Measuring Enthalpy Changes Worksheet

As you work through the steps in the lab procedures, record your experimental values and the results on this worksheet.

Table A: Heat of Solution

Initial temperature of water	°C
Temperature of solution after addition to $CaCl_2$	°C
ΔT_{1A} (T_{final} - $T_{initial}$) for dissolution of $CaCl_2$	°C
Initial temperature of water	°C
Temperature of solution after addition to NH_4NO_3	°C
ΔT_{2A} (T_{final} - $T_{initial}$) for dissolution of NH_4NO_3	°C

Question 1: For dissolution of $CaCl_2$, please answer a - c.

a. Was heat given off or absorbed? Could you feel it?

b. Was the process exothermic or endothermic?

c. Did the entropy increase, decrease, remain the same or can you not tell from your results?

Question 2: For dissolution of NH_4NO_3, please answer a - c.

a. Was heat given off or absorbed? Could you feel it?

b. Was the process exothermic or endothermic?

c. Did the entropy increase, decrease, remain the same or can you not tell from your results?

Question 3: Which chemical would you use in a cold pack, $CaCl_2$ or NH_4NO_3?

Table B: Heat of Reaction

	Temperature	Observations
Initial $FeCl_3$ solution	°C	
Solution after addition of NaOH	°C	
ΔT_{1B}	°C	

Question 4: For the reaction of $FeCl_3$ and NaOH, please answer a - d.

a. What evidence indicates that a reaction occurred?

b. Did the reaction give off or absorb heat? Could you feel it?

c. Did the entropy increase, decrease, remain the same or can you not tell from your results?

d. Was the reaction spontaneous? Justify your answer.

Table C: Heat of Neutralization

	Temperature	Observations
Initial NaOH solution	°C	
Solution after addition of water	°C	
ΔT_{1C}	°C	
Solution after addition of HCl	°C	
ΔT_{2C}	°C	
Solution after addition of HNO_3	°C	
ΔT_{3C}	°C	
Solution after addition of$HC_2H_3O_2$	°C	
ΔT_{4C}	°C	

Question 5: In which test tubes was there evidence for a reaction?

Question 6:

a. Were the temperature changes about the same or very different for the reactions?

b. Can you account for this result? Hint: write the reaction equations and compare them.

Question 7: Did the entropy increase, decrease, remain the same or can you not tell from your results?

Table D: Temperature and Time During the Heating of Water

Elapsed time, min	Temperature, °C	Observations
0.0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		
8.5		
9.0		
9.5		
10.0		

Elapsed time, min	Temperature, °C	Observations
13.0		
13.5		
14.0		
14.5		
15.0		
15.5		
16.0		
16.5		
17.0		
17.5		
18.0		
18.5		
19.0		
19.5		
20.0		
20.5		
21.0		
21.5		
22.0		
22.5		
23.0		

Elapsed time, min	Temperature, °C	Observations
10.5		
11.0		
11.5		
12.0		
12.5		

Elapsed time, min	Temperature, °C	Observations
23.5		
24.0		
24.5		
25.0		

Record the following.

Time at which all the ice has (just) melted	min
Time at which bubbles first appear	min
Time at which steam first appear	min
Time at which true boiling begins	min

Question 8:

a. Were there times when the temperature stayed constant for several readings?

b. What was happening during these times?

Question 9: What happened to the entropy of the system for each of the following processes? Did it increase greatly, increase slightly, decrease greatly, decrease slightly, stay the same or can you not tell from your results?

a. As the ice melted?

b. As the water was heated?

c. As the water boiled?