Sapna Gupta

Thermochemistry – Calorimetry 3
Heat of neutralization.

A 50.0 mL sample of 0.250 M HCl at 19.50 °C is added to 50.0 mL of 0.25 M NaOH at the same temp. in a calorimeter. After mixing the acid base, the temp. rises to 21.21 °C. Calculate the ΔH for the reaction.

Ans. 50.0 mL of 0.250 M HCl at 19.50C
50.0 mL of 0.250 M NaOH at 19.5°C

T_i T_f 21.21°C

$HCl + NaOH \longrightarrow NaCl + H_2O$ ΔH = ?

a) $50.0 mL + 50.0 mL = 100.0 mL \times \frac{1 g}{1 mL} = 100 g$

b) sp heat of $H_2O = 4.18 J/g°C$

$q_{cal} = m s \Delta T$

$100 g \times \frac{4.18 J}{g°C} \times (21.21 - 19.50)°C$

$= 715 J$ – heat abs. by cal.

$q_{rxn} = -q_{cal} = -715 J$ (heat of reaction)

enthalpy $\Delta H = J/mol$

mol HCl $= 0.0500 L \times 0.25 mol/L = 0.0125$ mol HCl

mol NaOH $= 0.0500 L \times 0.25 mol/L = 0.0125$ mol NaOH

$0.0125 \cancel{mol HCl} \times \frac{1 mol H_2O}{1 \cancel{mol HCl}} = 0.0125 mol H_2O$.

$\Delta H = \frac{-715 J}{0.0125 mol} = -5.72 \times 10^4 J$

$= \boxed{-57.2 kJ}$

Sapnashifts

Thermochemistry – Calorimetry 3
Heat of neutralization

A 50.0 mL sample of 0.250 M HCl at 19.50 °C is added to 50.0 mL of 0.25 M NaOH at the same temp. in a calorimeter. After mixing the acid-base, the temp. rises to 21.21 °C. Calculate the ΔH for the reaction.

Ans

50.0 mL of 0.250 M HCl at 19.50 C (T_i)
50.0 mL of 0.250 M NaOH at 19.5 °C

} 21.21 °C (T_f)

$$HCl + NaOH \longrightarrow NaCl + H_2O \quad \Delta H = ?$$

a) $50.0\,mL + 50.0\,mL = 100.0\,mL \times \frac{1\,g}{1\,mL} = 100\,g$

b) sp heat of $H_2O = 4.18\,J/g\,°C$

$$q_{cal} = m\,s\,\Delta T$$
$$100\,g \times \frac{4.18\,J}{g\,°C} \times (21.21 - 19.50)\,°C$$
$$= 715\,J$$ – heat abs. by cal.

$q_{rxn} = -q_{cal} = -715\,J$ (heat of reaction).

enthalpy: $\Delta H = J/mol$

mol HCl $= 0.0500\,L \times 0.25\,mol/L = 0.0125\,mol\,HCl$

mol NaOH $= 0.0500\,L \times 0.25\,mol/L = 0.0125\,mol\,NaOH$

$$0.0125\,mol\,\cancel{HCl} \times \frac{1\,mol\,H_2O}{1\,mol\,\cancel{HCl}} = 0.0125\,mol\,H_2O.$$

$$\Delta H = \frac{-715\,J}{0.0125\,mol} = -5.72 \times 10^4\,J$$
$$= \boxed{-57.2\,kJ}$$