Enthalpy of Rx Feedback Rubric

Sections	Descriptions	Self-Assessment
Title	• Descriptive • Include the reaction(s) as formula or words • Does not include the words "quantitative" or "qualitative"	
Data Table	• All quantitative data presented at numbers • Units must be included with number or stated in row	
Discussion Questions	• All answered • All questions rephrased as part of the question • Significant detail to support the answers	
Calculations	• Calculation for Temperature Change • Calculation for heat, q, for EACH reaction • Calculation for ΔH for EACH reaction • Calculation of percent error (Accepted vs. Experimental)	

Discussion Questions – The highlighted ones were graded.

☐ All were graded for completion, detail, thought AND accuracy

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ANSWERS TO THE DATA ANALYSIS QUESTIONS

1. Answers will vary. For the sample data, the heat energy for each reaction is shown below.

   Reaction 1: $q = (4.18\ J/g{\bullet}°C \times 103\ g \times 12.71°C) = 5472\ J = 5.47\ kJ$
   Reaction 2: $q = (4.18\ J/g{\bullet}°C \times 103\ g \times 1.01°C) = 434.8\ J = 0.435\ kJ$
   Reaction 3: $q = (4.18\ J/g{\bullet}°C \times 103\ g \times 11.27°C) = 4852\ J = 4.85\ kJ$

2. Answers will vary. Because 50 mL of 2 M solutions were used in all reactions, the conversion of q to kJ/mol of reactant is perfunctory, as shown below.

   Reaction 1: 5.47 kJ ÷ 0.10 mol = –54.7 kJ/mol
   Reaction 2: 0.435 kJ ÷ 0.10 mol = –4.35 kJ/mol
   Reaction 3: 4.85 kJ ÷ 0.10 mol = –48.5 kJ/mol

3. The experimental molar enthalpy of Reaction 3, using the data from Question 2, is –50.35 kJ. Hess's law is used by determining the sum of Reaction 1 plus the reverse of Reaction 2. For the sample data, the application of Hess's law yields:

   $$-54.7\ kJ/mol + 4.35\ kJ/mol = -50.35\ kJ/mol$$

4. The accepted (text value) of the molar enthalpy of Reaction 3 is –52.2 kJ/mol. Applying Hess's law yields: –55.9 kJ/mol +(3.70 kJ/mol) = –52.2 kJ/mol. The experimental value and the accepted value of ΔH compare well for the sample data.

5. The sample data and the experimental values of ΔH for Reaction 3, derived from summing the values of ΔH for Reactions 1 and 2, support Hess's law. Your students will have three values of ΔH for Reaction 3, and it may be helpful to guide them through the source of each of the three values.

SAMPLE DATA

	Reaction 1	Reaction 2	Reaction 3
Maximum temperature (°C)	34.16°C	21.84°C	32.01°C
Initial temperature (°C)	21.45°C	20.81°C	20.74°C
Temperature change (ΔT)	12.71°C	1.01°C	11.27°C