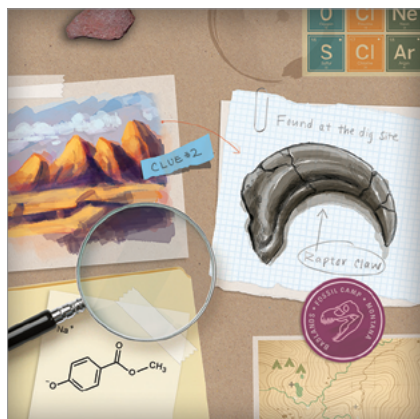


Grade 5

Unit 9: Chemical Matters



Use the Interactive Read-Aloud lesson and text on the following page to kick off this unit with your students.

Unit-level Essential Question

How do chemical changes affect your everyday life?

Lessons 1-5

Guiding Question: What does all matter have in common?

Writing Prompt: If the particles in gases are very far apart and full of energy, what might the particles in solids be like?

Lessons 6-10

Guiding Question: How can chemistry be used to solve problems?

Writing Prompt: If you were going to catch the fossil thief, what plan involving chemical reactions would you make?

Lessons 11-15

Guiding Question: What are some everyday chemical changes?

Writing Prompt: How are chemical changes similar to and different from recycling?

Unit 9 Culminating Activity

Amy and her friends learn a lot about everyday chemical reactions, like ice melting and pancakes bubbling. For one week, observe the world around you and keep a journal about what chemical reactions you see in day to day life, then report back with your findings!

GRADE 5 UNIT 9

Read-Aloud

Use the following Read-Aloud to introduce **Grade 5 Unit 9**.

Tell students that throughout this unit, they will think about the following **Essential Question**: How do chemical changes affect your everyday life?

Explain that in this unit, students will be reading about a group of youngsters who attend camp in the Badlands, an area in North and South Dakota with many dinosaur fossils. While at camp, these kids learn about science, including chemistry, and they learn how chemistry can help them solve both everyday and unusual problems. Before they start the unit, though, they need to learn a bit about chemical and physical changes.

Read the Read-Aloud, pausing after each section to discuss the text-based questions.

Everyday Chemistry

by Elizabeth Wade

If you're like most people, you probably do not think very often about chemistry—or at least you probably don't realize you do. But in actuality, chemistry is all around us! Have you ever baked cookies or roasted marshmallows over a campfire? You may not have known it, but those cookies and that campfire were both chemical changes at work!

All matter can be transformed by physical and chemical changes, which result in the extraordinary diversity of our physical world. But there is a big difference between these kinds of changes. Have you ever watched a popsicle melt on a hot summer day or noticed that a neighborhood pond has frozen over during the frigid winter? Those are examples of physical changes, not chemical ones.

Here's the difference: in a physical change, the form or appearance of a thing changes, but the substance (or chemical composition) of the thing does not change. That means that ice, water, and steam all have the same chemical composition, even though they take different physical forms. But when you mix and bake ingredients like eggs, flour, and vanilla, the result is a whole new thing: cookies! That's because chemical changes took place.

Literal. What is the difference between a chemical and a physical change?

» Chemical changes require a change in the substance of a thing. Physical changes do not require this.

Literal. Which kind of change is a popsicle melting?

» physical

Inferential. Would boiling an egg be a chemical or physical change?

» chemical

Physical and chemical changes happen throughout everyday life, often without us even realizing it. But sometimes they are very important to our well-being. For example, in 1914, a famous British explorer named Ernest Shackelton decided to do something no one had ever done before: cross the entire continent of Antarctica. Shackelton had experience in exploring, as he had been very close to the South Pole previously. But crossing Antarctica was a bold, ambitious undertaking—and even Shackelton did not succeed. He and his men were shipwrecked and had to abandon their plans; no one crossed Antarctica for another forty years!

Shackelton kept a detailed account of his journey, though, and in it he records how important he and his men found it to create—or sometimes prevent—certain chemical and physical changes along the journey. This was especially important after their ship sank, because the men did something very daring: they decided to camp on large of ice floating through the ocean. The men spent several months living carefully on these chunks of ice!

Shackelton's journals described these events, noting just how important it was to be aware of the physical changes of melting ice. On one hand, the men did not want the ice beneath them to melt, because it was the very thing that kept them from sinking! Shackelton writes:

“The thaw consequent upon these high temperatures was having a disastrous effect upon the surface of our camp. The surface is awful!—not slushy, but elusive. You step out gingerly. All is well for a few paces, then your foot suddenly sinks a couple of feet until it comes to a hard layer. You wade along in this way step by step, like a mudlark... hoping gradually to regain the surface. Soon you do, only to repeat the exasperating performance... What actually happens is that the warm air melts the surface sufficiently to cause drops of water to trickle down slightly, where, on meeting colder layers of snow, they freeze again, forming a honeycomb of icy nodules instead of the soft, powdery, granular snow that we are accustomed to.”

Clearly the men did not like this kind of physical change! On the other hand, sometimes they did want to create this very change—they just wanted it to happen somewhere other than the ice beneath them. Because Shackelton and his men were in the middle of the ocean, they were surrounded by water, but they did not have access to any drinking water. The only way for them to get fresh water to drink was by melting parts of the ice. They also lacked enough fuel for warming things, so they developed innovative ways of creating the physical change of melting ice into water. Shackelton describes how they did it: “As fuel is so scarce we have had to resort to melting ice for drinking-water in tins against our bodies.”

Literal. What were Shackelton and his men trying to do?

» cross the continent of Antarctica

Literal. What happened to disrupt their journey?

» They had a shipwreck.

Inferential. Why did the men want some physical changes to happen but not others?

- » They wanted the ice in their tins to melt so that they could have drinking water. They did not want the ice under their feet to melt, because they did not want to fall into the ocean.

While on their journey, the men also witnessed chemical changes. The most significant chemical change was rust, which happens when metal oxidizes. The possibility of rust worried the men, because if their tools grew rusty and unusable, they would be in big trouble. During their time on the ice, the men saw many ships that had wrecked and deteriorated; Shackelton recalled seeing “iron-bound timbers with the iron almost rusted through.” Though the men had their own hardships, seeing these wrecks made them feel lucky they had not become one of the “many tragedies” other explorers had suffered.

As they continued their journey, the men did their best to keep their tools in good condition. Shackelton described how, after a long day of fishing, the men would return to camp, where “rusty needles were rubbed bright on the rocks and clothes were mended and darned.” Although they were in dire circumstances and did not know how they would survive, Shackelton and his men were still surrounded by the same kind of physical and chemical changes that we experience every day. And their knowledge of those changes helped Shackelton get through the arduous experience and return to South Georgia Island, the place where his journey started.

Throughout this unit, you’ll learn more about these changes, their impact, and how people use their knowledge of these changes to shape their environment, bake better cookies, and even solve crimes! Let’s just hope you’re never stranded on the ice like Shackelton!

Literal. What kind of chemical change did the men see?

- » metal rusting

Inferential. Why did the men feel lucky, despite all the trouble they faced?

- » Their ship had sunk, but they had escaped.

Literal. Why was it important for the men to keep their tools from rusting?

- » They needed to use them, and they could not use or replace them if they rusted.

Inferential. The passage says that the men “were in dire circumstances.” Based on the rest of the passage, what do you think this means?

- » The men were in a very dangerous situation.

Use the following prompts to extend student understanding of the Read-Aloud.

Guiding Question: How are physical and chemical changes different?

Writing Prompt: Where or when have you seen a physical or chemical change take place?