Post Lab Questions

1.

Experiment	Chemical reaction	Calculated enthalpy value.
7.2 NaOH-HCL	$NaOH_{(aq)} + HCL_{(aq)} \rightarrow NaCL_{(aq)} + H_2O_{(L)}$	473.71 Joules
7.3 NH_4OH-HCL.	$NH_4OH_{(aq)} + HCL_{(aq)} \rightarrow NH_4CL_{(aq)} + H_2O_{(L)}$	295.47 Joules
7.4 NH_4CL-NaOH	$NH_4CL_{(aq)} + NaOH_{(aq)} \rightarrow NaCL_{(aq)} + NH_4OH_{(aq)}$	356.48 Joules

2.

The enthalpy of neutralization of NH_4CL calculated is much higher than the enthalpy of experimental value.
The differences is due to experimental errors that are as a result of surrounding environmental temparatures, errors in reading the thermometer temparatures and also as a result of equipment errors like that of calorimeter.

Calculate the enthalpy of reaction (ΔH HCL + NH_3)

$\Delta H = mc\Delta t$

$(5.35g \times 4.184 J/g.°C \times 13.2°C)$

$= 295.47$ Joules

Table 7.4

Moles of NH_4CL

$\left(\frac{2M \times 50 mL}{1000}\right)$

0.1 moles

Moles of NaOH

$\left(\frac{2M \times 50 mL}{1000}\right)$

0.1 moles

mass of NH_4CL

$(53.5 g/mole \times 0.1 moles)$

$= 5.35g$

mass of NaOH

$(40 g/mole \times 0.1 moles)$

4g

Total mass $= (5.35g + 4g)$

$9.35g$

Calculate the enthalpy of reaction (ΔH NH_4CL + NaOH

$\Delta H = (9.35g \times 4.184 J/g.°C \times 0.6°C)$

$= 23.47$ Joules

2.

$\Delta H = \Sigma n \Delta H_f^\circ(\text{product}) - \Sigma m \Delta H_f^\circ(\text{reactants})$

$n = 1$ (moles of C_2H_2).

$m = 2$ moles for C
1 mole for H

$\Delta H = 1(2599\ \text{kJ/mol}) - ((2\times -393.5\ \text{kJ/mol} + 1\times -285.8\ \text{kJ/mol}))$

$= (2599\ \text{kJ/mol}) - (-1072.8\ \text{kJ/mol})$

$= 3671.8\ \text{kJ/mol}$

3.

c. $NH_{3(g)} + H_2O_{(l)} \longrightarrow NH_4OH_{(aq)}$

d. $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

e. $NH_4OH_{(aq)} + HCl_{(aq)} \longrightarrow NH_4Cl_{(aq)} + H_2O_{(l)}$

f. $NH_4Cl_{(aq)} + NaOH_{(aq)} \longrightarrow NaOL_{(aq)} + NH_4OH_{(aq)}$

Table 1

Finding the heat capacity of the coffee cup.

Heat lost by water = heat gained by Calorimeter.

$\therefore Q_{water} = Q_{calorimeter}$.

$Q_{water} = (m \times c \times \Delta t)$.

$Q_{calorimeter} = (mc\Delta t)$.

Mass of water = 50g, mass of calorimeter = 50g.

$\left((50g \times 4.184 J/g.^{\circ}C \times (46^{\circ}C - 23.9^{\circ}C)\right) = \left(50g \times 4.184 J/g\ C_{calorimeter} \times (74.5^{\circ}C - 46^{\circ}C)\right)$

$(50g \times 4.184 J/g.^{\circ}C \times 22.1^{\circ}C) = (50g \times C_{cal} \times 28.5^{\circ}C)$

$4623.32 J = 1425 g.^{\circ}C \times C_{cal}$

$C_{cal} = \left(\frac{4623.32 J}{1425 g.^{\circ}C}\right)$

$C_{cal.} = 3.244 J/g.^{\circ}C$

Table 7.2

Moles of HCl $= \left(\frac{\text{Molarity} \times \text{volume of HCl}}{1000}\right)$

$= \left(\frac{2M \times 50ML}{1000}\right)$

0.1 moles of HCl.

Moles of NaOH.

$= \left(\frac{\text{Molarity of NaOH} \times \text{Volume of NaOH}}{1000}\right)$

$= \left(\frac{2M \times 50ml}{1000}\right)$

0.1 moles of NaOH

Total mass of the solution.

$$\text{Mass} = \left(\text{Relative molecular mass} \times \text{moles}\right)$$

$$\text{Mass of NaOH} = \left(40\text{g/mole} \times 0.1 \text{ moles}\right)$$

$$4\text{g}$$

$$\text{Mass of HCl} = \left(36.5\text{g/mole} \times 0.1 \text{moles}\right)$$

$$3.65\text{g}$$

$$\text{Total mass} = \left(4\text{g} + 3.65\text{g}\right)$$

$$7.65\text{g}$$

Calculate the enthalpy of the reaction (ΔH HCl + NaOH).

$$\Delta H = mc\Delta t$$

$$\left(7.65\text{g} \times 4.184\ \text{J/g}\cdot^{\circ}\text{C} \times (38.2^{\circ}\text{C} - 23.4^{\circ}\text{C})\right)$$

$$473.71 \text{ Joules}$$

Table 7.3

$$\text{Moles of HCl} = \left(\frac{2\text{M} \times 50\text{mL}}{1000}\right)$$

$$0.1 \text{ moles HCl}$$

$$\text{Moles of } NH_3 = \left(\frac{2\text{M} \times 50\text{mL}}{1000}\right)$$

$$0.1 \text{ moles of } NH_3$$

Total mass of solution

$$\text{mass of HCl} \left(36.5 \times 0.1 = 3.65\text{g}\right)$$

$$\text{mass of } NH_3 \left(17\text{g/mole} \times 0.1 \text{ moles}\right) = 1.7\text{g}$$

$$\text{Total mass of solution} = \left(3.65\text{g} + 1.7\text{g}\right) = 5.35\text{g}$$

①

a) $q = mc\Delta t$

Mass $= (100\,ML + 100\,ML) \times 1.00\,g/ML$

$= 200\,g.$

$\Delta t = (\text{final temperature} - \text{initial temperature})$.

$= (53.6^\circ C - 23.5^\circ C)$

$= \underline{30.1^\circ C}$

Now $q = (200\,g \times 4.184\,J/g^\circ C \times 30.1^\circ C)$

$= \underline{25,187.68}$ Joules.

b) $q = mc\Delta t$.

Mass $= (100\,mL + 100\,mL)\ 1.00\,g/mL$ for Acetic Acid and NaOH solution.

$= 200\,g.$

$\Delta t = (36.3^\circ C - 23.5^\circ C)$

$= 12.8^\circ C.$

$q = (200\,g \times 4.184\,J/g.^\circ C \times 12.8^\circ C)$

$= \underline{10,711.04}$ Joules

Q12

x = 11 TV ads

y = 26 Radio adds

Q1 (x, y) $\begin{bmatrix} 9 \\ 1 \end{bmatrix}$ $(9, 1)$

Q2 (x, y) $\begin{bmatrix} 5 \\ 4 \end{bmatrix}$ $(5, 4)$

Q3 (x, y) $\begin{bmatrix} 5 \\ 3 \end{bmatrix}$ $(5, 3)$

Q4 (x, y) $\begin{bmatrix} 10 \\ 4 \end{bmatrix}$ $(10, 4)$

Q5 ~~(x, y)~~

$x =$ 32 \$ 3000 investors

$y =$ 28 \$ 6000 investors

Q6 x 7

y 5

Q7 $x =$ 1600 sodas

$y =$ 1400 hot dogs

Q8 $\begin{bmatrix} 4 \\ 3 \end{bmatrix}$ $\begin{bmatrix} -1 \\ 9 \end{bmatrix}$ $\begin{bmatrix} -1 \\ 9 \end{bmatrix}$

Q9 $\begin{bmatrix} 5 \\ 0 \end{bmatrix}$ $\begin{bmatrix} -4 \\ 1 \end{bmatrix}$ $\begin{bmatrix} -42 \\ 5 \end{bmatrix}$

Q10 $(x, y) = \begin{bmatrix} 8 \\ -3 \end{bmatrix}$ $(8, -3)$

Q11 $(x, y) = \begin{bmatrix} 9 \\ 5 \end{bmatrix}$ $(9, 5)$