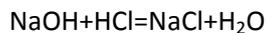


How much heat is released if 25 g of sodium hydroxide mix with 4 molar of hydrochloric acid?

**Solution:**



Use the periodic table to calculate the molar mass of NaOH:

$$M(\text{NaOH}) = 23 + 16 + 1 = 40 \text{ g/mol.}$$

Determine the number moles of NaOH in 25g of its:

$$v = \frac{m}{M} = \frac{25}{40} = 0.625 \text{ moles.}$$

So, the amount of NaOH is limited. Hence, the much heat is realized in this reaction we determined by amount of NaOH.

A measure of the heat of reaction is the enthalpy change ( $\Delta H$ , kJ/mol).

By applying Hess's Law

$$\Delta H = \sum \Delta H_{\text{of products}} - \sum \Delta H_{\text{of reactants}}$$

The enthalpy of reaction  $\Delta H^\circ$  will be:

$$(\Delta H \text{ of NaCl plus } \Delta H \text{ of H}_2\text{O}) \text{ minus } [(\Delta H \text{ of NaOH}) \text{ plus } (\Delta H \text{ of HCl})].$$

We give the standard enthalpies of formation of compounds are:

$$\Delta H \text{ of NaCl} = -411 \text{ kJ/mol}\cdot\text{K,}$$

$$\Delta H \text{ of H}_2\text{O} = -241.8 \text{ kJ/mol}\cdot\text{K,}$$

$$\Delta H \text{ of NaOH} = 426.3 \text{ kJ/mol}\cdot\text{K,}$$

$$\Delta H \text{ of HCl} = -92.3 \text{ kJ/mol}\cdot\text{K.}$$

When it is considered that there is only 0.625 mole of NaOH the enthalpy of reaction  $\Delta H^\circ$  will be:

$$\Delta H = 0.625\{-411 + (-241.8) - [426.3 + (-92.3)]\} = -894.5 \text{ kJ.}$$

**Answer: -894.5 kJ**