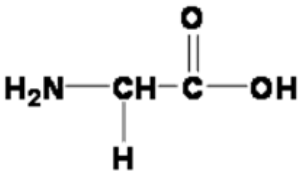
Titration of glycine (Gly)

Objectives

•To obtain the titration curve of glycine.
•To determine the pKa values.
•To determine isoelectric point (pI).
•To determine buffering regions

Glycine is an optically inactive, simplest amino acid.

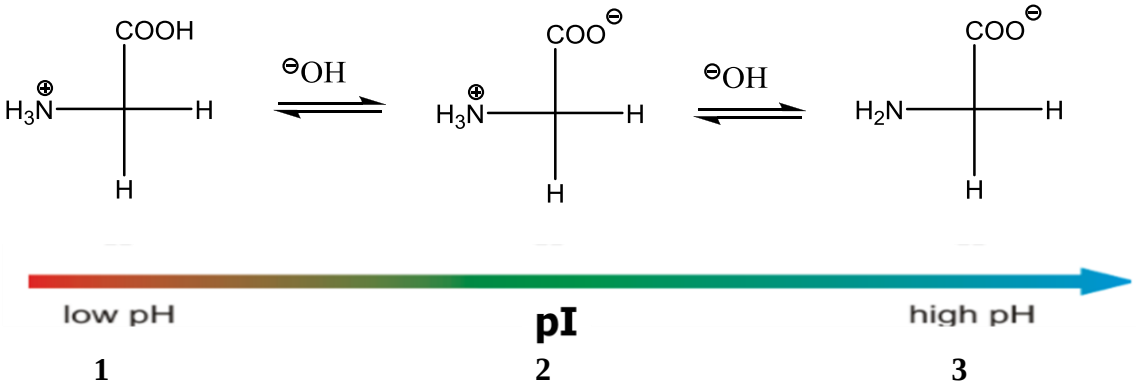


glycine

Properties of amino acids

• Amino acids are amphiprotic which means that they can react as an acid (donate a proton) as well as a base (accept a proton)
• Amphprotic properties of amino acids are due to the presence of their ionizable α-amino and α-carboxylic group which can act sometimes as acids and sometimes as bases depending on the pH of the solution.
• Ka is an equlibrium constant between two forms of amino acid (cationic and dipolar or dipolar and inionic). pKa = -log Ka
• pI is the pH value at which the positive charge equals the negative charge (i.e. the net charge of the molecule equals zero) (dipolar form). The pI is an average of the pKa values.

Depending on the pH of the solution, glycine can exist in 3 ionic forms:



1 **2** **3**

Titration of glycine involves the gradual removal of protons.
The fully protonated form of glycine (on the left) when titrated with NaOH ionizes in two steps. In the first step H^+ is removed from the carboxyl group (a dipolar form in the middle). In the second step H^+ is removed from the amino group giving an anionic form (on the right).

The mixture of form 1 and 2 is a buffer.
The mixture of form 2 and 3 is also a buffer.
Henderson-Haselbach equation for calculation of the pH of buffers:

$$pH = pK_a - \log\frac{[HA]}{[A^-]}$$

Procedure

Titration of glycine solution

1. Pour 60 mL of Gly solution into a beaker and place the electrode and a magnetic stirring bar in the beaker.
2. Read the initial pH value.
3. Add 3 drops of NaOH, stir the solution and read the pH.
4. Repeat point 3 until the pH value is around 12.
5. Construct a titration curve (pH versus number of NaOH drops)
6. Mark end-points of titration on the curve
7. From the graph read the pK values and the pI value for Gly.

The protocol should contain:

1. Title of the experiment
2. Equation of the neutralization of Gly
3. A graph with marked pKa values, pI value and buffering regions.