thinners, laundry detergent packets, and windshield washer fluids. These products are very useful but can also be harmful if not handled properly.

To begin this lesson, examine the picture below. How safely do you think the household chemical products in the picture have been stored?

How safely are the chemicals in the picture stored?

Show your thinking by placing an X along the rating scale.

Not at all safely — Somewhat safely — Very safely

Lesson Question: What is the safest way to store chemicals at home?

Think About the Lesson Challenge

In this lesson, you will learn about the physical and chemical properties of household chemical products and how understanding these can help us determine how to store them safely. You will use this knowledge and understanding to create tips for safely storing chemicals at home.

Before moving on to the next part of the lesson, let's pause and think about household chemical products that people often have in or around their homes. What are three steps we can take to make sure the chemicals are being stored safely?

Three steps we can take are…	Reasons These Will Help Store Products Safely
1. 2. 3.	

Grow Your Thinking

Chemicals are found all around us. The water we drink, the food we eat, the air we breathe, and even our bodies are made of chemicals. In fact, everything around us that is not energy, whether artificial or natural, is made of chemicals. Chemicals are neither good nor bad. However, some chemicals have properties that make them less safe for us to use.

Many chemical products are found in people's homes. Understanding the physical and chemical properties of matter can help us to make good decisions about how to store household chemical products safely.

Read the information below and on the next page to learn more about physical and chemical properties.

What Are Physical and Chemical Properties?

Different chemicals have characteristics that are unique to them. We call these characteristics physical and chemical properties. Some of these properties can make chemicals useful, but they can also be hazardous when we use, store, or dispose of them. For example, oven cleaner is a corrosive liquid (it breaks things down), which makes it helpful for degrading and dissolving hardened debris in ovens and on grills. But, it can also cause irritation and burns to exposed skin and other tissue. These properties affect how they behave and react and, therefore, how we should store them safely.

What Are Physical Properties?

Physical properties are the characteristics of chemicals that we can observe without changing the substance into another substance. We observe physical properties using our five senses or by measurement (numbers). Examples of physical properties are colour; odour; freezing, melting, and boiling (evaporating) points; state (solid, liquid, or gas); texture; and density.

What Are Chemical Properties?

Chemical properties are the characteristics that we can observe when a substance changes into a new substance. We can observe chemical properties during a chemical reaction. Reactions that change substances into new substances can happen by burning, rusting, exploding, or tarnishing.

Examples of Physical and Chemical Properties and Hazards

Physical Properties	
Examples of Physical Properties	**Potential Hazards**
• **colour** • **shape** • **size** • **state** (solid, liquid, or gas) • **odour** (pungent, fragrant, sour, putrid) • **melting, freezing, or boiling (evaporating) points** • **density** • **conductivity** (how easily it lets electricity or heat pass through) • **viscosity** (how easily it pours) • **texture** (smooth or rough) • **hardness** (hard or soft)	• Liquids can spill or leak. • Gases can leak through open or broken seals and move to fill a space. • Some solids and liquids can easily change to a gas when heated. Fumes can sometimes be harmful and can also cause containers to swell and burst. • Some substances will swell when frozen, which can cause the container to burst. • Odours coming from a container can indicate that the seal is broken and the contents are leaking out.
Chemical Properties	
Examples of Chemical Properties	**Potential Hazards**
• **flammable** (can burn) • **corrosive** (can break items down, causing damage) • **tarnishes** (reacts with oxygen to produce tarnish) • **rusts** (reacts with oxygen to produce rust) • **explosive** (can explode) • **toxic** (can poison) • **reacts with acid** (for example, bubbles in vinegar) • **reacts with water** (for example, explodes in water)	• Rust can break down the metal containers that hold household products, causing them to leak. Heat and moisture can speed up the process. • Reactive substances can produce even more dangerous chemicals when mixed with other substances. • **Explosive, corrosive, flammable, and toxic** materials are particularly hazardous. Household products with these chemical properties can be identified by symbols on their labels.

Think about what you have learned about physical and chemical properties. Look back at the picture on page 2 and consider how safely you now think the chemicals are stored.

How safely do you now think the chemicals in the picture are stored?

Show your thinking by placing an X along the rating scale.

Not at all safely — Somewhat safely — Very safely

Lesson Question: What is the safest way to store chemicals at home?

Hazard symbols are on the labels of many household chemical products, such as cooking spray, cleaning products, paint and paint thinners, drain cleaners, and windshield washer fluid. Hazard symbols give us useful information about the hazardous chemical properties of substances.

There are three parts to a hazard symbol:

1. **Picture**	**Explosive** The container can explode if heated or broken.	**Corrosive** The product can burn your skin or eyes or damage your throat or stomach if swallowed.	**Flammable** The product or its fumes may catch fire if it is near heat, flames, or sparks.	**Poisonous** The product can make you very sick or even die if swallowed, licked, or, in some cases, breathed in.
2. **Frame**	The shape of the frame around the hazard symbol tells you what part of the product is dangerous: If it's a **triangle**, it means the **container** is dangerous. If it's an **octagon**, it means the **contents** are dangerous.			
3. **Signal words**	The words under the hazard symbol explain the amount of risk: • **CAUTION** means temporary injury may result. Death may occur with extreme exposure. • **DANGER** means may cause temporary or permanent injury, or death. • **EXTREME DANGER** means exposure to very low amounts may cause death or serious injury.			

Source: Government of Canada, "Understanding Hazard Symbols." https://www.canada.ca/en/health-canada/services/home-safety/household-chemical-safety.html#a5

Lesson Question: What is the safest way to store chemicals at home?

Below you will find the hazard symbols and description for the products found in the picture on page 2.

For each product, identify the physical and chemical properties and possible hazards by following the steps below.

1. Look at the hazard symbol. What does it tell you about the chemical properties of the product and its hazards?
2. Read the description. What physical and chemical properties are described? What hazards are identified?
3. Write what you have learned under Physical and Chemical Properties and Possible Hazards.

Hazard Symbol	Description	Physical and Chemical Properties and Possible Hazards
Gasoline	Gasoline is a clear, yellowish liquid. It has a sweet, pungent odour. It evaporates, forming fumes, at low temperatures. The liquid and fumes are highly flammable. Fumes can accumulate in hazardous amounts in confined spaces. Gasoline can float on water and spread fire.	Physical properties: Chemical properties: Possible hazards:
Spray Paint	Many standard spray paints contain volatile organic compounds (VOCs). VOCs are emitted as gases from certain solids or liquids. The fumes can be flammable and cause health effects. The contents are under pressure in the can, which is an explosive hazard.	Physical properties: Chemical properties: Possible hazards:

Lesson Question: What is the safest way to store chemicals at home?

Hazard Symbol	Description	Physical and Chemical Properties and Possible Hazards
Bleach 	Bleach is a clear, colourless liquid that can splash easily when poured. Bleach is corrosive and can eat through materials, including skin, if it sits on it long enough. Chlorine bleach can react dangerously if mixed with other household or cleaning products. Doing so can result in different types of harmful acids being formed. Poisonous gases can also be released that will cause very serious breathing problems or death.	Physical properties: Chemical properties: Possible hazards:
Antifreeze 	Antifreeze is a bright yellow or green liquid that has a slightly sweet smell. Antifreeze can be spilled on the ground or leak from the radiators of cars and trucks. Because of its sweet smell, animals may be attracted to it. Antifreeze is very poisonous, so licking or drinking the fluid can kill an animal.	Physical properties: Chemical properties: Possible hazards:

Now that you have considered the physical and chemical properties and the information provided by hazard symbols, revisit the picture on page 2.

How safely do you now think the chemicals in the picture are stored?

Show your thinking by placing an X along the rating scale.

Not at all safely ⟷ Somewhat safely ⟷ Very safely

What safe storage tips would you recommend for these household chemical products based on what you have learned?

You can use criteria to help you determine tips for safely storing chemicals at home.

Safe storage tips are

- scientifically accurate: they consider all the physical and chemical properties and hazards of the chemical product;
- practical: it is possible to do them at home

Read the guidelines below for storing household chemical products. These are just suggestions to get you thinking about safe storage. Most hazardous household chemicals have information on their label about how to safely use and store the product. Always start by checking the label!

Storing Household Chemicals

- **Store in original containers.**
- **Store according to the instructions on the product label.**
- **Keep all safety information, and make sure it is readable.**
- **Keep safely out of sight and out of reach of children and pets.** Household chemicals should never be accessible to those who are not aware of their proper use or application.
- **Regularly check containers for leaks or damage.**
- **Store products that may release harmful fumes or catch fire outside of your home.** Examples: paints, solvents, gasoline, fuels, varnishes
- **Store flammable liquids outside in a metal cabinet or in a cool area. Never store near an open flame or spark.** Flammable liquids include gasoline, camp stove fuel, paint thinner, and lamp oil.
- **Store corrosive materials in a plastic tub or tray where the product can't spill out if the container leaks.** Examples of corrosive materials are drain cleaners, bleach, and acids.

Lesson Question: What is the safest way to store chemicals at home?

Now, use your knowledge of the physical and chemical properties of common household products and their potential hazards to create safe storage tips for these products. Remember to use the criteria to determine if your storage tips are safe.

Household Chemical Product	Safe Storage Tips
gasoline	
spray paint	
bleach	
antifreeze	

Criteria for safe storage tips:

- scientifically accurate: consider all the physical and chemical properties and hazards of the product
- practical: possible to implement at home

Reflect on Your Thinking

Think About the Lesson Challenge

In this lesson, you've learned about the physical and chemical properties of household chemical products and how understanding these can help you create safe storage tips for these products.

At the beginning of the lesson on page 3, you identified three steps we can take to make sure that household chemical products are stored safely. Look back at your initial thinking. Based on what you have learned, what do you now think? Update or revise your thinking in the space below.

Three steps we can take are…	Reasons These Will Help Store Products Safely
1. 2. 3.	

Think About the Overarching Challenge

If you completed the launch lesson ("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're 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.

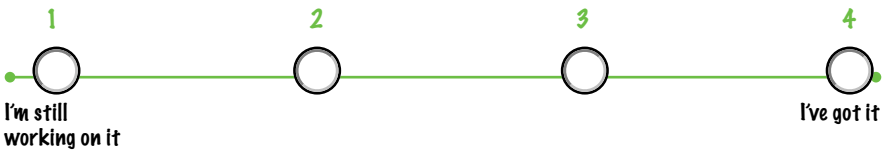
Revisit your Thoughtbook now, and think about what you've learned in this lesson:

- 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 13.

Lesson Question: What is the safest way to store chemicals at home?

To complete this lesson, take a moment to reflect on your learning.

Success Criteria	How well am I doing?
I can identify safety hazards of materials based on their physical and chemical properties.	 Examples that support my rating:
I can offer suggestions on how to store materials safely based on their physical and chemical properties and potential hazards.	 Examples that support my rating:

Lesson Question: What is the safest way to store chemicals at home?

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.