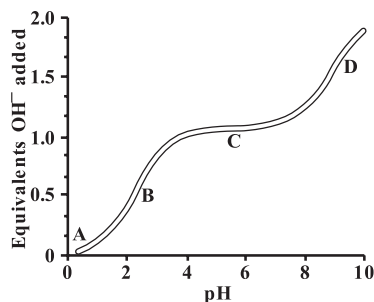


side chains attached to the α -carbon atom. The chemical nature of this R group determines the function of an amino acid in a protein and provides the basis for classification of the amino acids as **nonpolar, uncharged polar, acidic (polar negative)**, or **basic (polar positive)**. All free amino acids, plus charged amino acids in peptide chains, can serve as **buffers**. The quantitative relationship between the pH of a solution and the concentration of a weak acid (HA) and its conjugate base (A^-) is described by the **Henderson-Hasselbalch equation**. Buffering occurs within ± 1 pH unit of the pK_a and is maximal when $pH = pK_a$, at which $[A^-] = [HA]$. The α -carbon of each amino acid (except glycine) is attached to four different chemical groups and is, therefore, a **chiral**, or **optically active** carbon atom. The L-form of amino acids is found in proteins synthesized by the human body.

Study Questions

Choose the ONE best answer.

- 1.1 Which one of the following statements concerning the titration curve for a nonpolar amino acid is correct? The letters A through D designate certain regions on the curve below.



Correct answer = C. C represents the isoelectric point, or pI , and as such is midway between pK_1 and pK_2 for a nonpolar amino acid. The amino acid is fully protonated at Point A. Point B represents a region of maximum buffering, as does Point D. Lysine is a basic amino acid, and has an ionizable side chain.

- A. Point A represents the region where the amino acid is deprotonated.
- B. Point B represents a region of minimal buffering.
- C. Point C represents the region where the net charge on the amino acid is zero.
- D. Point D represents the pK of the amino acid's carboxyl group.
- E. The amino acid could be lysine.
- 1.2 Which one of the following statements concerning the peptide shown below is correct?
Val-Cys-Glu-Ser-Asp-Arg-Cys
- A. The peptide contains asparagine.
- B. The peptide contains a side chain with a secondary amino group.
- C. The peptide contains a side chain that can be phosphorylated.
- D. The peptide cannot form an internal disulfide bond.
- E. The peptide would move to the cathode (negative electrode) during electrophoresis at pH 5.
- 1.3 A 2-year-old child presents with metabolic acidosis after ingesting an unknown number of flavored aspirin tablets. At presentation, her blood pH was 7.0. Given that the pK_a of aspirin (salicylic acid) is 3, calculate the ratio of its ionized to un-ionized forms at pH 7.0.

Correct answer = C. The hydroxyl group of serine can accept a phosphate group. Asp is aspartate. Proline contains a secondary amino group. The two cysteine residues can, under oxidizing conditions, form a disulfide (covalent) bond. The net charge on the peptide at pH 5 is negative, and it would move to the anode.

Correct answer = 10,000 to 1.
 $pH = pK_a + \log \frac{[A^-]}{[HA]}$. Therefore, $7 = 3 + \log \frac{[A^-]}{[HA]}$ and $\log \frac{[A^-]}{[HA]} = 4$. The ratio of A^- (ionized) to HA (un-ionized), then, is 10,000 to 1 because the log of 10,000 is 4.