



**Reading Supports**

**Teacher’s Guide:**

**“‘Beeting’ Icy Roads”**

*December 2018/January 2019*

<http://www.acs.org/chemmatters>



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# Reading Supports

The pages that follow include reading supports in the form of an Anticipation Guide, a Graphic Organizer, and Student Reading Comprehension Questions. These resources are designed to help students prepare to read the article, and then locate and analyze information from the article.

* **Anticipation Guide (p. 5):** The Anticipation Guide helps to engage students by activating prior knowledge and stimulating student interest before reading. If class time permits, discuss students’ responses to each statement before reading each article. As they read, students should look for evidence supporting or refuting their initial responses.

**Or** consider the following ideas to engage your students in reading:

**‘Beeting’ Icy Roads**

* Before reading, ask students why salt is added to roads in cold climates in the winter. (*Note*: Students from warm climates may be surprised to find out this is done.)
* Ask students why adding salt might be a problem, and what other materials they can think of to use instead of salt.
* As they read, students can find information to confirm or refute their original ideas.
* **Graphic Organizer (p. 6):** The Graphic Organizer is provided to help students locate and analyze information from the article. Student understanding will be enhanced when they explore and evaluate the information themselves, with input from the teacher, if students are struggling. Encourage students to use their own words and avoid copying entire sentences from the article. The use of bullets helps them do this.

If you use the aforementioned organizers to evaluate student performance, you may want to develop a grading rubric such as the one below.

|  |  |  |
| --- | --- | --- |
| **Score** | **Description** | **Evidence** |
| 4 | Excellent | Complete; details provided; demonstrates deep understanding. |
| 3 | Good | Complete; few details provided; demonstrates some understanding. |
| 2 | Fair | Incomplete; few details provided; some misconceptions evident. |
| 1 | Poor | Very incomplete; no details provided; many misconceptions evident. |
| 0 | Not acceptable | So incomplete that no judgment can be made about student understanding |

* **Student Reading Comprehension Questions (p. 7):** The Student Reading Comprehension Questions are designed to encourage students to read the article (and graphics) for comprehension and attention to detail, to provide the teacher with a mechanism for assessing how well students understand the article and/or whether they have read the assignment, and, possibly, to help direct follow-up, in-class discussion, or additional, deeper assignments.

Some of the articles in this issue provide opportunities, references, and suggestions for students to do further research on their own about topics that interest them.

To help students engage with the text, ask students which article **engaged** them most and why, or what **questions** they still have about the articles. The “Web Resources for More Information” section of the Teacher’s Guide: Tools and Resources provides sources for additional information that might help you answer these questions.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Anticipation Guide

**Directions: *Before reading***, in the first column, write “A” or “D” indicating your agreement or disagreement with each statement. As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

|  |  |  |
| --- | --- | --- |
| **Me** | **Text** | **Statement** |
|  |  | 1. Salt is used on roads to keep ice and snow from sticking to the roads.
 |
|  |  | 1. Salts are ionic compounds.
 |
|  |  | 1. So far, there is no scientific evidence that road salt has increased salinity levels in freshwater lakes.
 |
|  |  | 1. Salinization can increase the oxygen content in deeper parts of freshwater lakes.
 |
|  |  | 1. Most of the salt used on roads in the United States is calcium chloride.
 |
|  |  | 1. Most freshwater lakes have a lower salinity than drinking water.
 |
|  |  | 1. Impervious surfaces such as roads in the U.S. take up enough land to cover the state of Ohio.
 |
|  |  | 1. Cities have tried using the wastewater from local industries, including cheese-making.
 |
|  |  | 1. Solutes interfere with ice crystal formation.
 |
|  |  | 1. One mole of calcium chloride has the same effect on lowering the freezing point of water as one mole of sodium chloride.
 |

## Graphic Organizer

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: As you read the article, complete the graphic organizer below to compare materials used to deice roads. Include at least 3 sources and 3 disadvantages for each material.

|  |  |  |
| --- | --- | --- |
|  | **Sources and Examples** | **Disadvantages** (Use bullets or numbers for each) |
| **Chloride salts** |  |  |
| **Waste-based alternatives** |  |  |

**Summary**: On the back of this paper, write a tweet (280 characters or less) about the importance of finding alternatives for deicing roadways, based on what you learned from reading the article.

## Student ReadingComprehension Questions

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: Use the article to answer the questions below.

* 1. (a) Under what conditions is salt sprinkled or beet juice sprayed on U.S. asphalt surfaces? (b) What does the salt or beet juice do? (c) Why is this important?
	2. In addition to corrosion of vehicle parts, what is the more subtle impact on the environment from the long-term use of winter road salt?
	3. What is meant by the subtitle “From streets to streams”?
	4. (a) How did researchers discover that road salt has contributed to the rising salinity in freshwater lakes across the United States, and (b) what did they find?
	5. Complete the following table to show the approximate concentration of dissolved salts in various sources of water.

|  |  |
| --- | --- |
| Source | Approximate dissolved salts (mg/L) |
| Fresh water |  |
| Drinking water |  |
| Sea water |  |

* 1. What is the range of salinity for brackish-water as shown on the map?

**Student Reading Comprehension Questions, cont.**

* 1. Provide one example of how increased salinity affects bottom-dwelling fish and plants.
	2. List three sources of increasing salt levels in freshwater systems.
	3. How does road salt prevent snow from sticking and freezing to road surfaces?
	4. (a) What is an impervious surface? (b) Give an example of an impervious road surface.
	(c) How does the impervious surface contribute to the salinity of waterways?
	5. What are three waste water alternatives tried by cities that contain lower amounts of sodium chloride than traditional road salt?
	6. What are two problems with applying beet juice as a deicer?

## Answers to Reading Comprehension Questions

1. **(a) Under what conditions is salt sprinkled or beet juice sprayed on U.S. asphalt surfaces? (b) What does the salt or beet juice do? (c) Why is this important?**
2. Salt is sprinkled or beet juice sprayed on U.S. asphalt surfaces when temperatures drop and snow threatens.
3. The salt or juice prevents snow from sticking to asphalt streets and sidewalks.
4. This is important because it prevents streets and sidewalks from freezing and becoming too slick to safely drive or walk on.
5. **In addition to corrosion of vehicle parts, what is the more subtle impact on the environment from the long-term use of winter road salt?**

In addition to corrosion of vehicle parts, the more subtle impact on the environment from using road salt over long periods of time is that the salt may be affecting plant and animal life in lakes.

1. **What is meant by the subtitle “From streets to streams”?**

“From streets to streams” means that the salt doesn’t stay on streets; as snow and ice melt, much of the salt is washed into freshwater streams and rivers that then pour into lakes.

1. **(a) How did researchers discover that road salt has contributed to the rising salinity in freshwater lakes across the United States, and (b) what did they find?**
2. Researchers monitored the chloride levels as an indicator of salinity in 371 freshwater lakes in the United States, and
3. they found that 44% of the lakes monitored had elevated chloride levels.
4. **Complete the following table to show the approximate concentration of dissolved salts in various sources of water.**

|  |  |
| --- | --- |
| **Source** | **Approximate dissolved salts (mg/L)** |
| **Fresh water** | 500 |
| **Drinking water** | 20 |
| **Sea water** | 35,000 |

1. **What is range of salinity for brackish-water as shown on the map?**

The brackish-water is located between zero and 20 parts per thousand (ppt) salinity on the map.

1. **Provide one example to show how increased salinity affects bottom-dwelling fish and plants.**

Increased salinity changes the normal flow and mixing of water within lakes from the lake surface to the bottom. This restricts the oxygen available for plants and animals living in deeper parts of lakes.

1. **List three sources of increasing salt levels in freshwater systems.**

Three sources of increasing salt levels in freshwater systems are

deicing roads,

pollution from construction, and

run-off from chemicals used in agriculture and other industries.

1. **How does road salt prevent snow and ice from sticking and freezing to road surfaces?**

Road salt acts as a solute to lower the freezing point of water on road surfaces so that water will not freeze until the temperature reaches almost –4 oC.

1. **(a) What is an impervious surface? (b) Give an example of an impervious road surface. (c) How does the impervious surface contribute to the salinity of waterways?**
	1. “An impervious surface is one that does not let liquid pass through.”
	2. An example of an impervious surface is a paved road.
	3. A paved road cannot absorb the salt solution, so it runs off into waterways.
2. **What are three waste-water alternatives tried by cities that contain lower amounts of sodium chloride than traditional road salt?**

The three waste-water alternatives used by cities that were mentioned in the article are

1. Beet processing
2. Pickle production
3. Cheese-making
4. **What are two problems with applying beet juice as a deicer?**

Two problems with applying beet-juice as a deicer are

1. beet juice smells like soy sauce or stale coffee, and
2. its sugars can invite unwanted bacterial growth.