

Exercise walk-through

4.6

Introduction to Titration

AP Chemistry

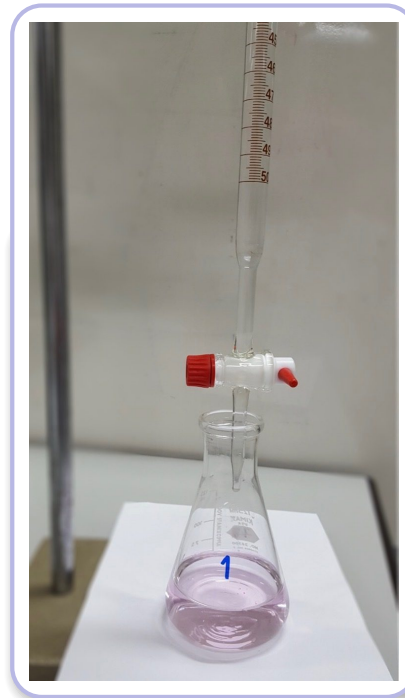
Titration

A **titration** finds an unknown concentration. Add **standard solution** until the reaction is just complete – the **equivalence point** (an **indicator** shows it).

Worked example

25 mL of 0.100 M NaOH neutralizes 20 mL HCl:

$$n = 0.00250 \Rightarrow c_{\text{HCl}} = 0.125 \text{ M}$$



Titration finds concentration by volume

Exercises 2.1-2.3

2.1 Find the moles in 30.0 mL of 0.200 M NaOH.

[2]

2.2 In a 1:1 titration, 0.0030 mol of base neutralizes how many moles of acid?

[1]

2.3 What is the equivalence point?

[1]

Exercises 2.1-2.3

2.1 Find the moles in 30.0 mL of 0.200 M NaOH. [2]

2.1

- $0.200 \times 0.0300 = 0.00600 \text{ mol}$
-

2.2 In a 1:1 titration, 0.0030 mol of base neutralizes how many moles of acid? [1]

2.2

- 0.0030 mol
-

2.3 What is the equivalence point? [1]

2.3

- The point where the titrant has exactly reacted with the unknown (per the mole ratio)

Exercise 3.1

3.1 At the equivalence point of an acid-base titration,

[1]

☐

A the acid is in excess

B the moles of acid and base have exactly reacted (per the ratio)

C the base is in excess

D nothing has reacted

Exercise 3.1

3.1 At the equivalence point of an acid-base titration, [1]

☐

A the acid is in excess

B the moles of acid and base have exactly reacted (per the ratio)

C the base is in excess

D nothing has reacted

3.1 B

- the acid and base have exactly reacted in the stoichiometric ratio

Exercise 3.2 (a)

3.2 25.0 mL of an unknown HCl solution is neutralized by 18.0 mL of 0.150 M NaOH (1:1).

(a) Find the moles of NaOH used.

[2]

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(a) Find the moles of NaOH used.

[2]

(a)

- $0.150 \times 0.0180 = 0.00270 \text{ mol}$

Exercise 3.2 (b)

3.2 25.0 mL of an unknown HCl solution is neutralized by 18.0 mL of 0.150 M NaOH (1:1).

(b) Find the concentration of the HCl.

[3]

Exercise 3.2 (b)

3.2 25.0 mL of an unknown HCl solution is neutralized by 18.0 mL of 0.150 M NaOH (1:1).

(b) Find the concentration of the HCl.

[3]

(b)

- $\text{moles HCl} = 0.00270; [\text{HCl}] = \frac{0.00270}{0.0250} = 0.108 \text{ M}$

Exercise 3.3

3.3 20.0 mL of H_2SO_4 is neutralized by 25.0 mL of 0.200 M NaOH. Using $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{products}$, find the concentration of the acid. [4]

Exercise 3.3

3.3 20.0 mL of H_2SO_4 is neutralized by 25.0 mL of 0.200 M NaOH. Using $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{products}$, find the concentration of the acid. [4]

3.3

- moles NaOH = $0.200 \times 0.0250 = 0.00500$; moles $\text{H}_2\text{SO}_4 = 0.00500 \div 2 = 0.00250$;
 $[\text{H}_2\text{SO}_4] = \frac{0.00250}{0.0200} = 0.125 \text{ M}$