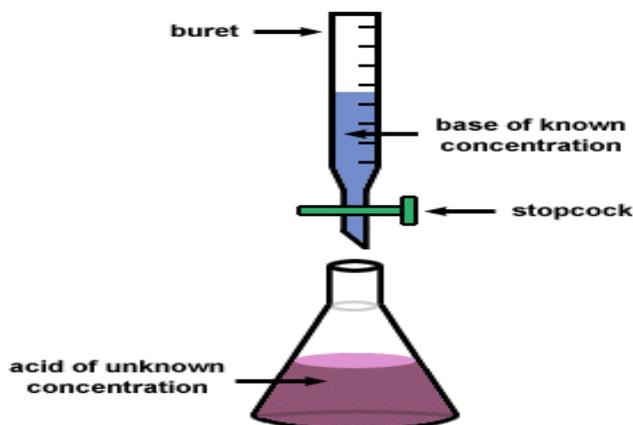


Titration of acids and bases

Titration is a type of quantitative analysis.

Titration of acids and bases enables determination of an unknown concentration of an acid if you have a base of a known concentration or *vice versa*.

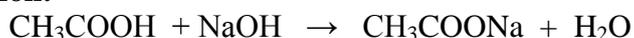


Indicator is a solution that changes color depending on the pH. Several indicators can be used that have different color in acidic and basic solutions.

Indicator	Acidic solution	Basic solution
phenolphthalein	colorless	pink
methyl orange	red	yellow

1. Determination of a weak acid (acetic acid)

Reaction:



The equation shows that 1 mol of acetic acid reacts with 1 mol of sodium hydroxide. The resulting mixture is neutral.

Indicator used in this reaction is phenolphthalein. In acidic solution phenolphthalein is colorless and it becomes pink in basic solution.

Principle of the method:

Acetic acid of an unknown concentration is in the flask, together with 3 drops of phenolphthalein. The solution is colorless. NaOH of a known concentration is in the burette. You add NaOH to the acid, drop by drop, until the pink color appears. It means that the acid was neutralized by the base. You read the number of ml of NaOH used to neutralize the acid.

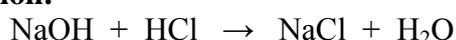
You can calculate the number of moles of NaOH used. The same number of moles of acetic acid was in the flask. You can calculate the number of moles of NaOH used. The same number of moles of the acid was in the flask.

Manual

Dilute obtained from the teacher sample of acetic acid in the volumetric flask to 100 ml, mix the content of the flask, and transfer 10 ml of the solution with a pipette to an Erlenmeyer flask. Add 2-3 drops of phenolphthalein solution and titrate the acid solution with NaOH until a faint pink color appears. Repeat the titration two more times. Calculate the amount of grams of CH₃COOH that you obtained from the teacher.

2. Determination of a strong base (NaOH)

Reaction:



The equation shows that 1 mol of NaOH reacts with 1 mol of HCl. The resulting mixture is neutral.

Indicator used in this reaction is methyl orange. In basic solution methyl orange is yellow and it becomes peach color when NaOH is neutralized.

Principle of the method:

NaOH of an unknown concentration is in the flask, together with 3 drops of methyl orange. The solution is yellow. HCl of a known concentration is in the burette. You add HCl to NaOH solution, drop by drop, until the color changes. It means that the base was neutralized by the acid. You read the number of ml of HCl used to neutralize the base. You can calculate the number of moles of HCl used. The same number of moles of NaOH was in the flask.

Manual

Dilute obtained from the teacher sample of NaOH in the volumetric flask to 100 ml, mix the content of the flask, and transfer 10 ml of the solution with a pipette to an Erlenmeyer flask. Add 2-3 drops of methyl orange and titrate the base with HCl until a peach-like color appears. Repeat the titration two more times. Calculate the amount of grams of NaOH that you obtained from the teacher.

The report should contain:

1. Neutralization reaction
2. Three values obtained during titration and the calculated mean value.
3. Calculation showing how many mg of CH₃COOH/ NaOH was in the flask obtained from the teacher.
4. The table as below:

Student's number	Mean volume (ml)
	Mass of acid/base in the flask (mg)