

## Enthalpy of an acid – base reaction

SCH4U\_07 - 08

10 cm<sup>3</sup> of sodium hydroxide solution were placed in an insulated container, initially at 17 °C, and 2.0 mol L<sup>-1</sup> hydrochloric acid, HCl<sub>(aq)</sub>, also at 17 °C was added in fixed amounts, the temperature was taken after each addition. The following data was collected:

Volume of HCl <sub>(aq)</sub> (cm <sup>3</sup> )	Temperature (°C)
0.00	17.0
2.00	19.0
4.00	21.0
6.00	23.0
8.00	25.0
10.00	27.0
12.00	29.0
14.00	29.0
16.00	28.0
18.00	27.0
20.00	26.
22.00	25.0
24.00	24.0
26.0	23.0

Answer the following questions:

- Plot a graph of these results with volume of hydrochloric acid on the x-axis.
- For what volume of HCl<sub>(aq)</sub> does maximum temperature rise occur?
- What has happened when the temperature reaches maximum?
- Why does the temperature drop after the maximum?
- How much heat was absorbed by the solution when the maximum temperature was observed? (Assume solution is water,  $c(\text{water}) = 4.17 \text{ J/g}\cdot^{\circ}\text{C}$ )
- How many moles of HCl<sub>(aq)</sub> in the volume of acid were required for the maximum temperature rise?
- What would be the heat change if 1 mol of HCl<sub>(aq)</sub> had been used?
- Write a thermochemical equation for the reaction of HCl<sub>(aq)</sub> with NaOH<sub>(aq)</sub>.
- Write a balanced chemical equation for the reaction of HCl<sub>(aq)</sub> with NaOH<sub>(aq)</sub>.
- Calculate the concentration of the NaOH<sub>(aq)</sub>.