

Lab 4 Calorimetry - Rudra Goll

Part A: Calibration

		Trial 1	Trial 2	Trial 3
M_2	Mass of Cold water (mL)	50.0 mL	40.0 mL	50.0 mL
M_1	Mass of Hot water (mL)	50.0 mL	40.0 mL	50.0 mL
T_{cold}	T of Cold water ($^{\circ}\text{C}$)	21.5 $^{\circ}\text{C}$	21.5 $^{\circ}\text{C}$	21.7 $^{\circ}\text{C}$
T_{hot}	T of Hot water ($^{\circ}\text{C}$)	49.5 $^{\circ}\text{C}$	61.0 $^{\circ}\text{C}$	88.0 $^{\circ}\text{C}$
T_{final}	T after mixing (T_{final} $^{\circ}\text{C}$)	34.9 $^{\circ}\text{C}$	40 $^{\circ}\text{C}$	49.9
	C_{cal} (J/ $^{\circ}\text{C}$)	18.7	22.6	73.4

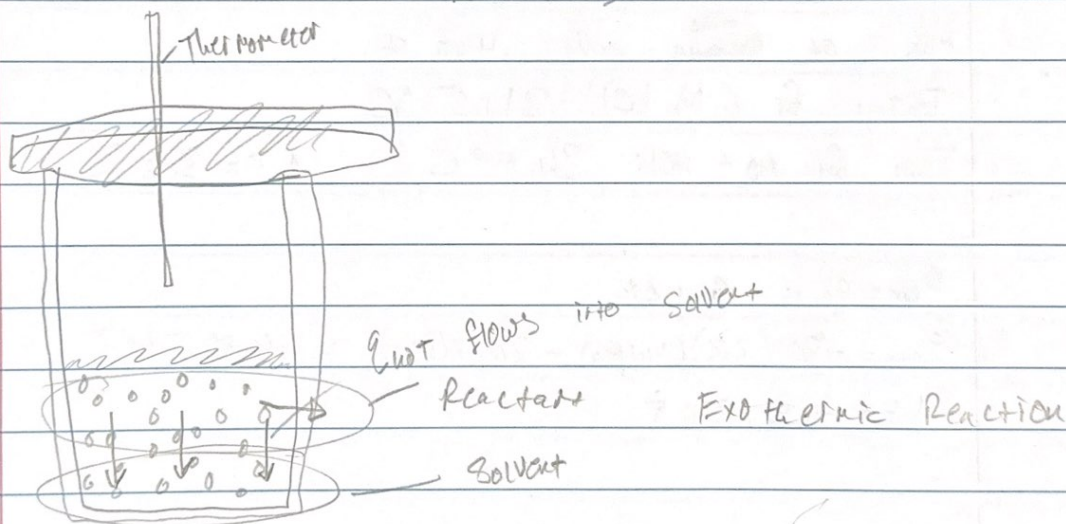
Average C_{cal} : 20.7

$$q_{\text{hot}} = -(q_{\text{cold}} + C_{\text{cal}} \Delta T)$$

$$M_1 C \Delta T = -(M_2 C \Delta T + C_{\text{cal}} \Delta T)$$

$$M_1 (4.184) (T_{\text{final}} - T_{\text{hot}}) = -(M_2 (4.184) (T_{\text{final}} - T_{\text{cold}}) + C_{\text{cal}} (T_{\text{final}} - T_{\text{cold}}))$$

$$C_{\text{cal}} = \frac{M_1 C (T_{\text{f}} - T_{\text{h}}) + M_2 C (T_{\text{f}} - T_{\text{cold}})}{-(T_{\text{final}} - T_{\text{cold}})}$$



Jesse B.

Part B: Metal w/ HCl - Zinc

Mass of metal (g): .102 g

T_{initial} for 6 M HCl: 22.2 °C

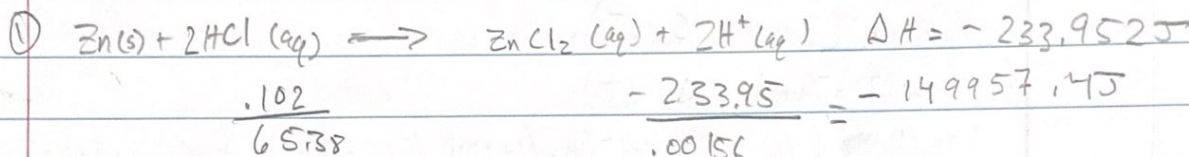
T_{final} for Zn + HCl: 23.8 ΔT = 1.6 °C

$$q_{\text{rxn}} = (q_{\text{soln}} + C_{\text{cal}} \Delta T)$$

$$q_{\text{rxn}} = m_{\text{HCl}} (C_{\text{HCl}}) \Delta T + C_{\text{cal}} \Delta T$$

$$q_{\text{rxn}} = (30)(4.184)(1.6) + 20.7(1.6)$$

$$q_{\text{rxn}} = -233.952 \text{ J}$$



Part C: metal oxide - zinc oxide

Mass of ^{Zinc} ~~oxide~~ oxide: .400 g

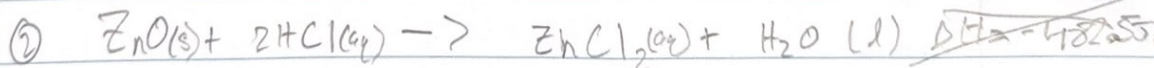
T_{initial} for 6 M HCl: 21.5 °C

T_{final} for Al₂O₃ + HCl: 24.8 °C ΔT = 3.3 °C

$$q_{\text{rxn}} = q_{\text{soln}} - C_{\text{cal}} \Delta T$$

$$q_{\text{rxn}} = -(30)(3.3)(4.184) - 20.7(3.3) = -480.216 \text{ J}$$

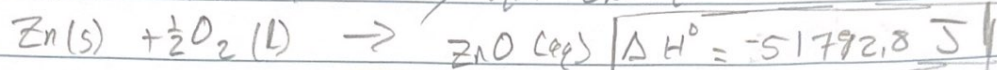
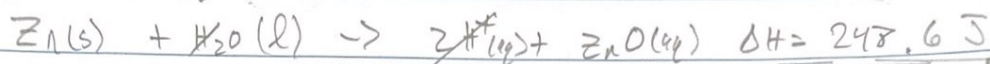
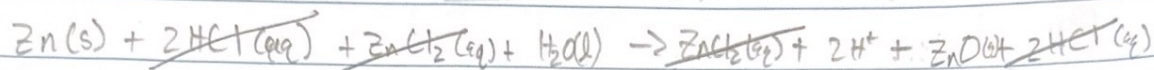
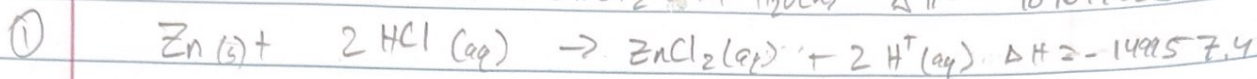
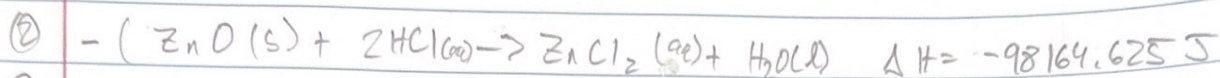
$$\Delta H = -480.216 \text{ J}$$



$\frac{.4}{81.38}$	$= .004915 \text{ mol ZnO}$	$\frac{-482.5}{1}$
	\rightarrow	

$$\Rightarrow -98164.625 \text{ J} = \Delta H^\circ$$

more



By reversing the zinc oxide rxn and adding it to the reaction of zinc metal, and then Hess law, we combined the enthalpies of each individual rxn to obtain a total enthalpy change

$$\Delta H = -51,792.8$$

un

jesse