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1). $\Delta H = \text{NaOH}(s) + \text{H}_2\text{O}(l)$	
#g NaOH + container	15.48g
# g container	13.02g
#mL H ₂ O	50
T _i	18.7°C
T _f	29.8°C

3). ΔH_{fus}	
#mL H ₂ O(l)	100 mL
#g H ₂ O(s)	8.8g
T _i	19.2°C
T _f	11.5°C
4). calorimeter's constant	
mL H ₂ O(hot)	100mL
mL H ₂ O(cold)	100mL
T _i (cold)	19.5°C
T _f (hot)	50.7°C
T _f mixture	34.7°C

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assume T_f(hot) = T_i(hot) = 50.7 C in data table 3; i.e. it's a typo

expt 1: dH dissolve solid NaOH in water

$$dH = -m c dT = -50 \text{ g} (4.18 \text{ J} / (\text{g C})) (29.8 - 18.7) \text{ C} = -2320 \text{ J}$$

$$dH = -2320 \text{ J} / (15.48 - 13.02) \text{ g NaOH} = -943 \text{ J} / \text{g} \rightarrow -37.7 \text{ kJ} / \text{mol}$$

expt 4: calorimeter constant

$$-q(\text{lost}) = q(\text{gain})$$

$$-m(\text{h}) c dT(\text{h}) = m(\text{c}) c dT(\text{c}) + C^* dT(\text{c})$$

$$-100 \text{ g} (4.18 \text{ J} / (\text{g C})) (34.7 - 50.7) = 100 \text{ g} (4.18 \text{ J} / (\text{g C})) (34.7 - 19.5) \text{ C} + C^* (34.7 - 19.5) \text{ C}$$

$$C^* = 22 \text{ J} / \text{C}$$

redo expt 1 using expt 4 results

$$-q(\text{lost}) = q(\text{gain})$$

$$-dH = m c dT + C^* dT = 50 \text{ g} (4.18 \text{ J} / (\text{g C})) (29.8 - 18.7) \text{ C} + (22 \text{ J} / \text{C}) (29.8 - 18.7) \text{ C}$$

$$= 2564 \text{ J}$$

$$dH = -2564 \text{ J} / (15.48 - 13.02) \text{ g NaOH} = -1042 \text{ J} / \text{g} \rightarrow -42 \text{ kJ} / \text{mol}$$

expt 3: dH melt ice

$$q(\text{gain}) = -q(\text{lost})$$

$$dH + m(\text{ice}) c (dT(\text{melted ice})) = -m c dT$$

$$dH + 8.8\text{g} (4.18\text{ J / (g C)}) (11.5 - 0) \text{ C} = -100\text{ g} (4.18\text{ J / (g C)}) (11.5 - 19.2) \text{ C}$$

$$dH + 432\text{ J} = 3219\text{ J}$$

$$dH = 2787\text{ J} / 8.8\text{ g ice} = 317\text{ J / g} \rightarrow 5.7\text{ kJ / mol}$$

expt 3: dH melt ice using expt 4 results

$$-q(\text{gain}) = q(\text{lost})$$

$$-[dH + m(\text{ice}) c (dT(\text{melted ice}))] = m c dT + C^* dT$$

$$-[dH + m(\text{ice}) c (dT(\text{melted ice}))] = 100\text{ g} (4.18\text{ J / (g C)}) (11.5 - 19.2) \text{ C} + 22\text{ J / C} (11.5 - 19.2) = -3388\text{ J}$$

$$dH + 8.8\text{ g} (4.18\text{ J / (g K)}) (11.5 - 0) = 3388\text{ J}$$

$$dH = 2965\text{ J} / 8.8\text{ g ice} = 337\text{ J / g} \rightarrow 6.0\text{ kJ / mol}$$