HONORS LAB 1a: Specific heat capacity

Aim To calculate the specific heat capacity of two metals

Apparatus 250 mL beaker, coffee cups, 100 mL graduated cylinder, hot plate, tongs, thermometers

Chemicals Water, samples of metals

Method

1. Select one sample of metal, place it on the balance and record the mass in table A.

2. Using the graduated cylinder, add exactly 120. mL of water to a "double coffee cup calorimeter". Using a thermometer record the temperature of the water in table A and in the "0 seconds row" in table B and set it aside.

3. Add water to a 250 mL beaker until it is approximately half full and place it on the hot plate. Carefully add the metal sample. Adjust the hot plate to a medium-high heat setting. Using another thermometer, monitor the temperature of the water as it heats up and continue heating until the water temperature reaches approximately 90^{o}C.

4. When the water reaches approximately 90^{o}C, turn off the hot plate and remove the beaker.

5. Using tongs, carefully transfer the hot metal sample from the hot water to the "double coffee cup calorimeter". At this point record the temperature of the hot water in table A.

6. Slowly sir the contents of the "double coffee cup calorimeter", recording the temperature every 30 seconds in table B. Continue to record the temperature until a maximum temperature has been reached.

7. Repeat steps #1 through #6, this time using a different metal.

Assumptions

- Assume the temperature of the sample of metal is the same as the hot water
- Assume the density of water to be 1.00 g/mL
- Assume specific heat capacity of water to be 4.184 J/g^{o}C
- Assume all the heat lost by the hot metal is transferred to the cold water
- Assume the accepted value of specific heat capacity of iron to be 0.45 J/g^{o}C
- Assume the accepted value of specific heat capacity of copper to be 0.385 J/g^{o}C
- Assume the accepted value of specific heat capacity of brass to be 0.38 J/g^{o}C
- Assume the accepted value of specific heat capacity of aluminum to be 0.900 J/g^{o}C

Results

FIRST METAL SAMPLE

TABLE A	
Mass of metal sample	
Initial temperature of cold water in coffee cup calorimeter	
Temperature of hot water (metal)	

TABLE B			
Water temperature in coffee cup calorimeter		**Water temperature in coffee cup calorimeter**	
Time in seconds	Temperature	Time in seconds	Temperature
0		540	
30		570	
60		600	
90		630	
120		660	
150		690	
180		720	
210		750	
240		780	
270		810	
300		840	
330		870	
360		900	
390		930	
420		960	
450		990	
480		1020	
510		1050	

SECOND METAL SAMPLE

TABLE A	
Mass of metal sample	
Initial temperature of cold water in coffee cup calorimeter	
Temperature of hot water (metal)	

TABLE B			
Water temperature in coffee cup calorimeter		**Water temperature in coffee cup calorimeter**	
Time in seconds	Temperature	Time in seconds	Temperature
0		540	
30		570	
60		600	
90		630	
120		660	
150		690	
180		720	
210		750	
240		780	
270		810	
300		840	
330		870	
360		900	
390		930	
420		960	
450		990	
480		1020	
510		1050	

Conclusion/Calculation

1. Using the following relationships, calculate the specific heat capacity of both metals and compare your results to the accepted values.

Heat lost from metal = (mass of metal) x (shc of metal) x (temp change of metal)
Heat gained by water = (mass of water) x (shc of water) x (temp change of water)

2. Identify all of the possible errors in your experiment.

3. Which of the assumptions made on page 1 is likely to be the least reliable?