

Table 1

Common pH dependent molecules in biology. Common weak acids and weak-bases in a cell are listed. Note that for amino acid side chains or termini the pK_a values given are those of free amino acids. These values can change drastically when incorporated into a protein depending on the structure of the protein and its surroundings.

protein residues		pK _a
amino-terminus	$\begin{array}{c} \text{H} \\ \\ -\text{N}^+-\text{H} \\ \\ \text{H} \end{array} \rightleftharpoons \begin{array}{c} \text{H} \\ \\ -\text{N}-\text{H} \\ \\ \text{H} \end{array} + \text{H}^+$	8.0
carboxyl-terminus	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{OH} \end{array} \rightleftharpoons \begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}^- \end{array} + \text{H}^+$	3.1
aspartic/glutamic acid	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{OH} \end{array} \rightleftharpoons \begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}^- \end{array} + \text{H}^+$	4.4
arginine	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{N}^+-\text{C}-\text{N}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} \rightleftharpoons \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{N}-\text{C}-\text{N}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \end{array} + \text{H}^+$	12.0
cysteine	$-\text{S}-\text{H} \rightleftharpoons -\text{S}^- + \text{H}^+$	8.5
histidine	$\begin{array}{c} \text{CH}-\text{NH} \\ \quad \\ \text{HN}^+-\text{CH} \end{array} \rightleftharpoons \begin{array}{c} \text{CH}-\text{NH} \\ \quad \\ \text{N}-\text{CH} \end{array} + \text{H}^+$	6.5
lysine	$\begin{array}{c} \text{H} \\ \\ -\text{N}^+-\text{H} \\ \\ \text{H} \end{array} \rightleftharpoons \begin{array}{c} \text{H} \\ \\ -\text{N}-\text{H} \\ \\ \text{H} \end{array} + \text{H}^+$	10.0
tyrosine	$\text{C}_6\text{H}_4-\text{OH} \rightleftharpoons \text{C}_6\text{H}_4-\text{O}^- + \text{H}^+$	10.0
metabolites		
ammonium	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{N}-\text{H} \\ \\ \text{H} \end{array} + \text{H}^+ \rightleftharpoons \begin{array}{c} \text{H} \\ \\ \text{H}-\text{N}^+-\text{H} \\ \\ \text{H} \end{array}$	9.2
phosphate	$\begin{array}{c} \text{OH} \\ \\ \text{O}=\text{P}-\text{OH} \\ \\ \text{OH} \end{array} \rightleftharpoons \begin{array}{c} \text{O}^- \\ \\ \text{O}=\text{P}-\text{OH} \\ \\ \text{OH} \end{array} + \text{H}^+ \rightleftharpoons \begin{array}{c} \text{O}^- \\ \\ \text{O}=\text{P}-\text{O}^- \\ \\ \text{OH} \end{array} + 2\text{H}^+ \rightleftharpoons \begin{array}{c} \text{O}^- \\ \\ \text{O}=\text{P}-\text{O}^- \\ \\ \text{O}^- \end{array} + 3\text{H}^+$	2.1, 7.2, 12.7