

Post Lab Questions

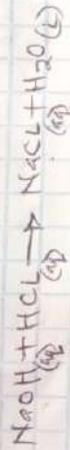
1.

Experiment

7-2

$\text{NaOH} + \text{HCl}$

Chemical reaction

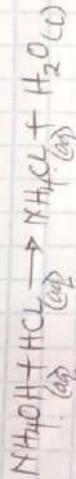


Calculated enthalpy value.

473.71 Joules

7-3

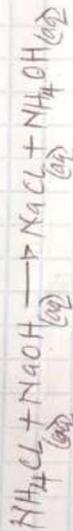
$\text{NH}_4\text{OH} + \text{HCl}$



295.47 Joules

7-4

$\text{NH}_4\text{Cl} + \text{NaOH}$



356.48 Joules

2.

The enthalpy of neutralization of NH_4Cl calculated is much higher than the enthalpy of experimental value. The difference is due to experimental errors that are as a result of surrounding environmental temperatures, errors in reading the thermometer temperatures and also as a result of equipment errors like that of calorimeter.

Calculate the enthalpy of reaction ($\Delta H_{\text{HCl} + \text{NH}_3}$)

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

$$(5.35\text{g} \times 4.184\text{J/g}\cdot^\circ\text{C} \times 13.2^\circ\text{C})$$

$$= \underline{\underline{295.47\text{Joules}}}$$

Table 7.4

moles of NH_4Cl

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

0.1 moles

moles of NaOH

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

0.1 moles

mass of NH_4Cl

$$(53.5\text{g/mole} \times 0.1\text{moles})$$

$$= \underline{\underline{5.35\text{g}}}$$

mass of NaOH

$$(40\text{g/mole} \times 0.1\text{moles})$$

$$= \underline{\underline{4\text{g}}}$$

$$\text{Total mass} = (5.35\text{g} + 4\text{g})$$

$$\underline{\underline{9.35\text{g}}}$$

Calculate the enthalpy of reaction ($\Delta H_{\text{NH}_4\text{Cl} + \text{NaOH}}$)

$$\Delta H = (9.35\text{g} \times 4.184\text{J/g}\cdot^\circ\text{C} \times 0.6^\circ\text{C})$$

$$= \underline{\underline{23.47\text{Joules}}}$$

2.

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

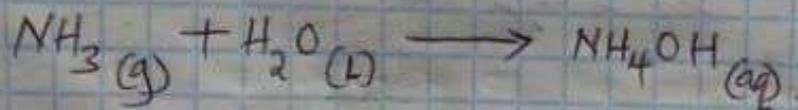
$$n = 1 \text{ (mole of } C_2H_2)$$

$$m = 2 \text{ moles for C} \\ 1 \text{ mole for H}$$

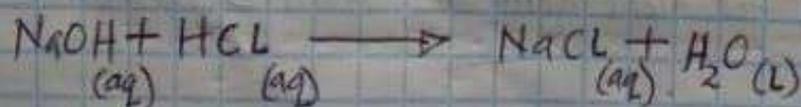
$$\Delta H = 1(2599 \text{ kJ/mol}) - ((2 \times -393.5 \text{ kJ/mol}) + 1 \times -285.8 \text{ kJ/mol}) \\ = (2599 \text{ kJ/mol}) - (-1072.8 \text{ kJ/mol}) \\ = \underline{\underline{3671.8 \text{ kJ/mol}}}$$

3.

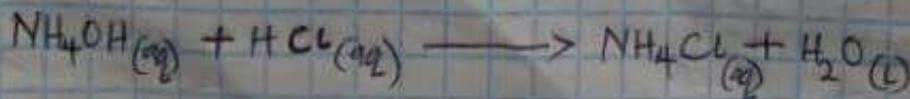
c.



d.



e.



f.



Table 1.

Finding the heat capacity of the coffee cup.

Heat lost by water = heat gained by calorimeter.

$$Q_{\text{water}} = Q_{\text{calorimeter}}$$

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

$$Q_{\text{calorimeter}} = (m c \Delta t)$$

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

$$\left((50g \times 4.184 \text{ J/g}^\circ\text{C} \times (46^\circ\text{C} - 23.7^\circ\text{C})) = (50g \times 4.184 \text{ J/g} \times c_{\text{calorimeter}} \times (74.5^\circ\text{C} - 46^\circ\text{C})) \right)$$

$$(50g \times 4.184 \text{ J/g}^\circ\text{C} \times 22.3^\circ\text{C}) = (50g \times c_{\text{cal}} \times 28.5^\circ\text{C})$$

$$4623.32 \text{ J} = 1425 \text{ g}^\circ\text{C} \times c_{\text{cal}}$$

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

$$c_{\text{cal}} = \underline{\underline{3.244 \text{ J/g}^\circ\text{C}}}$$

Table 7.2

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

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

$$\underline{\underline{0.1 \text{ moles of HCl}}}$$

Moles of NaOH.

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

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

$$\underline{\underline{0.1 \text{ moles of NaOH}}}$$

Total mass of the solution.

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

$$\text{mass of NaOH} = \left(\frac{40 \text{ g/mole} \times 0.1 \text{ moles}}{4 \text{ g}} \right)$$

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

$$\text{Total mass} = (4 \text{ g} + 3.65 \text{ g})$$
$$\underline{\underline{7.65 \text{ g}}}$$

Calculate the enthalpy of the reaction ($\Delta H_{\text{HCl} + \text{NaOH}}$).

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

$$\left(7.65 \text{ g} \times 4.184 \text{ J/g} \cdot ^\circ\text{C} \times (38.2^\circ - 23.4^\circ) \right)$$
$$\underline{\underline{473.71 \text{ Joules}}}$$

Table 7.3

$$\text{Moles of HCl} = \left(\frac{2 \text{ M} \times 50 \text{ mL}}{1000} \right)$$
$$\underline{\underline{0.1 \text{ moles HCl}}}$$

$$\text{Moles of } \text{NH}_3 = \left(\frac{2 \text{ M} \times 50 \text{ mL}}{1000} \right)$$
$$\underline{\underline{0.1 \text{ moles of } \text{NH}_3}}$$

Total mass of solution

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

$$\text{mass of } \text{NH}_3 = (17 \text{ g/mole} \times 0.1 \text{ moles})$$
$$= 1.7 \text{ g}$$

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

0

$$a) q = mc\Delta t$$

$$\text{Mass} = (100\text{mL} + 100\text{mL}) \times 1.00\text{g/mL}$$

$$= 200\text{g}$$

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

$$= (53.6^\circ\text{C} - 23.5^\circ\text{C})$$

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

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

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

$$b) q = mc\Delta t$$

$$\text{Mass} = (100\text{mL} + 100\text{mL}) \times 1.00\text{g/mL} \text{ for Acetic Acid and NaOH solution.}$$

$$= 200\text{g}$$

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

$$= 12.8^\circ\text{C}$$

$$q = (200\text{g} \times 4.184\text{J/g}^\circ\text{C} \times 12.8^\circ\text{C})$$

$$= \underline{\underline{10,711.04\text{ Joules}}}$$

P 12

$$x = \boxed{11}$$

$$y = \boxed{26}$$

TV ads

Radio ads

$$Q1 \quad (x, y) = \begin{pmatrix} 9 \\ 1 \end{pmatrix} (9, 1)$$

$$Q2 \quad (x, y) = \begin{pmatrix} 5 \\ 4 \end{pmatrix} (5, 4)$$

$$Q3 \quad (x, y) = \begin{pmatrix} 5 \\ 3 \end{pmatrix} (5, 3)$$

$$Q4 \quad (x, y) = \begin{pmatrix} 10 \\ 4 \end{pmatrix} (10, 4)$$

$$Q5 \quad \begin{matrix} x = \\ y = \end{matrix} \begin{pmatrix} 32 \\ 28 \end{pmatrix} \begin{matrix} \$ 3000 \text{ investors} \\ \$ 6000 \text{ investors} \end{matrix}$$

$$Q6 \quad \begin{matrix} x \\ y \end{matrix} \begin{pmatrix} 7 \\ 5 \end{pmatrix}$$

$$Q7 \quad \begin{matrix} x = \\ y = \end{matrix} \begin{matrix} 1600 \text{ sodas} \\ 1400 \text{ hot dogs} \end{matrix}$$

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

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

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

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