

Question #83994, Chemistry / General Chemistry | for completion

200cm<sup>3</sup> of 0.45M HCL solution was added to 300cm<sup>3</sup> of 0.25M NaOH solution. Calculate the concentration of chloride ions in solution

Solution.

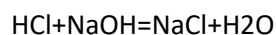
$$V(\text{HCl})=200\text{cm}^3=200\text{ml}=0.2\text{l}$$

$$C_m(\text{HCl})=0.45\text{M}$$

$$V(\text{NaOH})=300\text{cm}^3=300\text{ml}=0.3\text{l}$$

$$C_m(\text{NaOH})=0.25\text{M}$$

$$C_m(\text{Cl}^-)\text{--?}$$



$$n(\text{HCl})=C_m \cdot V(\text{HCl})=0.45 \cdot 0.2=0.09\text{moles}$$

Then, In solution there are 0.09 moles of Cl<sup>-</sup>, because 1 mole of HCl contains one mole of Cl<sup>-</sup>

$$n(\text{NaOH})=C_m \cdot V(\text{NaOH})=0.25 \cdot 0.3=0.075\text{moles}$$

HCl is in excess, mole ratio from the reaction equation is 1:1.

Extra HCl:  $n(\text{HCl}_{\text{exc}})=0.09-0.075=0.015$  moles. And it contains 0.015 moles of Cl<sup>-</sup>

0.075 moles of HCl reacts with NaOH, and NaCl is formed.

$n(\text{NaCl})=n(\text{NaOH})=0.075$  moles. And 0.075 moles of NaCl contains 0.075 moles of Cl<sup>-</sup>

NaCl in solution is fully dissociated:



So, full  $n(\text{Cl}^-)=0.075+0.015=0.09$  moles

$$C(\text{Cl}^-)=n/V$$

We can suggest that densities of these two solutions are equal to density of H<sub>2</sub>O. Then, we may:

$$V_{\text{sum}}=V(\text{NaOH})+V(\text{H}_2\text{O})=0.2+0.3=0.5\text{ l}$$

$$C(\text{Cl}^-)=0.09/0.5=0.18\text{M}$$

Answer:

$C(\text{Cl}^-) = 0,18\text{M}$

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