M.Sc Chemistry
Inorganic Chemistry
Semester-IV

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Inorganic Group 1

REFERENCE BOOKS:

1. Vogel's Quantitative inorganic analysis, 6th edition
Quantitative Chemical Analysis, 9th edition, D.C. Harris.
3. Fundamentals of Analytical Chemistry, 9th edition, Douglas A. Skoog, D.M. West, F.J. Holler, S. R. Crouch.

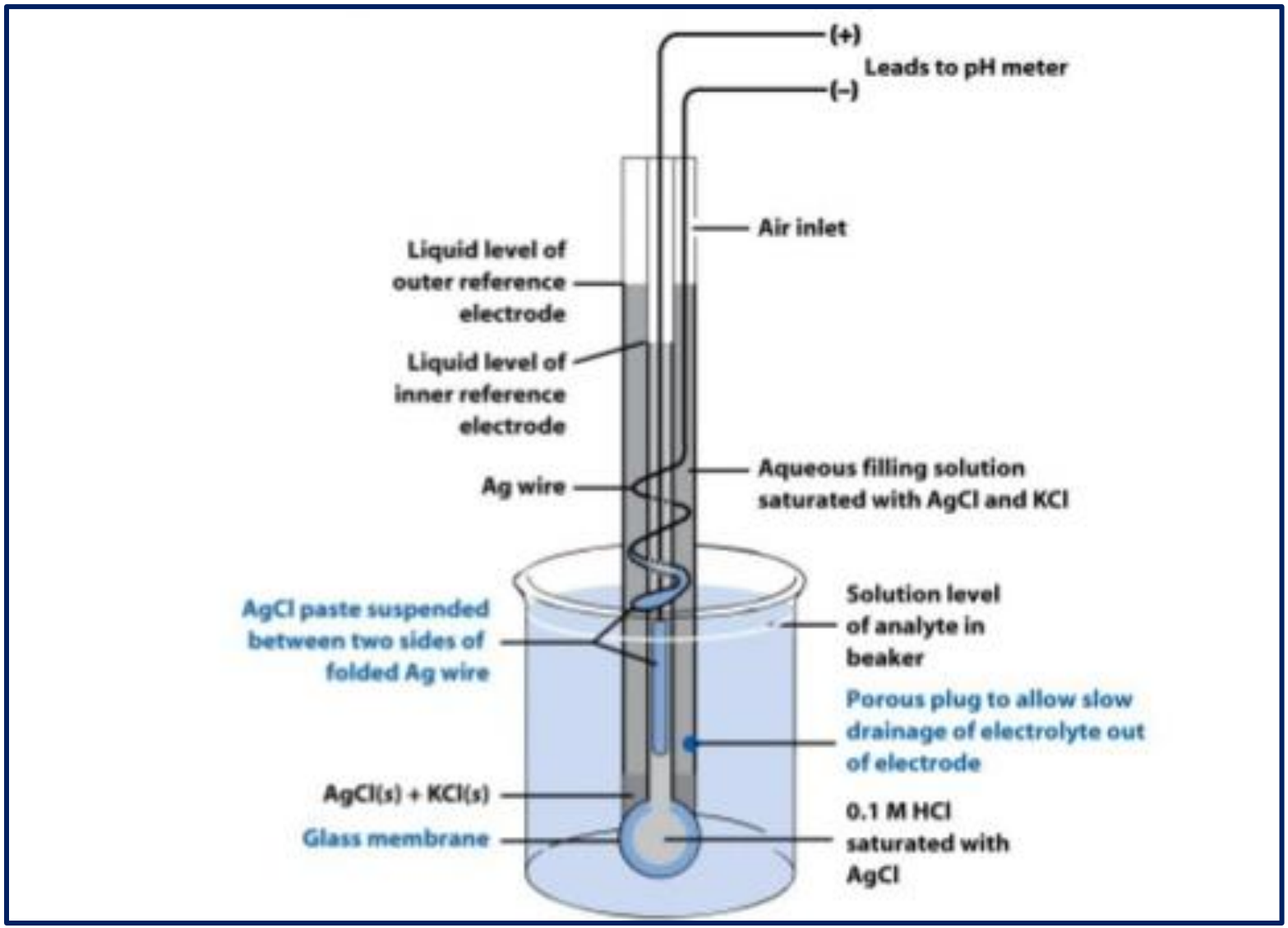
pH metric titrations

Basic pH meter

What is pH meter?

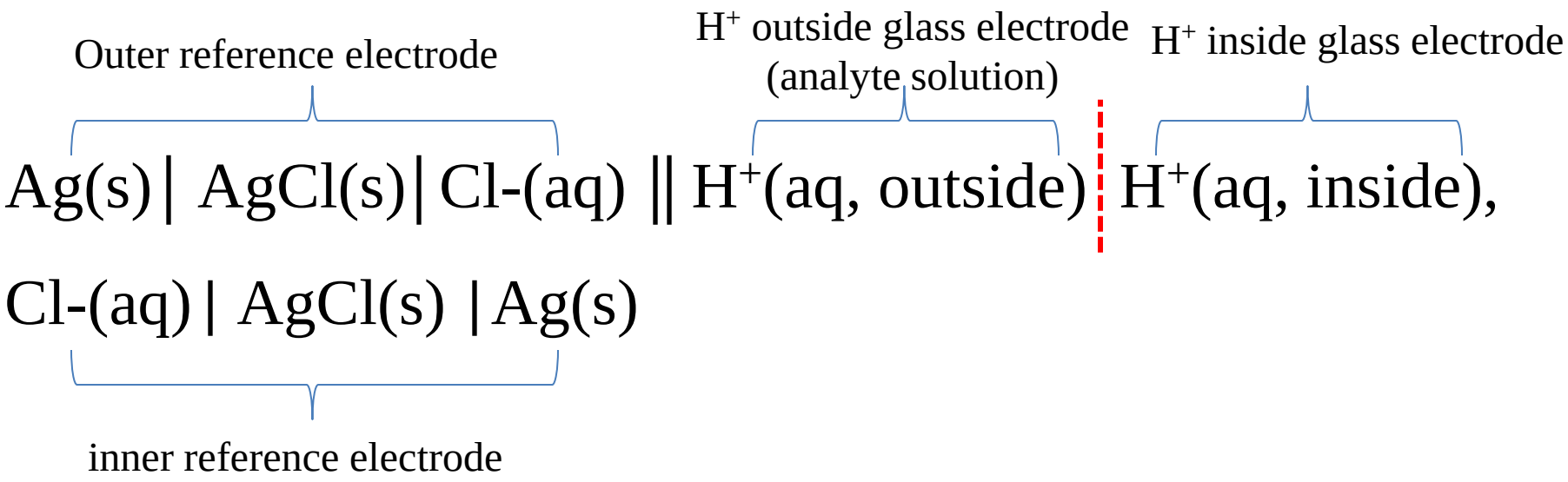
pH meter is a scientific device that is used to measure acidity and alkalinity of solutions. It measures the potential difference between reference and indicator electrode.

Generally, modern pH electrodes are of combination type wherein both reference and indicator electrodes are placed together in single tube.



Pictorial representation of glass combination electrode

Cell equation



Principle of pH metric titrations

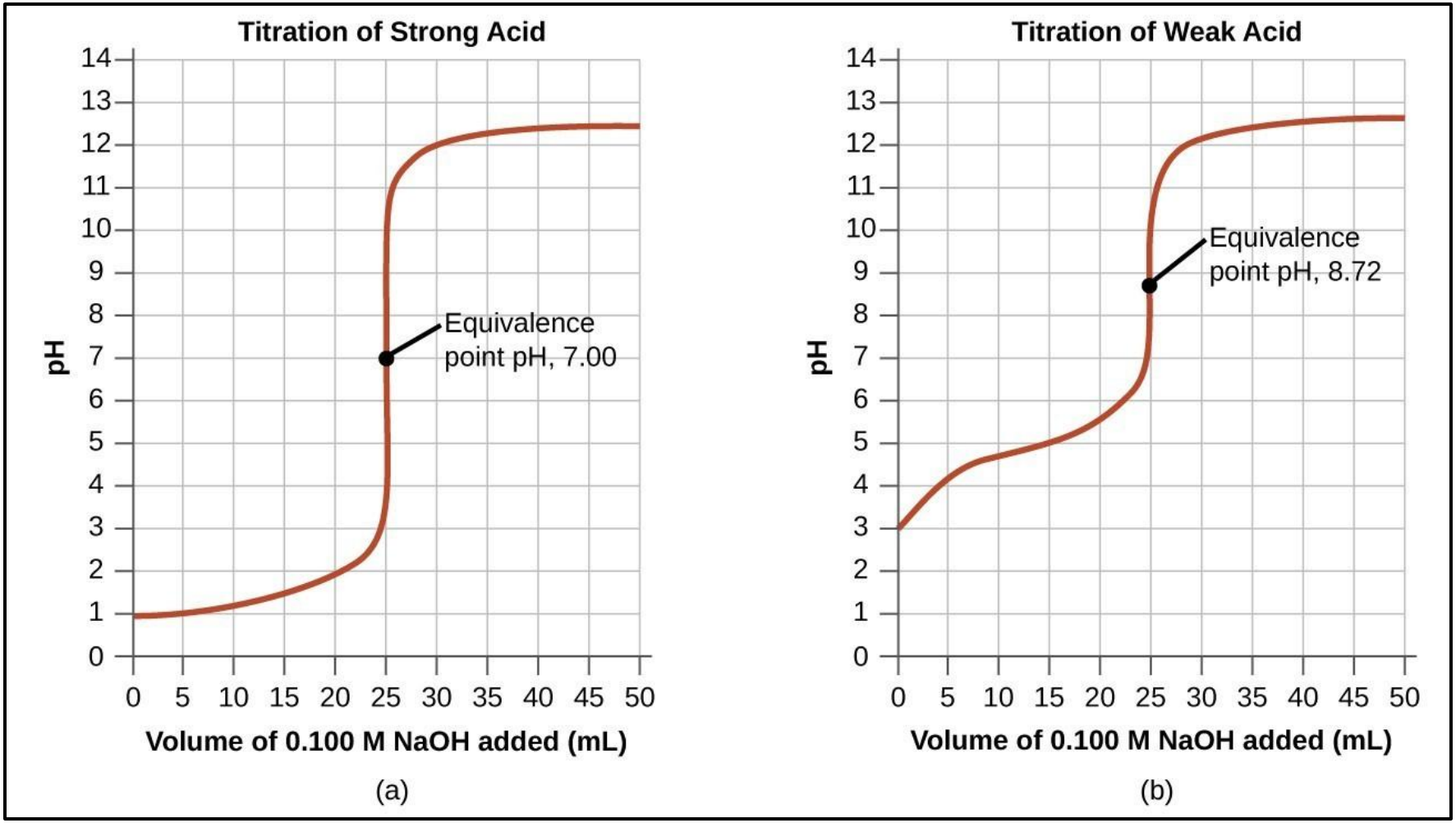
❖Titration is the quantitative addition of a solution of known concentration to a solution of unknown concentration until the reaction between them is complete in order to determine the concentration of the second solution.

❖An acid–base titration is the quantitative determination of the concentration of an acid or a base.

❖ In pH metric titrations, neutralization of acid and base is monitored by change in pH of solution.

❖Generally in acid-base titrations, the pH rises slowly with the amount of added base until the vicinity of the equivalence point is reached, where it rises sharply.

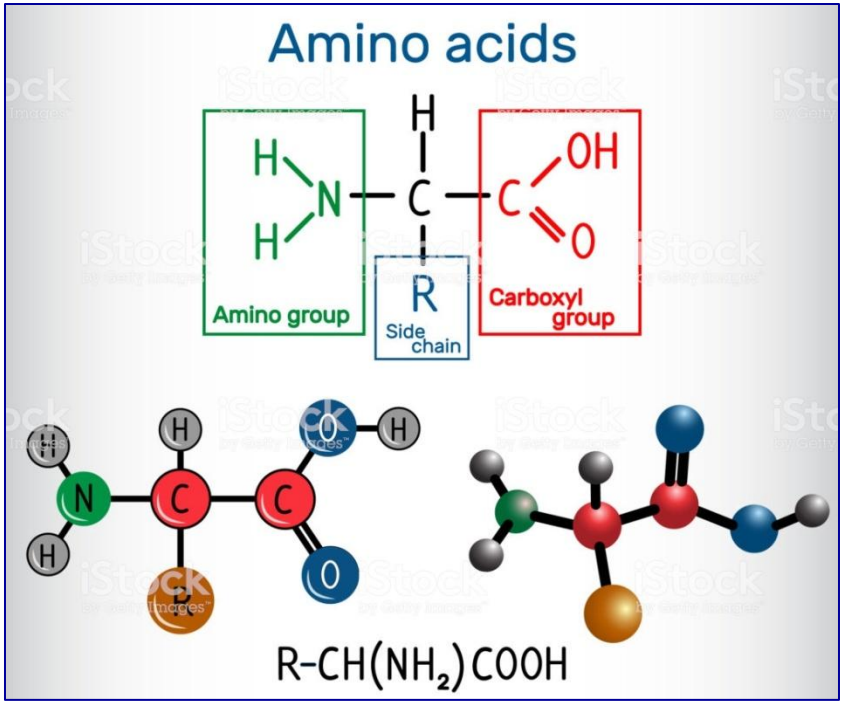
❖ At the equivalence point, the amount of base added is equal to the amount of acid initially present; thus, the acid has been completely neutralized.



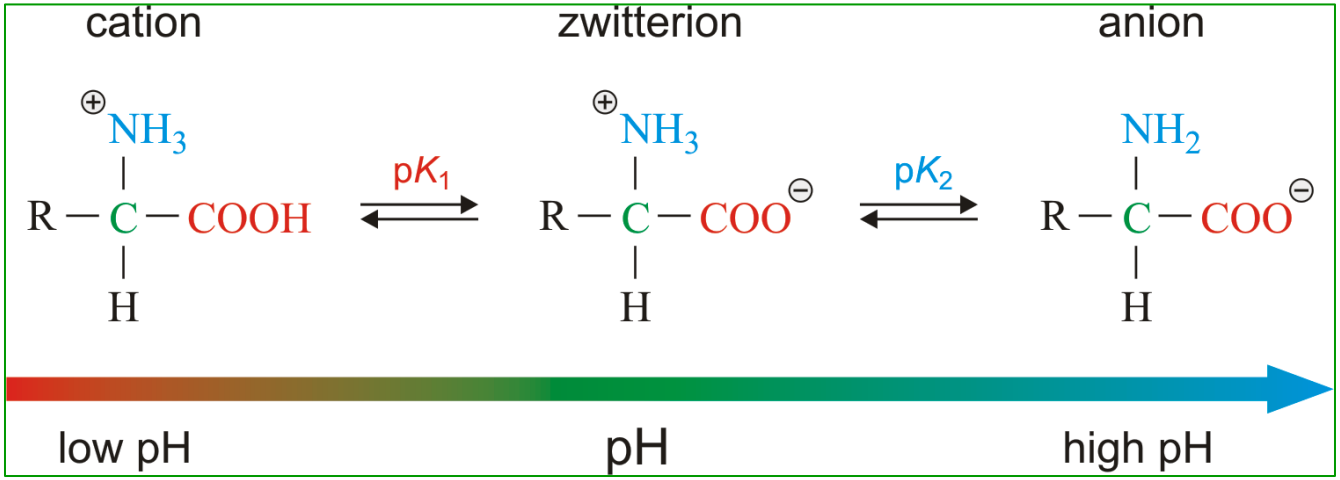
Titration curves for strong acid and strong base and weak acid and strong base

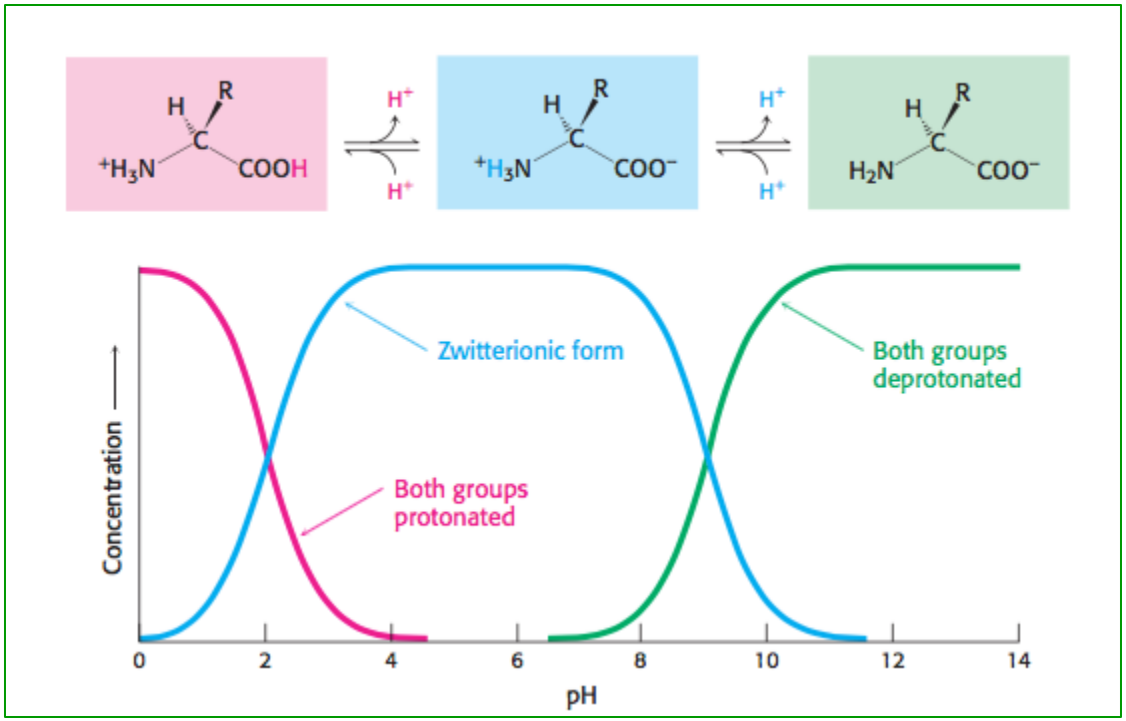
pH metric titrations of amino acids

Amino acids are biomolecules that contain both amine ($–NH_2$) and carboxylic acid (–COOH) functional groups.



Zwitter ionic form of amino acids

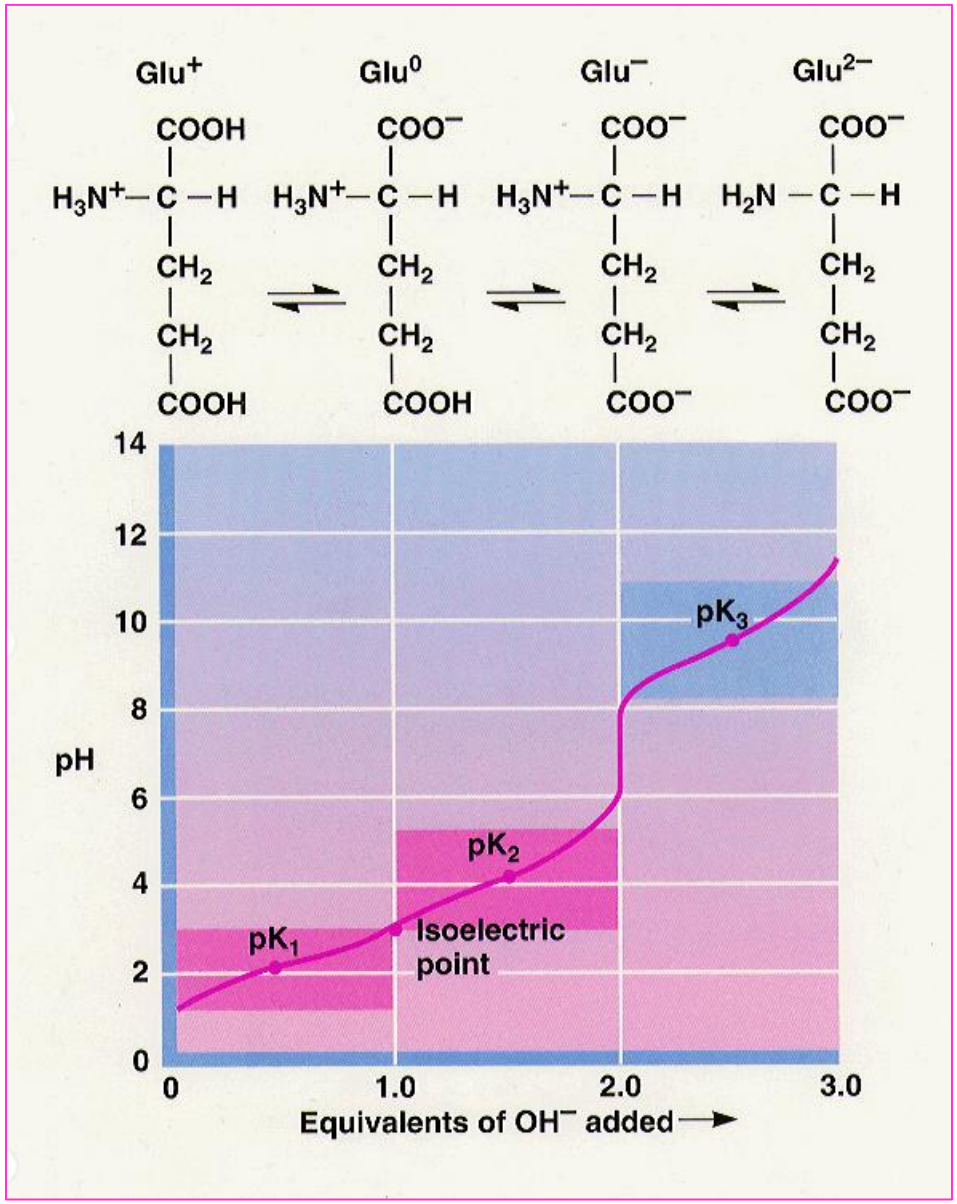




- Amino acids behave like weak polyprotic acids.
- At neutral pH, they exist in form of zwitter ions.
- They are amphoteric molecules that can be titrated with both acid and alkali.
- All of the amino acids have at least an acidic group (COOH) and a basic group (NH_2) that have tendency to ionize and act as weak acids or bases, giving off or taking on protons when the pH is altered.
- Some amino acids have ionizable groups in their side chains that can also be titrated.

- Titration curves of amino acids are very useful for their identification
- A simple amino acid has two dissociation steps corresponding to loss of H^+ from the acidic carboxyl group at low pH followed by loss of H^+ from the more basic amino group at high pH.
- The pKa value for each dissociable group of an amino acid can be determined from such a titration curve by extrapolating the midpoint of each buffering region (the plateau) in the titration curve.

Titration curve



References

1. Vogel's Quantitative inorganic analysis, 6th edition
2. Quantitative Chemical Analysis, 9th edition, D.C. Harris.
3. Fundamentals of Analytical Chemistry, 9th edition, Douglas A. Skoog, D.M. West, F.J. Holler, S. R. Crouch.

List of the experiments

1. To study the titration curve of glycine and determine its pKa values by titrating it against standard base.
2. To study the titration curve of leucine and determine its pKa values by titrating it against standard base.
3. To study the titration curve of alanine and determine its pKa values by titrating it against standard base.
4. To study the titration curve of aspartic acid and determine its pKa values by titrating it against standard base.

5. To study the titration curve of glutamic acid and determine its pKa values by titrating it against standard base.
6. To study the titration curve of phenylalanine and determine its pKa values by titrating it against standard base.
7. To study the titration curve of arginine and determine its pKa values by titrating it against standard base.
8. To study the titration curve of histidine and determine its pKa values by titrating it against standard base.
9. To study the titration curve of glutamine and determine its pKa values by titrating it against standard base.

10. To study the titration curve of asparagine and determine its pKa values by titrating it against standard base.
11. To study the titration curve of methionine and determine its pKa values by titrating it against standard base.
12. To study the titration curve of succinic acid and determine its pKa values by titrating it against standard base.
13. To study the titration curve of malonic acid and determine its pKa values by titrating it against standard base.
14. To study the titration curve of oxalic acid and determine its pKa values by titrating it against standard base.

15. To study the titration curve of phosphoric acid and determine its pKa values by titrating it against standard base.