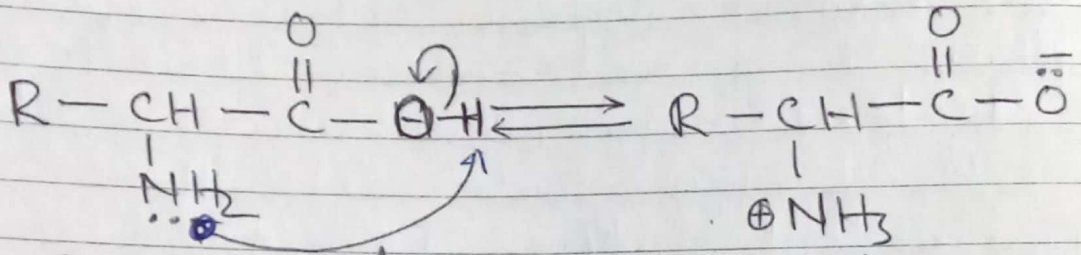
Acid-Base behaviour (Zwitterion)

In solution amino acids exist as charged molecules. This is because they contain both an acidic $-COOH$ group and a basic $-NH_2$ group in the same molecule. Transfer of proton takes place in a kind of internal acid-base reaction.



Amino acid. Zwitterion.

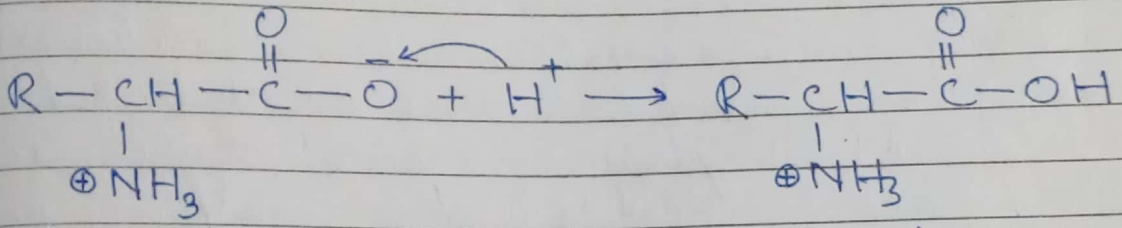
The product of this reaction is a dipolar ion called a zwitterion (or dipolar ion). A zwitterion is an amino acid molecule containing both a positive and negative charge. The zwitterion is the more common form in which amino acid exist in aqueous solution.

Zwitterion contain both a positive and negative charge by transferring a proton internally therefore they ~~have~~ are neutral and have no net charge

Isoelectric Point

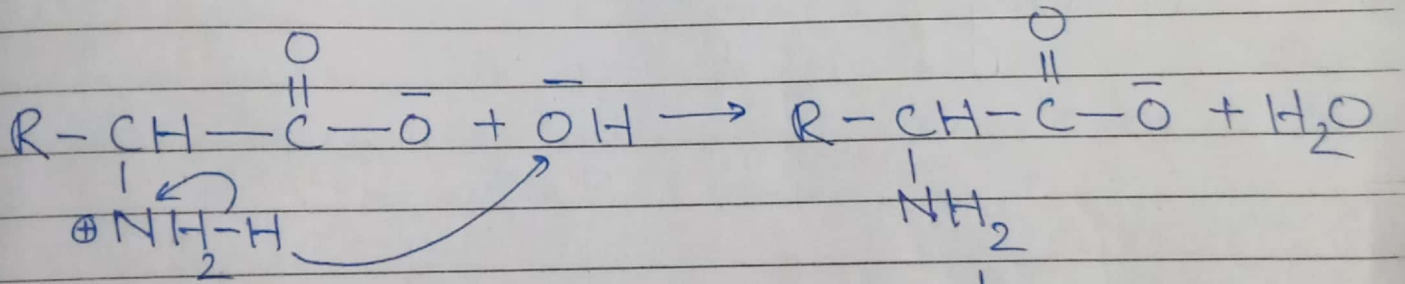
Amino acids in the zwitterion form are amphoteric. That is, they react readily with acids or bases. The reaction with base converts the ammonium group ($-\overset{\oplus}{N}H_3$) into an amino group ($-NH_2$). The reaction with acids converts the carboxylate group ($-COO^-$) into a carboxyl group ($-COOH$)

Amino acid in acidic solution:



Positive ion

Amino acid in basic solution:



Negative ion.

In acidic solution, amino acids exist as positive ions and are attracted towards the cathode (-ve electrode). In basic solutions, amino acids exist as negative ions and are attracted towards the anode (positive electrode). At a

certain pH aminoacids would not migrate to either electrode and exist as neutral zwitterion. This pH is called isoelectric point. The isoelectric point is the pH at which an amino acid exists completely as zwitterion.

Each amino acid has a characteristic isoelectric point. Proteins which are composed of amino acids also have characteristic isoelectric points. (pI)

Most of the neutral amino acids have isoelectric point always less than 7. For glycine, the isoelectric point is at pH 6.1. Isoelectric points of alanine & valine are 6.1 and 6.0 respectively. For alanine, the isoelectric point is at pH = 6.0. Isoelectric points of Lysine and glutamic acid are 9.7 and 3.2 respectively.