

## Energy of Solutions

**BACKGROUND:** Icy streets and sidewalks can lead to slippery and dangerous conditions for drivers and pedestrians. Chemical deicers are often used to help and prevent this from occurring. A chemical deicer works to melt ice and keep it from forming on surfaces. It does this by lowering the freezing point of water and preventing a bond between ice and the paved surface.

**OBJECTIVE:** Examine the energy changes that occur when liquid solutions are made. Use what you learn to analyze compounds to find which one would be the best deicer. Determine the most effective concentration of solution for a deicer.

### PROCEDURE - Part 1

#### Sparkvue set up

1. Set up a Sparkvue lab with a graph on one page.
2. Connect a temperature probe to your laptop.

#### Obtain samples

1. In separate, labeled, weigh boats, obtain 5.00 g samples of each solute (about a half teaspoon each). Record the masses of each compound in your data table.
2. Control: Use an electronic balance to measure out identical masses of each compound.
3. Control: Use 100 mL of water as the solvent for each solution.

#### Follow the steps below for the first sample and then for the second sample

1. Add 100 mL of water to a 250 mL beaker, (Hint: What's the best way to measure volume?). Record your data in your data table.
2. Use a temperature probe to record the temperature of the water for 5 seconds, then while continuing to record the temperature, add the first sample to the water and begin to stir with the temperature probe. Keep recording the temperature until the temperature levels off, then stop recording.
3. Rinse off the temperature probe and dry it.
4. Record the initial and final temperatures in your data table.
5. Follow steps 1 - 3 above for the second sample in a clean beaker.

#### Label and analyze your data

1. Label the lines on your temperature graph with the names of the chemicals
2. Change the title of the page from "Untitled" to the last names of both lab partners (you can shorten the last names if they are really long).
3. Label each of your graph lines with the name or formula of the compound tested and BOTH the initial and the final temperatures for each compound.
4. Take a screen shot of your Sparkvue graph for your lab report. Save it to your Google Drive (both lab partners!)
5. Calculate the mass percent concentration of each solution you tested. Be sure and show your scanned calculations in your lab report and include the concentrations in your data table. (Don't forget that 1 mL of water has a mass of 1 g and that your solution will have your compound and water in it.)

$$\text{Mass \% Concentration} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

6. (Write your lab report using the outline shown on the next page.)

## PROCEDURE - Part 2

1. Once you have determined which compound is the best deicer. Design an experiment to determine the concentration of the solution that will give the best performance as a deicer.
  - You can only have a maximum of 20 g of compound to test
  - Hint: You don't have to use 100 mL of water! Hmmmm....
2. Include a data table, a labelled graph, and calculations for evidence for your lab report. (Don't forget that 1 mL of water has a mass of 1 g and that your solution will have your compound and water in it.)

$$\text{Mass \% Concentration} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

## CLEAN UP

1. Return any extra dry, clean chemical to the front.
2. Solutions should be poured down the drain with lots of water.
3. Wash and rinse everything that had a chemical in it.
4. Return washed and dried weigh boats to the front.

## BRAINSTORMING:

(Lab Report Format)

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OBJECTIVE:

PROCEDURE: (Summarize what you did in the experiment – each step in a separate mini-paragraph.)

- Include photos – label photos

OBSERVATIONS:

- Sparkvue Graph – Part 1 and Data Table for any measurements

Sample Data Table

Compound		
Mass of compound		
Volume of Water		
Mass of Solution		
Concentration of Solution		
Initial Temperature		
Final Temperature		
Change in Temperature		

- Sparkvue Table & Graph – Part 2 and Data Table for any measurements

CONCLUSION: (Which solution was exothermic and which was endothermic and why? Which compounds is used by companies as a deicer and why? For Part 2, which concentration of solution would be the best deicer. Why?)