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

Solution:

$NaOH+HCl=NaCl+H_2O$

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

M(NaOH)=23+16+1=40 g/mol.

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

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

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 (ΔH, kJ/mol).

By applying Hess's Law

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

The enthalpy of reaction ΔH° will be:

(ΔH of NaCl plus (ΔH of H2O) minus [(ΔH of NaOH) plus (ΔH of HCl)].

We give the standard enthalpies of formation of compounds are:

ΔH of NaCl = -411 kJ/mol·K,

ΔH of H2O = -241.8 kJ/mol·K,

ΔH of NaOH = 426.3 kJ/mol·K,

ΔH of HCl = -92.3 kJ/mol·K.

When it is considered that there is only 0.625 mole of NaOH the enthalpy of reaction ΔH° will be:

ΔH = 0.625{-411+(-241.8)-[426.3+(-92.3)]}= -894.5 kJ.

Answer: -894.5 kJ