

Problem

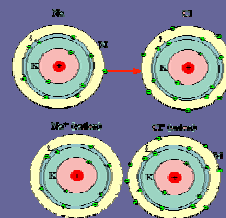
- Every year 7,000 deaths and 800,000 accidents on all highways and interstates are weather related, mostly due to icy roads. A key factor in preventing these highway accidents is the use of road salt and the ability of salt to depress the freezing point of water.

Introduction

- Sodium chloride, also written as NaCl, is the main salt used to melt ice on roads.
- Sodium chloride is responsible for freezing/boiling point depression in water.
- Freezing point depression refers to the ability of salt to lower the temperature at which water will freeze.

Introduction

- A mole of any substance will always contain 6.023×10^{23} molecules.
- The gram molecular mass of NaCl is 58.44 grams, meaning that 1 mole of NaCl is 58.44 grams.



Introduction

- Another common salt is Magnesium Sulfate, also written as $MgSO_4$.
- The gram molecular mass of $MgSO_4$ is 120 grams per mole.
- Magnesium Sulfate dissolves very well in water, or H_2O .
- The boiling point of a liquid is the temperature at which the liquid can turn from a liquid to a gas.
- Freezing point is the temperature at which a liquid turns into a solid.

Hypothesis

- When either sodium chloride or magnesium sulfate are added to water, the freezing point of the water will be a lower temperature and the boiling point will be a lower temperature.

Methods

- A 250 ml beaker was filled with 50 ml of water and boiled as a control to know the boiling point prior to the addition of any salt to the water.
- 1 gram of sodium chloride was added to the water and boiled again, when the water began to bubble, signifying that it was boiling, the temperature of the water was measured and recorded.
- The amount of salt was increased in increments of 5 grams, going from 1 to 5, 10, 15, and 20 grams.
- The same process was repeated with the

Results

MI of water	Grams of NaCl	Moles of NaCl	Temperature at which water boiled
50ml	0.0g	0.0m	100 c
50ml	1.0g	0.0171m	91 c
50ml	5.0g	0.0855m	101 c
50ml	10.0g	0.1711m	89 c
50ml	15.0g	0.2566m	89 c
50ml	20.0g	0.3422m	85 c

Results

MI of Water	Grams of MgSO ₄	Moles of MgSO ₄	Temperature at which water boiled
50ml	0.0g	0.0m	100 c
50ml	1.0g	0.0083m	85 c
50ml	5.0g	0.0416m	83 c
50ml	10.0g	0.0833m	83 c
50ml	15.0g	0.1250m	79 c
50ml	20.0g	0.1666m	78 c

Results

MI of Water	Grams of NaCl	Moles of NaCl	Freezing Temperature
50ml	0.0g	0.0m	0 c
50ml	1.0g	0.0171m	-1c
50ml	5.0g	0.0855m	-1.5 c
50ml	10.0g	0.1711m	-2.0 c
50ml	15.0g	0.2566m	-2.5 c
50ml	20.0g	0.3422m	-2.5 c

Results

MI of water	Grams of MgSO ₄	Moles of MgSO ₄	Freezing Temperature
50ml	0.0g	0.0m	0 c
50ml	1.0g	0.0083m	-0.5 c
50ml	5.0g	0.0416m	-1 c
50ml	10.0g	0.0833m	-1.5 c
50ml	15.0g	0.1250m	-1.75 c
50ml	20.0g	0.1666m	-2 c

Conclusion

- When salt is added to water, it lowers the temperature at which water will boil and lowers the temperature at which water freezes, thus proving my hypothesis true.

Future Studies

- Road salts, such as NaCl are known to be harmful to the environments that they are released into, therefore a study could be done on the environmental effects of different road salts. A study of this nature would have many aspects such as the effect on aquatic life, the effect on plant life, ect.