STOICHIOMETRY (VOLUME, CONC.)

EXAMPLE

20.00mL of a standard solution of 0.109 mol L^{-1} sebacic acid was titrated against sodium hydroxide. An average of 20.32 mL of sodium hydroxide was required.

$C_{10}H_{18}O_4 + 2\ NaOH \rightarrow Na_2(C_{10}H_{16}O_4) + 2\ H_2O$

Find the concentration of Sodium Hydroxide.

PROCESS

STEP ONE
Calculate the amount (moles) for the species which has a **known** volume and concentration

$n(C_{10}H_{18}O_4) = c \times v$
$= 0.109\ mol\ L^{-1} \times 0.020\ L$
$= 0.00218\ mol$

STEP TWO
Use the equation to write a mole ratio

1 $C_{10}H_{18}O_4$: **2** NaOH

STEP THREE
Convert the ratio to an equation

2 x $n(C_{10}H_{18}O_4)$ = **1 x** n(NaOH)

STEP FOUR
Use the answer from Step 1 to solve the equation in step three

2 x 0.00218 = n(NaOH)
0.00436 = n(NaOH)
n(NaOH) = 0.00436 mol

STEP FIVE
Finally, find the concentration of the **unknown** (what the question asked for)

$c(NaOH) = \frac{n}{v}$
$= \frac{0.00436\ mol}{0.02032\ L}$
$= 0.215\ mol\ L^{-1}$

A very short summary of steps

$n = cv \longrightarrow$ mol ratio $\longrightarrow c = \frac{n}{v}$

HOW IT LOOKS ON PAPER

Hydrochloric acid was titrated against 15.00 mL of sodium carbonate which had a concentration of 0.139 mol L^{-1}. The average titre volume of hydrochloric acid required was 17.76 mL

$2\ HCl + Na_2CO_3 \rightarrow 2\ NaCl + H_2O + CO_2$

Find the concentration of hydrochloric acid.

$n(Na_2CO_3) = c \times V$
$= 0.139\ mol\ L^{-1} \times \left(\frac{15.00}{1000}\right)$
$= 0.00209\ mol$

$2\ HCl : 1\ Na_2CO_3$
$1 \times n(HCl) = 2 \times n(Na_2CO_3)$
$n(HCl) = 2 \times 0.00209\ mol$
$= 0.00417\ mol$

$c(HCl) = \frac{n}{V}$
$= \frac{0.00417\ mol}{\left(\frac{17.76}{1000}\right)}$
$= 0.235\ mol\ L^{-1}$

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