Sample of a Student's Work/Notebook for

A Natural Approach to Chemistry
Investigations 3A-3C

LAB-AIDS®

A NATURAL APPROACH TO CHEMISTRY

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LAB 3A: Temperature

Part 1 4)

Time	Cold H_2O Temp	Hot H_2O Temp
10:02	12°C	62.3°C
10:08	12.1°C	29.7°C

Part 2 a Temperature describes heat energy so hot water has more

b Cold will warm up and hot will cool down

c Heat flows out of hot into the air and heat flows into the cold from the air

d See chart

Part 3

Cold H_2O	Hot H_2O	Mix
11°C	64.2°C	29.5°C

Part 4 a Hot water because temp measures heat energy

b Around 40°C - middle

c Energy is same before & after

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Part 5

Part 5: Analyzing the data

	Mass (g)		Temperature (°C)		gram degrees (g • °C)
Before mixing					
Cold Water	100	x	0 °C	=	~~[illegible]~~
	+		+		+
Hot Water	100	x	64.2	=	6420
After mixing	II				II
Mixture	200	x	32.1	=	6420
			unknown		

c) Temp of mix
d) see chart
e) pretty close

Part 6

Sample	Mass (g)	Temp (°C)
Cup 1	100 g	5.2
Cup 2	100 g	63.1
Cup 3	100 g	60.8
Mix	300 g	39.9

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Part 7

Before mixing	Mass (g)		Temperature (°C)		gram degrees (g • °C)
Cup 1	100	x	0 °C	=	0
	+		+		+
Cup 2	100	x	63.1	=	6310
	+		+		+
Cup 3	100	x	60.8	=	6080
After mixing	II				II
Mixture	300	x	41.3 (unknown)	=	12390

Part 8

a) I didn't make a prediction but it made sense because w/ 2 cups of hot water the mix was hotter "agree" means to be pretty close because of errors in accuracy and precision.

b) use chart like part 7

c) if objects are different like wood & metal

d) same as c

e) Temp- how hot something is measured by a thermometer →

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Energy - how much mass x how much temp

Lab 3B: Specific Heat

washer mass	washer temp	water mass	water temp	mix
115.2	0.8	100	60.6	51.9

Part 2: Analyzing the data

?	x	115.2	0°C	=	0	A
specific heat of steel (?)		mass of steel	initial temperature of steel		joules	
				+		
4.18 J/(g°C)	x	100	60.6	=	25331	B
specific heat of water		mass of water	initial temperature of water		joules	
				II		
Before mixing				total energy	25331	A+B

After mixing

4.18 J/(g°C)	x	100	51.9	=	21694	C
specific heat of water		mass of water	mixture temperature		Subtract the energy left in the water from the total energy (A+B – C)	
0.61	x	115.2	51.9	=	3637	A+B-C
specific heat of steel		mass of steel	mixture temperature		energy in steel washers	

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Part 3

a) because they're made of different types of material

b) still 0 joules

c) 25331 joules

d) perfect

DONT DO E & F

Part 5

a) $E = mc_p(T_2 - T_1)$

$100 = (50)(4.18)(T_2 - T_1)$

$100 = 209(T_2 - T_1)$

$0.48 = (T_2 - T_1)$

b) 100g steel & 100g water @ same temp

c) 100g steel @ hot temp and 100g water @ cold temp →

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LaB

d) (i) Closer to 0°C than 50°C

e) Because specific heat of gold is very low so it can't add much energy

Part 6

a. *The diagram below is similar to the one used on page 28.*
Here we will enter the value of specific heat you calculated in Part 2. Here we will enter the actual temperature of the steel.

0.61	x	115.2		0.8	=	56.2	A
specific heat of steel (?)		mass of steel		initial temperature of steel		joules	
						+	
4.18 J/(g°C)	x	100		60.6	=	2883	B
specific heat of water		mass of water		initial temperature of water		joules	
						=	
Before mixing						total energy 2939.2	A+B

After mixing

4.18 J/(g°C)	x	100		51.9	=	21694	C
specific heat of water		mass of water		mixture temperature		Subtract the energy left in the water from the total energy (A+B – C)	
0.62	x	115.2		51.9	=	3693.2	A+B-C
specific heat of steel		mass of steel		mixture temperature		energy in steel washers	

improved value for the specific heat of steel

e) 0.01 higher because we used real temp not 0

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3C Heat Flow

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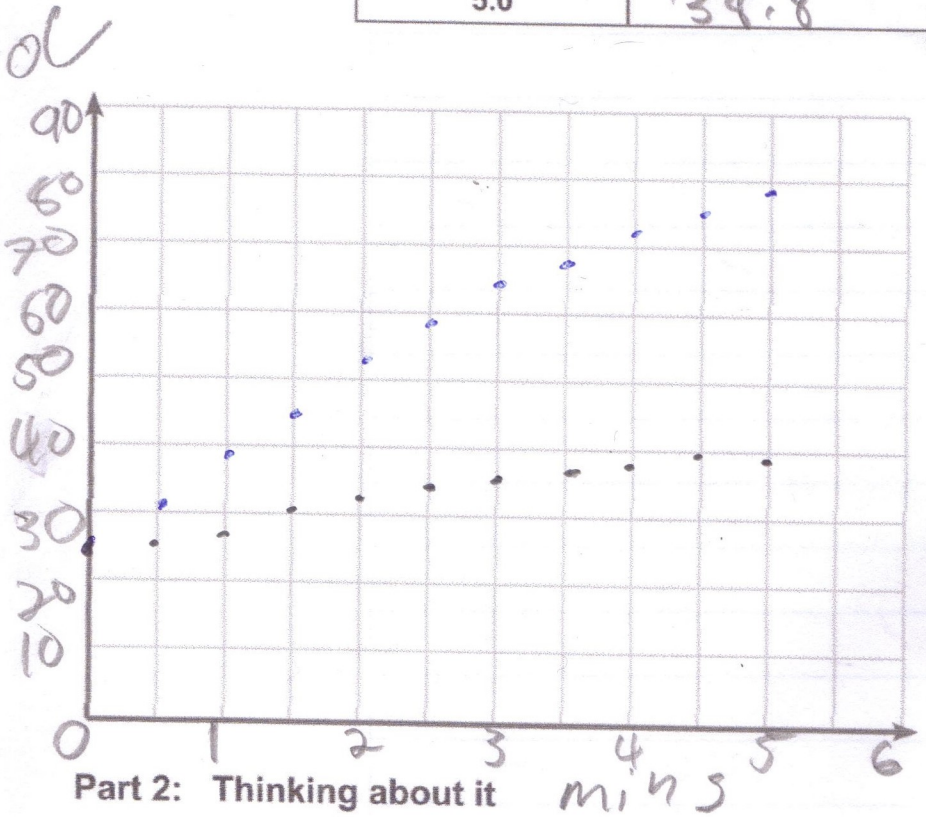
TABLE 1: Water temperature (°C)

Time (min)	Heater set to 50°C	Heater set to 100°C
0.0	24.2	24.6
0.5	26.4	31.2
1.0	29.6	39.0
1.5	30.7	46.4
2.0	32.5	57.8
2.5	34.1	59.3
3.0	35.8	64.1
3.5	36.9	68.2
4.0	38.0	72.7
4.5	38.9	76.1
5.0	39.8	78.8



Identify three differences and three similarities between the two plots, and write them below.

Similarities:

1. go up
2. start same
3. don't reach set temp

Differences:

1. 100° set steeper
2. end temps different
3. 50° set went down @ end

Part 2: Thinking about it

a. Why is it important not to have too much water in the test tube? might spill

b. *Why do you have to stir the water while heating it?* make temp even out

c. What was the highest reading you measured on the temperature probe? 78.8

d. Describe the temperature versus time graph. What are the differences between the two plots?