

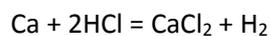
Answer on Question#38976 - Chemistry - Inorganic Chemistry

Task:

What volume (in L) of 1M HCl is needed to react completely with 0.6 grams of calcium metal?

Solution:

The chemical equation of the reaction is



The number of moles of Ca is

$$n(\text{Ca}) = m(\text{Ca})/\text{MW}(\text{Ca}) = 0.6 / 40 = 0.015 \text{ mol}$$

the number of moles of HCl is twice the number of moles of Ca

$$n(\text{HCl}) = 2n(\text{Ca}) = 2 \cdot 0.015 = 0.030 \text{ mol}$$

Now we can find the volume of HCl solution

$C(M) = n(\text{mol})/V(L)$, where C is molar concentration

$$V(L) = n(\text{mol})/C(M) = 0.030/1 = \mathbf{0.030 \text{ L}}$$

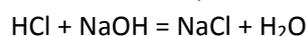
Answer: $V(L) = 0.030 \text{ L}$

Task:

Suppose that a temperature rise of 11 degrees Celcius was observed when 80.0 mL of 1.00 M HCl was mixed with 20.0 mL of 4.00 sodium hydroxide. What is the molar heat of neutralization?

Solution:

The chemical equation of the reaction is



The number of moles of acid is

$$C(M) = n(\text{mol})/V(L)$$

$$n(\text{HCl}) = C(\text{HCl}) \cdot V(L) = 1.00 \cdot 0.080 = 0.080 \text{ mol}$$

The number of moles of base is

$$C(M) = n(\text{mol})/V(L)$$

$$n(\text{NaOH}) = C(\text{NaOH}) \cdot V(L) = 4.00 \cdot 0.020 = 0.080 \text{ mol}$$

The mass of acid is

$$m(\text{HCl}) = n(\text{mol}) \cdot M(\text{mol}) = 0.080 \cdot 36.5 = 2.92 \text{ g}$$

The molar heat of neutralization is

$$Q = m \cdot C_p \cdot \Delta T$$

m – the mass of acid

C_p - The specific heat capacity of the aqueous solutions is $4.184 \text{ J } ^\circ\text{C}^{-1} \text{ g}^{-1}$

$$Q = m \cdot C_p \cdot \Delta T = 2.92 \cdot 4.184 \cdot 11 = 134.4 \text{ J}$$

To calculate the molar heat of neutralization we must divide the obtained value by the number of moles reacted:

$$Q_m = Q/n = 134.4/0.08 = 1680 \text{ J/mol}$$

Answer: $Q_m = 1680 \text{ J/mol}$