Problem 1

<u>Analysis</u>

$$n_{NaOH} = \frac{m_{NaOH}}{M_{NaOH}}$$

$$= \frac{4.00 \cancel{g}}{40.00 \cancel{g}\,mol^{-1}} \quad \text{☞ show unit analysis}$$

$$= 0.100 \text{ mol}$$

$$q_{cal} = m_{H2O}\,c_{H2O}\,\Delta T_{H2O}$$

$$= m_{H2O}\,c_{H2O}\,(T_2 - T_1)$$

$$= (100.0 \text{ g})(4.18 \text{ J g}^{-1}\,°C^{-1})(29.8\,°C - 19.2\,°C) \quad \text{☞ density of water is 1g/mL}$$

$$= (100.0\,\cancel{g})(4.18 \text{ J}\,\cancel{g}^{-1}\,°\cancel{C}^{-1})(10.6\,°\cancel{C}) \quad \text{☞ show unit analysis}$$

$$= 4430.8 \text{ J}$$

$$= 4.4308 \text{ kJ} \quad \text{☞ convert to kJ}$$

$$q_{rxn} = -q_{cal} \quad \text{(assuming that the calorimeter is an isolated system)} \quad \text{☞ state assumption}$$

$$= -4.4308 \text{ kJ}$$

$$\Delta H = q_{rxn} \quad \text{☞ enthalpy change is equal to the heat released/absorbed by reaction}$$

$$= -4.4308 \text{ kJ}$$

$$\Delta H_{sol} = \frac{\Delta H}{n_{NaOH}}$$

$$= \frac{-4.4308 \text{ kJ}}{0.100 \text{ mol}}$$

$$= -44.308 \text{ kJ mol}^{-1}$$

<u>Conclusion</u>
The molar enthalpy of dissolution for sodium hydroxide is -44.3 kJ mol^{-1}.

Problem 2

Analysis

$n_{Ba(OH)2}$ = $c_{Ba(OH)2}$ $V_{Ba(OH)2}$ ☞ use concentration formula to find the amount of $Ba(OH)_2$

= $(0.50 \text{ mol L}^{-1})(0.075 \text{ L})$ ☞ convert mL to L; show unit analysis

= 0.0375 mol

q_{cal} = $m_{solution}$ $c_{solution}$ $\Delta T_{solution}$

= $m_{solution}$ $c_{solution}$ $(T_2 - T_1)$

= $(150 \text{ g})(4.18 \text{ J g}^{-1} \, ^{\circ}\text{C}^{-1})(18.5 \, ^{\circ}\text{C} - 22.3 \, ^{\circ}\text{C})$ ☞ use combined volume of solution

(assuming solutions have the same density and heat capacity as water)   ☞ state assumptions

= $(150 \text{ g})(4.18 \text{ J g}^{-1} \, ^{\circ}\text{C}^{-1})(- 3.8 \, ^{\circ}\text{C})$ ☞ show unit analysis

= − 2382.6 J

= − 2.3826 kJ   ☞ convert to kJ

q_{rxn} = − q_{cal} (assuming that the calorimeter is an isolated system)   ☞ state assumption

= − (− 2.3826 kJ)

= + 2.3826 kJ

ΔH = q_{rxn} ☞ enthalpy change is equal to the heat released/absorbed by reaction

= + 2.3826 kJ   ☞ positive sign emphasizes that reaction is endothermic

ΔH_{rxn} = $\dfrac{\Delta H}{n_{Ba(OH)2}}$

= $\dfrac{+ \, 2.3826 \text{ kJ}}{0.0375 \text{ mol}}$

= $+ 63.536 \text{ kJ mol}^{-1}$

Conclusion
The molar enthalpy change for the reaction is + 64 kJ/mol $Ba(OH)_2$.