

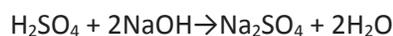
## Answer on Question #55347 – Chemistry – General chemistry

### Question:

In a constant-pressure calorimeter, 65.0 mL of 0.870 M  $\text{H}_2\text{SO}_4$  was added to 65.0 mL of 0.450 M NaOH. The reaction caused the temperature of the solution to rise from 24.09 °C to 27.16 °C. If the solution has the same density and specific heat as water, what is  $\Delta H$  for this reaction (per mole of  $\text{H}_2\text{O}$  produced)? Assume that the total volume is the sum of the individual volumes.

### Answer:

Conducted reaction is neutralization:



The amount of produced water is defined:

$$v(\text{H}_2\text{O}) = v(\text{NaOH}) = V(\text{NaOH}) \times C(\text{NaOH}) = 65 \text{ ml} \times 0.450 \text{ mol/L} = 29.25 \text{ mmol} = 29.25 \times 10^{-3} \text{ mol}$$

The total mass of the solution is:  $m = V\rho$ , where  $V$  – the total volume ( $V = 65 \text{ ml} + 65 \text{ ml} = 130 \text{ ml}$ ) and  $\rho$  – the density of water ( $\rho = 1 \text{ g/ml}$ ).

$$m = 130 \text{ ml} \times 1 \text{ g/ml} = 130 \text{ g}$$

Then find the heat released by this reaction:

$Q = mC\Delta t$ , where  $C$  – the specific heat for water which equals  $4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$  and  $\Delta t$  – the change of temperature ( $\Delta t = 27.16 \text{ }^\circ\text{C} - 24.09 \text{ }^\circ\text{C} = 3.07 \text{ }^\circ\text{C}$ )

$$Q = 130 \text{ g} \times 4.2 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1} \times 3.07 \text{ }^\circ\text{C} = 1676.22 \text{ J}$$

$$\text{Thus, } \Delta H = Q/v(\text{H}_2\text{O}) = 1676.22 \text{ J} / 29.25 \times 10^{-3} \text{ mol} = 56821.02 \text{ J mol}^{-1}$$