

Lab: Colligative Properties of Water

Part A:

Purpose: To find the melting point of ice.

Materials:

crushed ice (50 grams)	250 mL beaker
Vernier Temperature probe	Vernier Lab Pro
stop watch	balances
graph paper	paper for data table

Procedure:

1. Get a 250 mL breaker, weigh it on the balance, and record its mass in your data table.
2. Obtain about 50 grams of ice from the supply table and record the exact mass in your table. (do this by placing about 50 grams more weight of ice in the beaker you are massing). *Subtract the mass of the beaker from the mass of the ice and the beaker to record the mass of ice.*
3. Set up the probe as follows:
Obtain a LabPro Device and a TI 83+ calculator. Plug in the LabPro and attach the calculator to the LabPro using the small black connector.
Plug the temperature probe into Channel 1.
Press the APPS button on your calculator (1/2 up and to the left) and select DATAMATE.

Press the CLEAR button on the calculator.
4. Place the temperature probe into the beaker with the ice in it and look at the calculator. In the upper right corner you should see the temperature displayed in Celsius. Read the first stable temperature (initial) and record this temperature in your data table.
5. Record the temperature every 30 seconds until the teacher tells you to stop.
6. Graph your data on the graph paper provided.

Analysis:

Interpret your results from the graph. Analyze your procedure for possible sources of error.

Conclusion: what is the melting point and what evidence do you have to back up your statement.

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Part B:

Purpose: To find the boiling point of water.

Materials:

graduated cylinder	400mL beaker
Bunsen burner/ hotplate	250 mL of water
Vernier Temperature probe	Vernier Lab Pro
stop watch	balances
graph paper	notebook paper for data

Procedure:

1. Get a 400 mL breaker and a graduated cylinder. Measure out 250 mL of water and put it in the beaker.
2. Record this volume in your data table and place the beaker on the hot plate/ Bunsen burner.
3. Get a temperature probe.
4. Set up the probe as follows:
Obtain a LabPro Device and a TI 83+ calculator. Plug in the LabPro and attach the calculator to the LabPro using the small black connector.

Plug the temperature probe into Channel 1.

Press the APPS button on your calculator (1/2 up and to the left) and select DATAMATE.

Press the CLEAR button on the calculator.

5. Place the temperature probe into the beaker with the water and look at the calculator. In the upper right corner you should see the temperature displayed in Celsius. Read the first stable temperature (T_{initial}) and record this temperature in your data table.
6. Turn on the hot plate/ Bunsen burner with the water filled beaker on it.
7. Record the temperature every 30 seconds until the teacher tells you to stop.
8. Graph your data on the graph paper provided.

Lab: Colligative Properties of unknown substances

Part C:

Purpose: To find the freezing points of the unknowns.

Materials:

400 mL beaker	stop watch
Bunsen burner/ hotplate	Vernier LabPro
Vernier Temperature probe	graph paper
notebook paper for data	

Procedure:

1. Get a 400 mL beaker.
2. Get a temperature probe.
3. Set up the probe as follows:

Obtain a LabPro Device and a TI 83+ calculator. Plug in the LabPro and attach the calculator to the LabPro using the small black connector.

Plug the temperature probe into Channel 1.

Press the APPS button on your calculator (1/2 up and to the left) and select DATAMATE.

Press the CLEAR button on the calculator.

4. Obtain a test tube filled with unknown A from the teacher's demonstration desk and place it in your beaker. Place the temperature probe into the unknown A test tube such that the probe is immersed in the unknown substance.
5. In the upper right corner you should see the temperature displayed in Celsius. Read the first stable temperature (T_{initial}) and record this temperature in your data table.
6. Record the temperature every 30 seconds until your teacher tells you to stop.
7. Graph your data on the graph paper provided.
8. Obtain unknown B from the teacher's demonstration desk and repeat steps 1 – 7.

Analysis:

Interpret your results from the graphs. Analyze your procedure for possible sources of error.

Conclusion: what is the freezing point for each unknown and what evidence do you have to back up your statement.

Put M & M/ Mars to the Test

Overview: This lesson uses the knowledge of mean, median, mode and percent in a real world application.

Purpose: The student will be able to find the mean, median, mode and percentages of collected data and relate this information to the real world.

Background Information: The student needs to have working knowledge of mean, median, and mode and experience using the graphing calculator.

Materials: One 1.5 ounce bag or mini bag of M & M's per student
Graphing calculator

Standards:

- Cooperative learning, discussion
- Real world application of concepts
- Estimating
- Percents
- Working with the graphing calculator

Engagement: Hand out bags of M & M's and tell the student's not to open them. Ask "Is the M & M's / Mars Company really fairly accurate with their percentages of colors they report?"

Exploration: Students are to find the mean, median, and mode of the M & M's for the class and find the percentages of each color.

Explanation: After finding the mean, median, and mode of the number o M&M's finding the percentage of colors, and a discussion of similarities and differences, the students see how their results compared with that of the M & M's/ Mars Company.

Extension:

- The students can make a plot and whiskers graph.
- The students can make a bar graph.
- The students can calculate the degrees of a circle for each color and make a circle graph (pie graph).
- The student can answer probability questions from the data collected.

M & M Lab

1. Estimate the number of M & M's in your package. _____
2. Record the Number of M & M's in each person's package in the class.
Compute the mean, median and mode of this data.

Number of M & M's in Each Person's Package					
Mean		Median		Mode	

Counts	Red	Green	Yellow	Orange	Brown	Blue	Total
Your Package							
Small group							
Total class							

1. Find the percent of each color and record the percents below.

Percent	Red	Green	Yellow	Orange	Brown	Blue	Total
Your Package							
Small Group							
Total Class							

2. a) Using the information in #2 above, estimate the number of M & M's in a bag that weighs 32 ounces. _____

b) If brown M & M's were your favorite, how many would you get in a bag that weighs 32 ounces? _____

c) Using the information in #4 above for the class, find the number of each color in a bag of M & M's with 32 ounces.

Red	Green	Yellow	Orange	Brown	Blue	Total

1. Answer the following questions:

a. How were your results similar to those of the entire class?

b. How were your results different from those of the entire class?

c. If all of the math classes conducted this activity, what results would you expect? Why?

d. The M & M/Mars Company colors M & M's according to the following specific percents

Red	Green	Yellow	Orange	Brown	Blue	Total
20%	10%	20%	10%	30%	10%	100%

Using the above information to calculate the % error in your sample and the class data % error.

How well do your results compare with the company's stated percent? Why?