



SALTY ICE: **HOW DOES SALT AFFECT THE MELTING OF ICE?**

YEAR LEVELS

Year 3-4

THEME OF UNIT

Why go to Antarctica?

Antarctica is the fifth largest continent. Covering 14 million km², it makes up ten per cent of the earth's land area. In addition to the land area, there is another 2.5 million km² of sea ice, which increases to 19 million km² in winter, more than doubling the size of Antarctica!

Antarctica is the least known of the earth's land masses with fewer than 200,000 people ever visiting the continent. It's pristine conditions attracts scientists from all over the world to come and study such things as organisms that live in this unspoiled ecosystem, the consequences of climate change and clues to the origins of the universe.

However, the Antarctica is becoming more and more accessible. Various cruise options are now available for tourists while Qantas has a New Year's Eve sightseeing flight. Scientists can make their way to the Antarctica via ship or aircraft.

The opening up of the continent poses the following social, ethical and scientific questions:

- What is unique about Antarctica?
- How tough are the conditions in Antarctica?
- Should we develop Antarctica as a tourist destination?
- Should we change Antarctica?

The salt activity described here, links in with the unit topic - showing at first hand how to melt ice quickly. This activity demonstrates how salt can be used to make roads and footpaths safer when they are icy.

ACTIVITY CURRICULUM LINKS

- English/Literacy - Writing a Report
- Mathematics/Numeracy - Timing the melting, finding the average
- Information and Communications Technology (ICT)
- Study of Society and Environment or HSIE - use of salt in community

ACTIVITY LINKS TO NATIONAL STATEMENTS OF LEARNING FOR SCIENCE

Science as a human endeavour

Broad learning objectives

- Students recognise scientific aspects of their everyday activities, application of science in their own lives and the place of science in the work of people in their community.
- Students show and share responsibility for the quality of their immediate environments and for resource conservation

Concepts developed

- Processing data and evaluating.

Science as a way to know

Broad learning objectives

- Students begin asking questions and making predictions related to their everyday experience.
- Students plan and conduct simple investigations and learn how to use appropriate tools and equipment. They follow suggestions to collect, record and present data.
- Students revisit their questions in light of their results. They share findings, talk about the way in which the investigation could be changed and begin to consider fairness of tests.

Concepts developed

- Students investigate how salt affect the melting of ice?
- Investigating scientifically

Science as a body of knowledge (Matter)

Broad learning objectives

- Students examine and compare the observable properties of common materials- ice. They observe and describe how familiar materials change their properties
- Demonstrate learning by answering big questions and completing tasks. Increase awareness of science

Concepts developed

- Co-operative group skills
- Drawing conclusions
- Communicating results

PRIOR UNDERSTANDINGS RECOMMENDED FOR THE ACTIVITY

- WINK (What I Now Know) about Antarctica. Reflective writing and cooperative group discussions
- On a map of Antarctica mark on the main seas, ice shelves, mountains and stations.

ASSESSMENT

- Written science report
- Tabulate and graph results
- Calculation of averages
- Conversation and discussion about student's observations and conclusions

GENERAL ASSESSMENT

- Oral- debates and oral report.
- Written assessment- research: explorers and animals. Also answers to the big questions at the end.
- Rubric to assess brochures, bookmarks, placemats and posters-peer assessment task.

TEACHER BACKGROUND INFORMATION

Icy footpaths and roads are dangerous to drive and walk upon. To solve this problem, people spread salt on the roads and footpaths which melts the ice and makes them safer.

The chemical principles behind the use of salt are: 1) Matter and 2) Equilibrium.

1. Everything is made up of atoms

Combining several atoms, for example two hydrogen atoms and one oxygen atom, gives one molecule of water. A beaker of water is made up of millions of molecules. These molecules move around. When they are cooled down (freezing, below 0°C) they move slower until a seed crystal is formed and this crystal increases in size as it captures more slow moving molecules, until all the water is frozen. If this ice is then placed on a plate at room temperature, the molecules at the surface begin to move faster, creating a layer of water on the surface of the ice. More water is formed as the molecules in the ice come in contact with the liquid and begin to move faster, until all the ice has melted.

2. Equilibrium is the preservation of balance between two systems.

For example: water and ice. The balance between water and ice is maintained at 0°C, the temperature at which water melts. Heating or cooling the ice/water mixture above or below this temperature upsets the balance and causes a change in the equilibrium (melting or freezing). The addition of a foreign substance such as salt will also disrupt the equilibrium. The foreign molecules dissolve in the water but do not pack easily into the tight structure of the solid.

This means that the rate of freezing is slower as the total number of water molecules captured by the ice per second goes down. The rate of melting does not change in the presence of foreign molecules, and so melting occurs faster than freezing. This is why salt melts ice.

Observations from the experiment:

The ice cube with 2 teaspoons of salt melts faster than the ice cube with only ½ teaspoon of salt. The ice cube with no added salt melts the slowest. The outcome is that the more salt added to the ice cube the faster it melts.

EQUIPMENT AND MATERIALS

- Salt (7 ½ teaspoons)
- Ice cubes
- 3 plates or small jars
- Measuring spoons
- Labels for the plates

SAFETY

- Safety issues – possible cold burn injury from ice cubes. Salt being eaten.
- Steps to be done by the teacher – putting ice cubes on the plates and the addition of salt to the ice cubes.
- Disposal of the final salty solution down the sink with plenty of water.
- First aid tips: Cold burn - warm the area up slowly and see a doctor if necessary. If salt has been eaten in a large quantity ring the poisons information line (phone number 13 1126 Australia).

PREPARATION REQUIRED

- Prior to the lesson, ice cubes should be made in the freezer at least 24 hours beforehand
- Get an identical set of plates for cubes
- Stopwatches for each group

LESSON STEPS

1. Get students to gather around a table.
2. Place three plates on the table and label them 1, 2, and 3.
3. Place one ice cube on each plate.
4. Pour ½ teaspoon of salt over the ice cube on plate 2.
5. Pour 2 teaspoons of salt over the ice cube on plate 3.
6. Start a stop watch after the salt has been added to the ice cubes. Do not touch the ice cubes during the experiment.
7. Write down the time on the stopwatch when the ice cubes have completely melted
8. Repeat the experiment to determine if anything has changed.

The ice cube with 2 teaspoons of salt takes about 25-30 minutes to melt.

The entire experiment takes about 1 hour as the ice cube without salt melts very slowly.

FURTHER INFORMATION

Handy Hints

Keep the room temperature the same for each trial.

You may experience problems with getting all the groups started at the same time because groups that get their ice cubes first will have them melt faster.

Possible activity variations

Variables to change:

1. Add other chemicals to ice cubes instead of salt: for example sugar or calcium chloride.
2. Use different sized containers (really large versus very small).
3. Use smaller containers and move the beakers occasionally to ensure mixing of the ice with the salt solution.
4. Conduct the experiment in the sun and in the shade and see if there are differences.

Student activities

Students could do graphs and tables of the data they collect

Additional student activities that can be undertaken as part of the unit include:

- Making a food web for animal and plant life.
- Research Project: wildlife and explorers.
- Preparing a debate- Arguments for and against Tourism.
- Making a tourism brochure and showbag, which included:
 - Placemat showing places to visit and things to do.
 - A bookmark of Antarctic scenery with a slogan.
 - Poster advertising an Antarctic tour.
 - Narrative entitled: 'My Life in Antarctica'.
- Oral Report: Why should we visit Antarctica?
- Maths problems: Birds eye view of a typical station.
- Research explorers: Roald Amundsen, for example.

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