

Determining ΔH_n^\ominus

400.0 cm³ of 0.600 mol dm⁻³ HNO₃(aq) are mixed with 400.0 cm³ of 0.300 mol dm⁻³ Ba(OH)₂(aq) in a polystyrene cup.

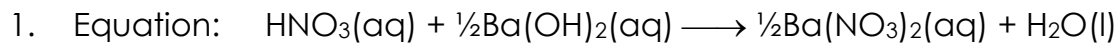
The initial temperature of both solutions is the same at 18.9 °C, and the final temperature of the mixed solution is 22.5 °C.

What is the enthalpy change of neutralization between HNO₃(aq) and Ba(OH)₂(aq)?

(Density of mixed solution = 1.00 g cm⁻³;

specific heat capacity of mixed solution = 4.18 J g⁻¹ K⁻¹)

Suggested Answer



2. number of mole of $\text{HNO}_3 = 0.6 \times 0.4 = 0.24$
number of mole of $\text{Ba}(\text{OH})_2 = 0.3 \times 0.4 = 0.12$
number of mole of **water** = 0.24

3. Volume of resulting solution = $400 + 400 = 800 \text{ cm}^3$
Mass of resulting solution = $800 \times 1.00 = 800 \text{ g}$

4. $\Delta T = 22.5 - 18.9 = 3.6 \text{ }^\circ\text{C}$

5. Calculation:

$$\begin{aligned}\text{Energy released, } E &= m c \Delta T \\ &= (800)(4.18)(3.6) \\ &= 12038 \text{ J} \\ &= 12.04 \text{ kJ}\end{aligned}$$

$$\begin{aligned}\text{Standard Enthalpy Change of Neutralization, } \Delta H_n^\ominus & \\ &= - E / \text{mole of water} \\ &= - 12.04 / 0.24 \\ &= - 50.16 \text{ kJ mol}^{-1}\end{aligned}$$