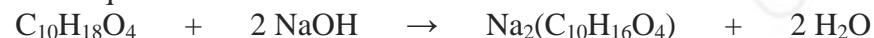


# STOICHIOMETRY (VOLUME, CONC.)

**EXAMPLE**

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



**Find the concentration of Sodium Hydroxide.**

**PROCESS****STEP ONE**

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

$$\begin{aligned} n(\text{C}_{10}\text{H}_{18}\text{O}_4) &= c \times v \\ &= 0.109 \text{ mol L}^{-1} \times 0.020 \text{ L} \\ &= 0.00218 \text{ mol} \end{aligned}$$

**STEP TWO**

Use the equation to write a mole ratio

**STEP THREE**

Convert the ratio to an equation

$$2 \times n(\text{C}_{10}\text{H}_{18}\text{O}_4) = 1 \times n(\text{NaOH})$$

**STEP FOUR**

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

$$\begin{aligned} 2 \times 0.00218 &= n(\text{NaOH}) \\ 0.00436 &= n(\text{NaOH}) \\ n(\text{NaOH}) &= 0.00436 \text{ mol} \end{aligned}$$

**STEP FIVE**

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

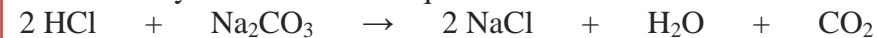
$$\begin{aligned} c(\text{NaOH}) &= \frac{n}{v} \\ &= \frac{0.00436 \text{ mol}}{0.02032 \text{ L}} \\ &= 0.215 \text{ mol L}^{-1} \end{aligned}$$

**A very short summary of steps**

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

**HOW IT LOOKS ON PAPER**

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



**Find the concentration of hydrochloric acid.**

$$\begin{aligned} n(\text{Na}_2\text{CO}_3) &= c \times v \\ &= 0.139 \text{ mol L}^{-1} \times \left(\frac{15.00}{1000}\right) \\ &= 0.00209 \text{ mol} \end{aligned}$$



$$1 \times n(\text{HCl}) = 2 \times n(\text{Na}_2\text{CO}_3)$$

$$\begin{aligned} n(\text{HCl}) &= 2 \times 0.00209 \text{ mol} \\ &= 0.00417 \text{ mol} \end{aligned}$$

$$\begin{aligned} c(\text{HCl}) &= \frac{n}{v} \\ &= \frac{0.00417 \text{ mol}}{\left(\frac{17.76}{1000}\right)} \\ &= 0.235 \text{ mol L}^{-1} \end{aligned}$$

