Calorimetry Lab APQ

Name: key
Period:

Quick lime, calcium oxide, was an important resource for building in the 19th and early 20th century, when it was used to make lime putty. A student is conducting and experiment to determine the enthalpy of reaction for the reaction of calcium oxide, CaO, with water to form calcium hydroxide, $Ca(OH)_2$. The following materials are available.

distilled Water	1.00 M $HCl_{(aq)}$	insulated cups with lids
thermometer	1.00 M $NaOH_{(aq)}$	digital scale
stirring rod	goggles	lab coats

The student may select from the glassware listed below.

Glassware Item	Precision
250 mL Erlenmeyer flasks	± 25 mL
100 mL beakers	± 10 mL
100 mL graduated cylinders	± 0.1 mL

A) The student measures out 0.50 grams of calcium oxide and then selects one of the 100 mL beakers to measure out 50 mL of distilled water. The student measures the initial temperature of the water as 25.4 °C and then pours the water into an insulated cup, the student then adds the calcium oxide, stirs the mixture, covers the cup and measures a maximum temperature of 28.1 °C.

i) Is the experimental design sufficient to determine the enthalpy of reaction to a precision of two significant figures? Justify your answer.

No, beakers are poor choices for measuring with 50mL ± 10mL we would only have 1 sig. Fig.

ii) List two specific changes to the experiment that will allow the student to determine the enthalpy of the reaction to a precision of three significant figures. Explain.

Use the graduated cylinder to measure the volume and move to 100mL this would give us 4 sig Figs for volume.

Use ~~the~~ a larger mass of CaO this would increase the ΔT to make than 10.0C which would give us at least 3 sig Figs.

B) In a different trial a student is given 5.00 g of calcium oxide and 100.0 mL of water at 25.0 °C. The student pours the water into an insulated cup. stirs in the calcium oxide, covers the cup and records the maximum temperature of the mixture ← 38.0°C

i) Assuming that the solution has a specific heat capacity of water, 4.18 J g °C, determine the heat released by the reaction.

$q_{rxn} = -q_{soln} = -(105.0\,g \cdot 4.18\,\frac{J}{g^\circ C} \cdot (38.0-25.0))$

$q_{rxn} = -5706\,J$ or $-5.71\,kJ$

ii) Based on the heat released, calculate the students experimental value for the enthalpy of reaction, in kJ/mol_{rxn}.

$CaO + H_2O \rightarrow Ca(OH)_2$

$\Delta H = \frac{q}{n} = \frac{-5.71\,kJ}{0.08925} =$

$5.00\,g\,CaO \cdot \frac{1\,mol}{56.0\,g} = 0.08928$

$\Delta H = -63.95\,\frac{kJ}{mol}$ or $-64.0\,\frac{kJ}{mol}$

iii) The student did not include the heat capacity of the insulated cup durning the experiment. Would this assumption cause the calculated value of the enthalpy of reaction to be higher than, lower than or the same as it would have been had the heat capacity of the insulated cup been taken into account? Justify your answer.

The calculated value would be lower than it should be. If the energy that was lost to the cup was included in the heat of the reaction the q_{rxn} would have been larger making the enthalpy of reaction larger.