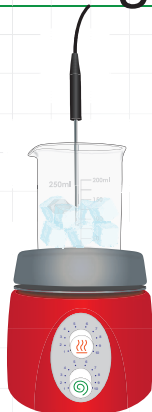


Changes



Explore/Explain 2

Investigate: Phase Change

Safety

Study the MSDS for the chemicals used in Part A. Discuss safety precautions that must be used and list them in the space below.

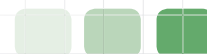
1. Place 4–5 ice cubes (less than 100 g) and about 50 mL of water in a 250 mL beaker.
2. Connect the graphing calculator (TI-84) to CBL 2™ using the link.
3. Insert the temperature probe into Channel 1.
4. Select the “DataMate” program from APPS for data collection.
5. Follow the instructions as directed by the program.
6. Set the program in “time graph” data collection mode.
7. Set the program to collect samples every 10 seconds.
8. Set the total number of samples as 90. This should be a total of 15 minutes.
9. Place the temperature probe in the ice-water mixture.
10. Place the beaker with the ice-water mixture, thermometer, and magnetic stirrer on a hot plate.
11. Ensure that the probe is not touching the sides or bottom of the beaker by suspending it in the ice-water mixture with a clamp and stand.
12. Begin heating and start the data collection.

Changes

13. When data collection is complete and the graph is displayed, analyze and discuss it with your lab group.
14. Data and graphs from the calculator may be transferred to a computer using an interface program such as TI-Connect™. The investigation report may be then printed out.
OR
Data may be transferred manually to the data table, and graphs may be constructed.

Note

If data is collected manually, record the temperature every 30 seconds until the temperature reaches approximately 100 °C and remains constant over several readings. The water should be visibly boiling at this time.



Changes

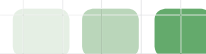
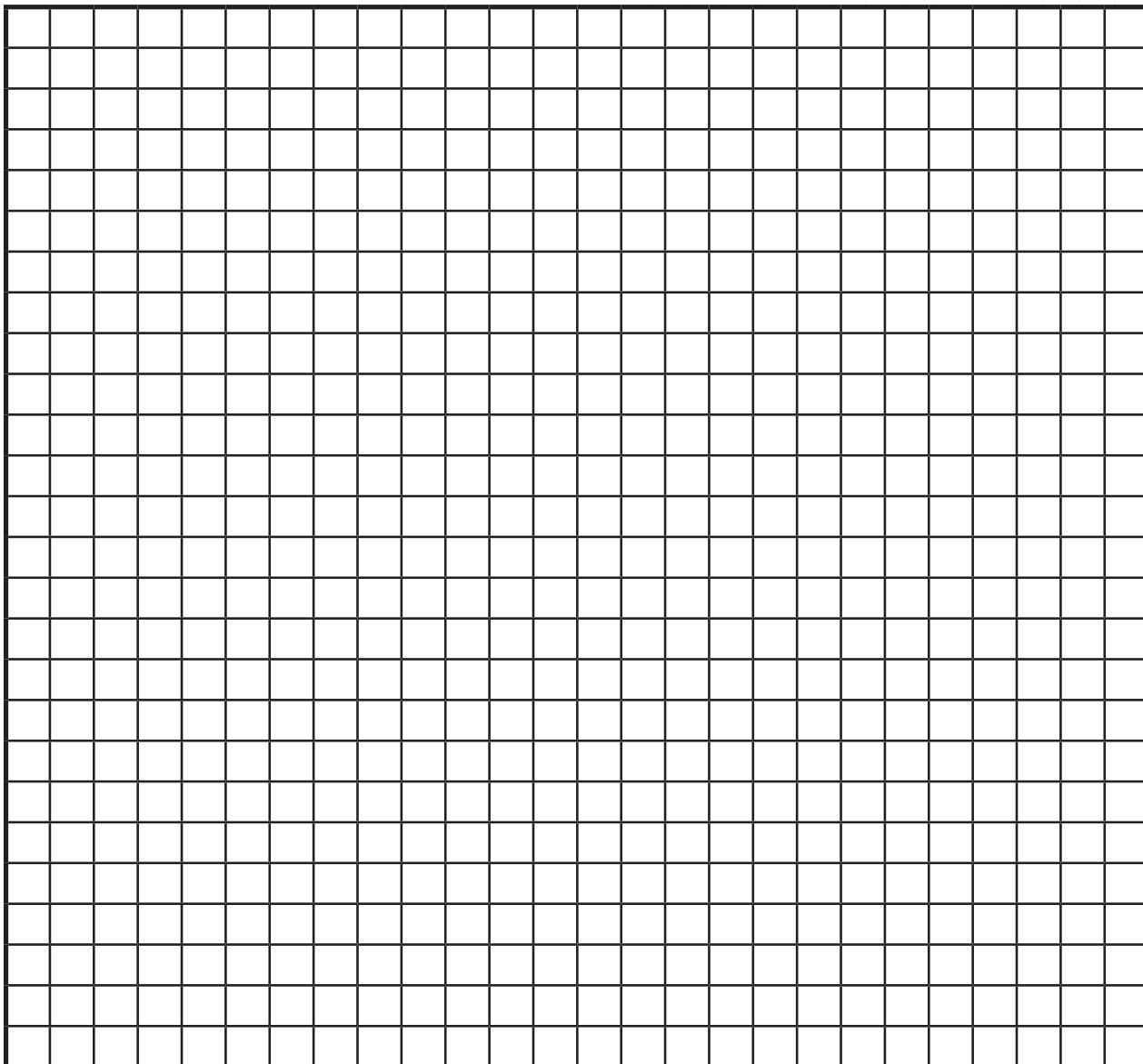
Data (for Manual Data Collection)

Time (30 sec intervals)	Temp (°C)	Time (30 sec intervals)	Temp (°C)	Time (30 sec intervals)	Temp (°C)	Time (30 sec intervals)	Temp (°C)
0		25		50		75	
1		26		51		76	
2		27		52		77	
3		28		53		78	
4		29		54		79	
5		30		55		80	
6		31		56		81	
7		32		57		82	
8		33		58		83	
9		34		59		84	
10		35		60		85	
11		36		61		86	
12		37		62		87	
13		38		63		88	
14		39		64		89	
15		40		65		90	
16		41		66		91	
17		42		67		92	
18		43		68		93	
19		44		69		94	
20		45		70		95	
21		46		71		96	
22		47		72		97	
23		48		73		98	
24		49		74		99	



Changes

Graph



Changes

Analysis and Conclusions

1. In your investigation, identify the independent and the dependent variables.
2. How does the temperature of the ice-water mixture vary as it is continually heated?
3. What do the different sections of the graph represent?
4. From your graph, identify the melting temperature of ice and the boiling temperature of water.
5. Predict the shape of the graph if you cooled steam continually to change it to ice. Draw the predicted shape of the graph below. Identify the condensation temperature and the freezing temperature on the graph.



Changes

6. Classify the following changes as endothermic or exothermic and give reasons for your classification.

Change	Endothermic or Exothermic	Reason
Melting		
Freezing		
Boiling		
Condensation		

7. Why do you think the temperature stayed constant as the ice melted into water?

8. Why do you think the temperature stayed constant as the water boiled?

9. What is the difference between evaporation and boiling?



Changes

10. Classify the following changes as physical or chemical and exothermic or endothermic. Give reasons for your classification.

Change	Physical or Chemical	Exothermic or Endothermic	Reason
Melting			
Freezing			
Boiling			
Condensation			
Evaporation			

