2022 ISS Logbook record

Class: S2-06
Group: E
Names of members: Jeremy,KianPing,JunLin

Title: **Investigation of the effect of different salt concentrations on the freezing point of water.**

Project planning:

- **Project planning.** As you plan your science project, use your lab notebook to capture the questions you hope to investigate, your hypothesis, and your variables.

When thinking of the questions we hoped to investigate, we referred to the hypothesis graph as it was an accurate graph. Hence, the hypothesis and research question did not require much thought as it was already given by past researchers.

Here were our variables:

1.4.2 Research Questions

Our Research Question is:

How do different salt concentrations affect the freezing point of water?

1.4.3 Research Hypotheses

Our hypothesis is that the freezing point of water will decrease as the salt concentration increases.

1.4.3.1 Independent variable

The independent variable is the salt concentration in the water. Specifically, it is the mass of salt in g against 1kg of water.

1.4.3.2 Dependent variable

The dependent variable is the freezing point of water.

1.4.3.3 Controlled variables

a) The location of the sampling should be the same

b) the amount of water in each sample should be the same.

c) The sampling period should be around the same time.

d) Type of container should be the same

There was nothing to change as we had an accurate graph to refer to and our experiment was rather simple.

Research:

- **Research.** Record your background research, noting sources you use (including URLs or bibliographic data). Summarise articles and publications you review (or plan to review) during your background research, any interviews you conduct, and notes related to feedback, suggestions, or troubleshooting you receive from a teacher or mentor. This information will make compiling your bibliography much easier

When doing background research, we researched on both the effects of global warming and past research related to our project.

In summary, we found out that since the pre-industrial period, human activities are estimated to have increased Earth's global average temperature by about 1 degree Celsius, a number that is currently increasing by 0.2 degrees Celsius per decade. This research on global warming gave us a rough idea on the rapid rate of melting of ice caps. We also found out on facts about how ice melts and salinity.

However, when we checked our research, we realized that some of the formulas or concepts we copied were not related to our project experiment. Hence we changed our research to suit our project.

Here are the URLs to the resources used:

https://www.academia.edu/download/47759510/Revised_equation_and_table_for_determini20160803-12399-1wie3qs.pdf

https://www.britannica.com/video/179991/seawater-water-points

https://climate.nasa.gov/resources/global-warming-vs-climate-change/

https://oceanservice.noaa.gov/facts/sea-ice-climate.html

Materials:

- **Materials.** Document the materials you use (including specific brands, quantities, and costs).

These were the materials we used:

- Temperature probes x6

- Table salt (500g) x2

- metal cups x 9

- Refrigerator (-22 degrees Celsius)

- Electronic balance

- 2 pairs of thongs

- Data logger x2

- foam box

Experiments

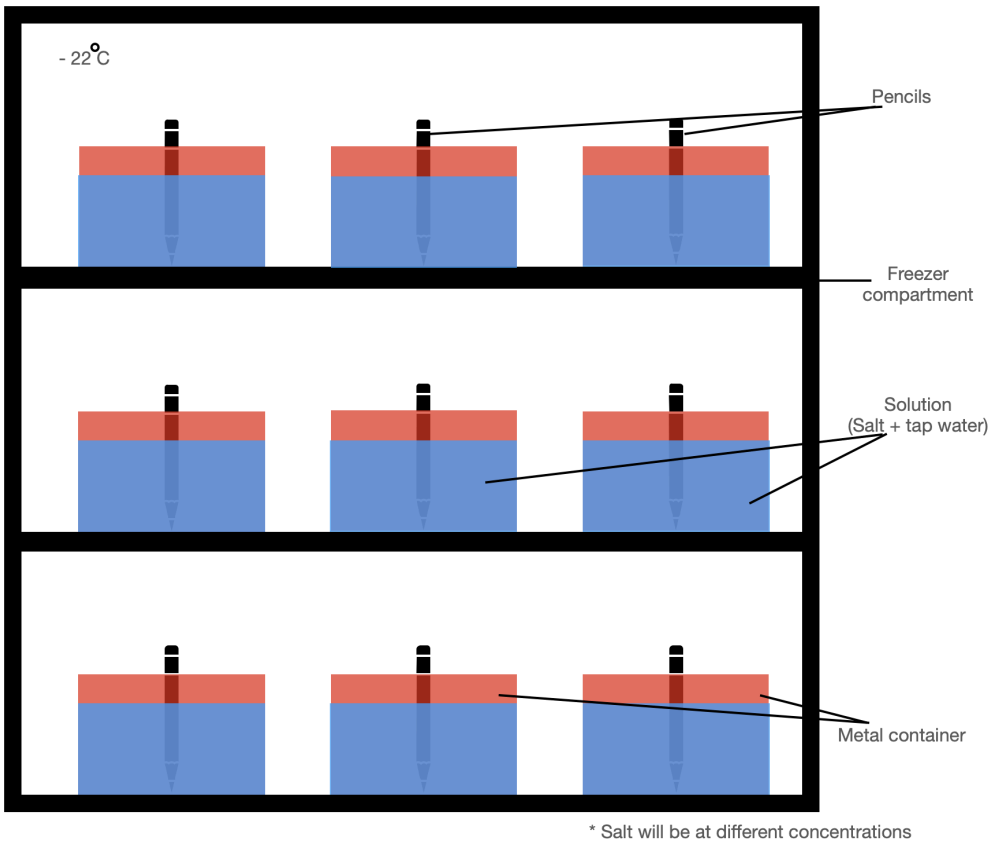
- **Experimental design:** Record all details related to your experimental design. For each research question, there should be 1 hypothesis. For each hypothesis, there should be 1 experiment. How many levels are there for the independent variable (usually 6 for a significant evaluation of hypothesis)? How do you change the independent variable? How do you measure the dependent variable? Did you carry out a trial experiment? Did you repeat your experiment and take the average to improve accuracy? There are some designs that are unique to your experiment.

- **Experimental setup:** Record all details related to your setup. Include a diagram and any changes to diagram subsequently if your setup should change during the course of the experiment.

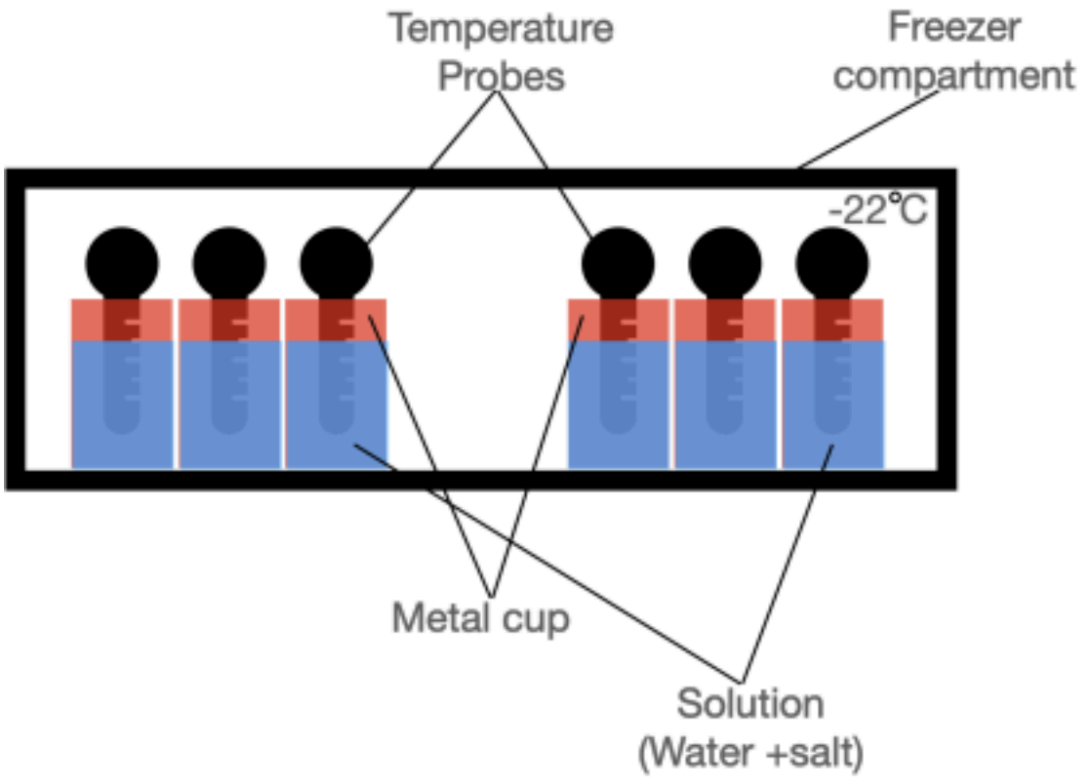
- **Experimental procedure.** Record all details related to your procedure. Document your steps, trials, and observations to be made. Make sure that your experimental design steps (e.g. levels of independent variable, repeat experiment) are incorporated to the procedure section. You must also list the procedures on how would you analyse the data, including a table that you will use to tabulate your data, a graph if your hypothesis is correct, and how you will arrive at a statement of how your hypothesis is verified or not.

- Be sure and clearly note any modifications you make and any problems you encounter, including any mistakes. Even if it seems trivial or inconsequential, you should write it down in this paragraph.

Before the experiment, we came uo with an idea of how our setup would look like.



But, after the first 2 tries, we realised that pencils/chopsticks could not be taken out. Hence, we change the setup to have the probes frozen with the solution instead. Hence, this is our final setup.



Event Log 1
Date:21 Jan 2022
Details: *We have finished the first draft of the proposal.*
Our project was the *Investigation of the effect of different salt concentrations on the freezing point of water. Our hypothesis is that the freezing point of water will decrease as the salt concentration increases.*
Independent variable
The independent variable is the salt concentration in the water.

Dependent variable

The dependent variable is the freezing point of water

Controlled variables

a) The location of the sampling should be the same

b) the amount of water in each sample should be the same.

c) The sampling period should be around the same time.

d) Type of container should be the same

We used these sources for the references:

Bodnar, R. J. (1993). Revised equation and table for determining the freezing point depression of H2O-NaCl solutions. *Geochimica et Cosmochimica acta*, *57*(3), 683-684.

NASA. (2021, August 24). *Overview: Weather, Global Warming and climate change*. NASA. Retrieved January 21, 2022, from https://climate.nasa.gov/resources/global-warming-vs-climate-change

NOAA (2011, November 1). *How does sea ice affect global climate?* NOAA's National Ocean Service. Retrieved January 21, 2022, from https://oceanservice.noaa.gov/facts/sea-ice-climate.html

And these for the bibliography:

Kissner, A. (2022). [web log]. Retrieved January 18, 2022, from https://www.kissner.com/why-does-salt-melt-ice.

Selin, H. and Mann, . Michael E. (2021, August 9). global warming. Encyclopedia Britannica. https://www.britannica.com/science/global-warming

Chen, S. (1970, January 1). *The physics of Salting Roads*. The Physics of Salting Roads. Retrieved January 24, 2022, from http://colgatephys111.blogspot.com/2017/12/the-physics-of-salting-roads.html

We used these to see the effects of the polar ice caps melting and to see how people researched freezing point depression in the past for references.

The materials we are going to use are:

- *thermometer x9*
- *Table salt (500g) x2*
- *taporware x 9*
- *Refrigerator (-22 degrees Celsius)*
- *Electronic balance*
- *2 pairs of reusable thick rubber gloves*
- *2 pairs of thongs*
- *2 tweezers*
- *straw/pencil*
- *lighter*

Event Log 2
Date: 4 Feb
Details:
We started building our experimental set up.

Event Log 3
Date:9 Feb 2022
Details: Experiment has failed as the chopstick could not be taken out for the thermometer to measure the melting point.

Event Log 4
Date: 11 Feb 2022
Details: We tried to redo the experiment with straws instead of chopsticks, hoping the material will cause it to be removed easily. But, it did not work as we put too much blu tac.

Data Collection:

- **Data collection.** Your data is critical to your science project and to the conclusions you will draw at the end of the project. As you gather data, be careful to accurately enter *all* numbers, measurements, temperatures, calculations, or other data. It is best to enter **all** data **directly** in your lab notebook. If you have data logged electronically, keep a list of log dates and file names and tape or glue printed copies into your lab notebook when possible. All trial data should be listed here besides the final set of data. The format of the data could be hand-written or digital.
- **Anomalous results:** There should be highlights of data that are anomalous and the experiment is repeated and corrected.

We repeated the experiment a total of 3 times, 2 of which were failed attempts as the solution melted before we started recording the data. The third time was the successful attempt.

We first recorded our data on the data loggers. Then, we saved the data into a USB flash drive. The graphs are shown in Annex B.

When looking at the graphs, we were expecting a horizontal zone for each graph which would represent the melting point. However, as shown in Annex B, only one graph from each set of data was distinctively horizontal, hence it was difficult to find the melting points. However, we were still able to find the melting points. However, some of the graphs of the data in the graphs had to be thrown away to find the melting point quicker. For example, certain parts of the graph increased and

decreased continuously, so we removed some data points from the part when finding the melting point.

Event Log 5
Date: 16 Feb 2022
Details: We recorded the first set of data.

Event Log 6
Date: 17 Feb 2022
Details: The data logger did not save the project despite us pressing the "save" button. Therefore, we have to make a new set of data. During lesson time, we made the new set of data.

Event Log 7
Date: 18 Feb 2022
Details: We recorded our first set of data, but we did not meet the deadline for the second set of data. So we asked for a one day extension, so that we can give the second set of data on the following monday, 21 Feb 22.

Event Log 8
Date: 21 Feb 2022
Details: We have started to record our second set of data.

Data Analysis:

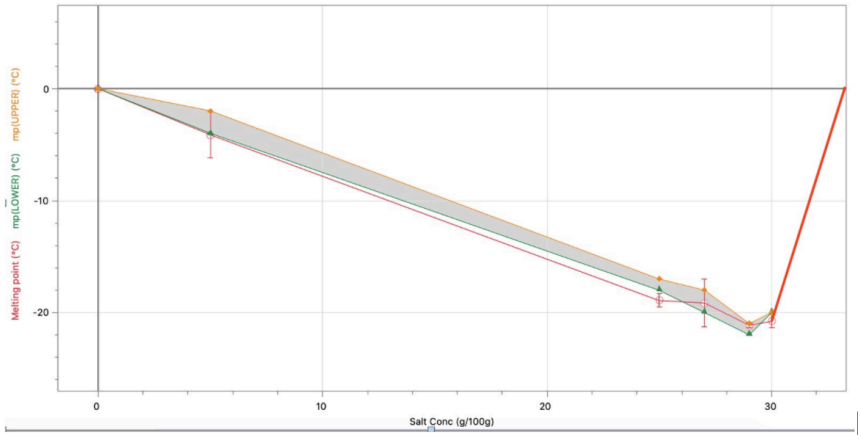
- **Data analysis.** This section must show how your processed data (graphs or histograms) is being compared to the hypothesis. There should be highlighted points where they are similar and different.
- **Discussion:** There should be some discussion on how the experimental data support or rejects the hypothesis or support to a certain extent. Is there a modified theory behind this trend or behaviour?

After we found the melting points, we transferred the data into a table.

concentration of salt (g/kg)	Reading 1 (°C)	Reading 2 (°C)	Average (°C)	Error (°C)
0	-0.11	0.10	-0.01	0.11
50	-2.08	-6.16	-4.12	2.04
250	-19.53	-18.31	-18.92	0.61
270	-17.05	-21.29	-19.17	2.12
290	-20.97	-21.39	-21.18	0.21
300	-20.18	-21.38	-20.78	0.60

After that, we transferred the average melting point to a graph to compare it with the hypothesis.

Here was our original graph



But, as we only needed the hypothesis graph and our results graph, we decided to do it again.

This was our final graph.

- **Data analysis.** This section must show how your processed data (graphs or histograms) is being compared to the hypothesis. There should be highlighted points where they are similar and different.
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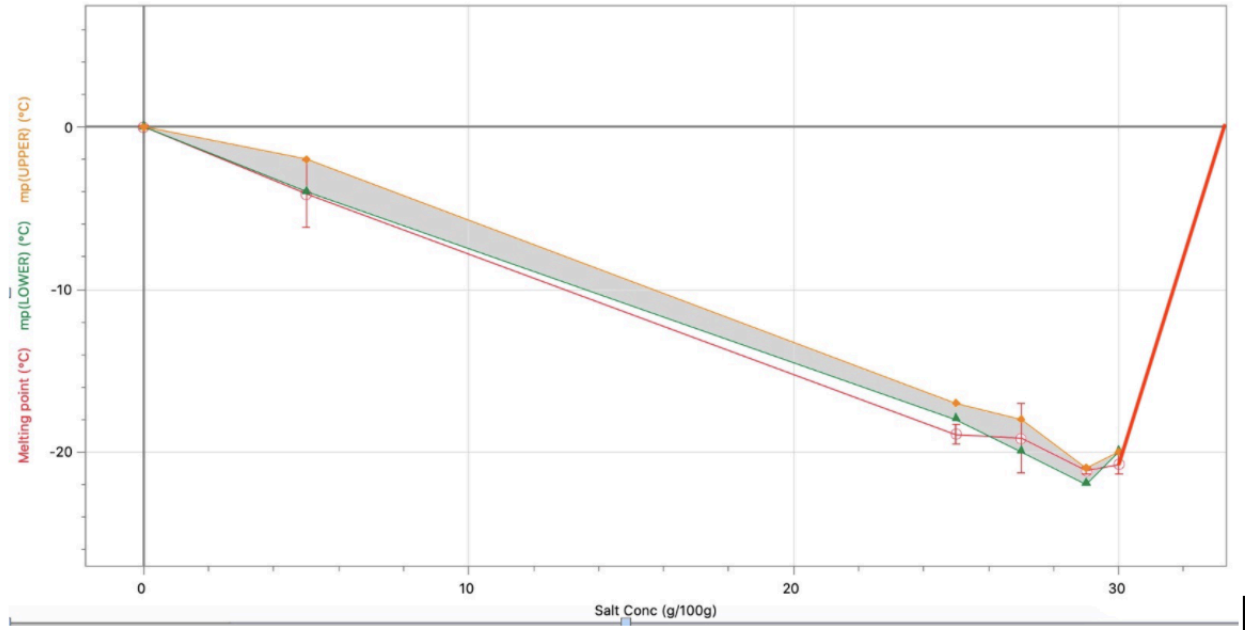
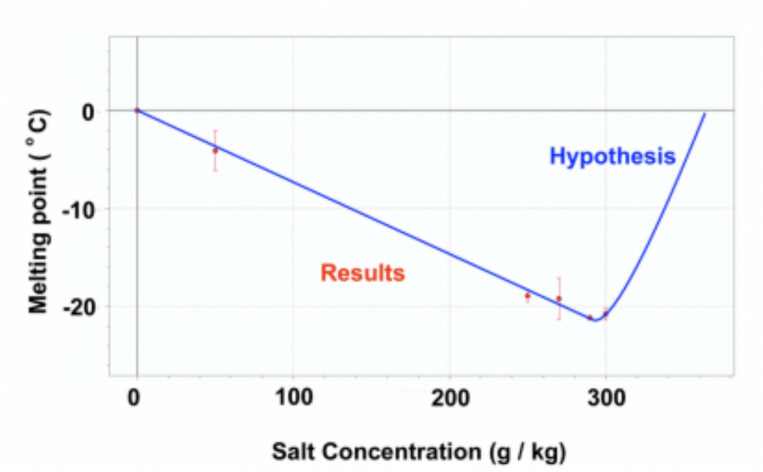
After that, we transferred the average melting point to a graph to compare it with the hypothesis.

Here was our original graph



But, as we only needed the hypothesis graph and our results graph, we decided to do it again.

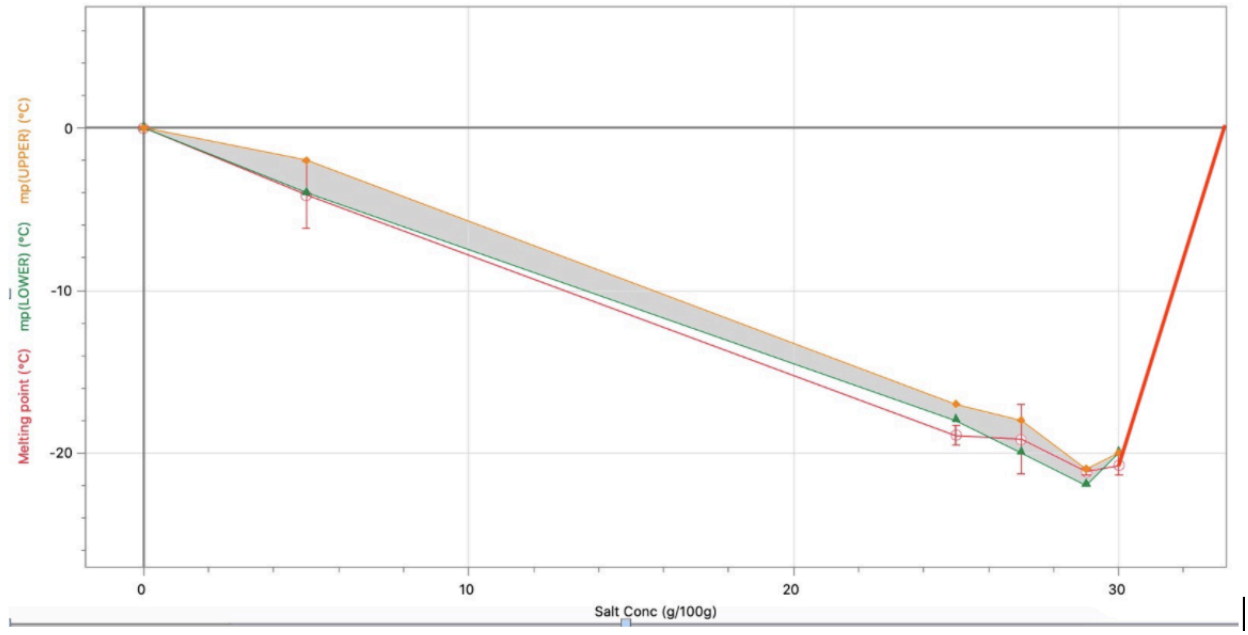
This was our final graph.



Event Log 9
Date: 22 Feb 2022
Details: We inserted the data into a table, as well as a graph to compare our hypothesis
Here is the table:

concentration of salt (g/kg)	Reading 1 (°C)	Reading 2 (°C)	Average (°C)	Error (°C)
0	-0.11	0.10	-0.01	0.11
50	-2.08	-6.16	-4.12	2.04
250	-19.53	-18.31	-18.92	0.61
270	-17.05	-21.29	-19.17	2.12
290	-20.97	-21.39	-21.18	0.21
300	-20.18	-21.38	-20.78	0.60

Here is the graph:



Event Log 10
Date:
Details:

Group Reflection: Consider the following questions

1. What are the local or global issues that your project is trying to address?
   Global warming is a looming threat, and we are trying to solve it by understanding the cause of the increasing rate of the melting of polar ice caps. Global warming leads to faster melting of ice and to the changes in melting point of ice. As more polar ice caps melting faster due to the increase in global warming, the amount of water in the sea will increase, causing the salinity of the water to decrease. With a lower salinity, the melting point of the ice will increase, causing the polar ice caps to melt even faster.

2. How have your team made progress in personal effectiveness during the course of this project?
   Yes, as we were committed in completing the tasks on time.

3. How have your team made progress in inter-personal effectiveness during the course of this project?

Kian PIng:Yes, I became more responsible and confident.

Jeremy: I learn to become more responsible and plan better.